Proposed Methodological Revisions Regarding Consideration of Structural Alterations for Establishing Category 3 Lake Minimum Levels in the Southwest Florida Water Management District

April 21, 2006 Peer-Review Draft

Resource Conservation and Development Department
Ecologic Evaluation Section

Southwest Florida
Water Management District

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On the cover: Water control structure at the outlet of Little Lake Jackson in Highlands County, Florida.

Table of Contents

Title Page 1

Table of Contents 2

Acknowledgements 3

Section 1
Introduction to the Issue 4

Section 2
Minimum Lake Level Methods and Suggested Methodological Revisions 8

Section 3
Case Studies 19

Section 4
Literature Cited 48

Appendix A
Excerpts from Chapter 40D-8, Florida Administrative Code 50

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Section 1
Introduction to the Issue

Minimum Flows and Levels Development in the Southwest Florida Water Management District with Emphasis on Lake Level Methods

State law (Section 373.042, Florida Statutes; hereafter F.S.) directs the Department of Environmental Protection or the state water management districts to establish minimum flows and levels for lakes, wetlands, rivers and aquifers. As currently defined by statute, the minimum flow for a given watercourse "shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area", and 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". Minimum flows and levels are used by the Southwest Florida Water Management District (District or SWFWMD) for water resource planning, as one of the criteria used for evaluating water use permit applications, and for the design, construction and use of surface water management systems. Establishing a minimum flow or level does not in itself protect a water body from significant harm; however, resource protection, recovery and regulatory compliance may be ensured once the flow or level standards have been adopted.

Minimum flows and levels are established based upon the best available information with consideration given to "…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.). The Florida Water Resources Implementation Rule (Chapter 62-40.473, Florida Administrative Code; hereafter F.A.C.) provides additional guidance for the establishment of minimum flows and levels, requiring 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."

The Southwest Florida Water Management District has developed specific methodologies for establishing minimum flows or levels for lakes, wetlands, rivers and aquifers, subjected the methodologies to independent, scientific peer-review, and incorporated the methods 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 levels expected to fully maintain the integrity of the wetlands are classified as Category 2 Lakes. Lakes without at least 0.5 acre of 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. Information regarding the development of adopted methods for establishing guidance and minimum lake levels is provided in SWFWMD (1999) and Leeper *et al.* (2001). Bedient *et al.* (1999) and Dierberg and Wagner (2001) provide peer-review findings regarding the lake level methods.

In accordance with Chapter 40D-8, F.A.C., Minimum and Guidance Levels for seventy-one lakes within the Southwest Florida Water Management District have been adopted (or approved), and proposed levels have been developed for a number of additional lakes. Typically, two Minimum Levels and three Guidance Levels are established, 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 defined as follows.

- 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.

Revision of Minimum Flows and Levels Methodologies

As necessary, the District is committed to refinement of methods used for establishing minimum flows and levels. In support of this goal, District staff has identified an aspect of the methodology used for establishing Category 3 Lake minimum levels that warrants review. Specifically, staff believes that the methods for establishing Category 3 Lake minimum levels should be modified to incorporate an evaluation of structural alteration impacts when determining minimum levels, and that this methodological change should be implemented in a manner that is consistent with the approach used for lakes with fringing cypress wetlands (Category 1 and 2 Lakes).

Consistency regarding the evaluation of structural alterations for development of minimum levels for all lake types may be addressed with a relatively simple change to the methods used for establishing levels for Category 3 Lakes. Staff proposes that the methodology for this lake type be modified to include a step which stipulates that for lakes where appropriate significant change standard elevations are higher than the long-term median lake stage that would be expected in the absence of water withdrawals, the long-term median lake stage should be used to establish the Minimum Lake Level only for systems that have been structurally altered.

Use of the long-term median lake stage that would be expected in the absence of withdrawals for establishment of the Minimum Lake Level has been considered in previous reviews of the District's lake level methodologies. Bedient *et al.* (1999) noted that for lakes with fringing cypress wetlands, it is reasonable to assume that establishment of the Minimum Lake Level at the long-term median lake stage should limit damage to the wetland/lake system that has resulted from existing structural alterations. In their review of District methods for establishing minimum levels for lakes that lack fringing cypress wetlands, Dierberg and Wagner (2001) suggested that use of the long-term median lake stage for the Minimum Lake Level would be appropriate when any significant change standard is higher than the long-term median value. Further advocating use of the long-term median for the Minimum Lake Level, they suggested that rather than use any significant change standards for minimum levels development it may be appropriate to establish the Minimum Lake Level at the long-term median lake stage.

Lake level methodologies that were adopted into District rules (see Appendix A) subsequent to the reviews by Bedient *et al.* (1999) and Dierberg and Wagner (2001) have been implemented for adoption (or Board approval) of minimum and guidance levels for seventy-one lakes. Proposed levels for an additional eighteen lakes have been developed, and are awaiting Board approval. Forty-eight of the eighty-nine lakes with adopted or proposed levels are Category 3 Lakes. Twenty-eight of the Category 3 Lakes have a Minimum Lake Level that was established at the long-term median lake stage that would be expected in the absence of withdrawals, based on the median stage value being lower than an appropriate significant change standard. For the purpose of minimum levels development, eight of these lakes were determined to not have outlets, or were not considered to have been structurally altered in a manner that has measurably affected lake water levels.

Outline for the Remainder of this Report

This report was prepared to facilitate the review of proposed revisions to the methods used by the District for establishing minimum levels for Category 3 Lakes. Information on adopted lake level methods and the suggested methodological revisions is summarized in Section Two. Case studies outlining the development of adopted or proposed levels for eight Category 3 Lakes that are not structurally altered and for which the long-term median lake stage was used to establish the Minimum Lake Level are provided in Section Three, along with information on alternative levels that could be developed upon implementation of the revised lake level methods. The report concludes with a list of cited documents (Section Four) and is appended by excerpts from current District rules regarding the development of minimum and guidance levels for lakes (Appendix A).

Section 2
Minimum Lake Levels Methods and Suggested Methodological Revisions

Lake Stage Data and Percentiles

For the purpose of minimum levels development, 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. In the context of minimum levels development, "structural alterations" means man's physical alteration of the control point, or highest stable point along the outlet conveyance system of a lake, to the degree that water level fluctuations are affected. 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 can be used to estimate the range of water level fluctuation likely to occur in a lake basin that is not influenced by water withdrawals, but which may be influenced by structural alterations. This range of fluctuation is statistically defined by determining the lake stage elevations that have been exceeded ten, fifty and ninety percent of the time during a specified period of time. These statistics are determined using mean monthly water levels and the elevations associated with these statistics are referred to, respectively, as the Historic P10, Historic P50 and Historic P90.

Current data can be used to estimate lake stage fluctuations for periods when water withdrawals have been measurable, and structural alterations may have been in place. Current P10, Current P50 and Current P90 elevations are calculated in a manner similar to that used for determining Historic lake stage fluctuation statistics.

Normal Pool, Control Point Elevation and Determination of Structural Alteration Status

The normal pool elevation, a reference elevation used for development of minimum lake and wetland levels, is established based on the distribution of hydrologic indicators of sustained inundation. Hydrologic indicators of normal pool include biological and physical features that become established as a result of recent or long-term water levels. For development of minimum lake levels, the normal pool elevation is considered an approximation of the Historic P10.

For lakes with outlets, a control point elevation is established. The control point elevation is the highest stable point along the outlet profile of a surface water conveyance system (*e.g.,* weir, canal or culvert) that is the principal control of water level fluctuations in the lake. A control point may be established at the invert or crest

elevation associated with a water control structure at a lake outlet, or at a high, stable point in a lake-outlet canal, ditch or wetland area. The invert elevation is the lowest point on the portion of a water control structure that provides for conveyance of water across or through the structure. A crest elevation typically refers to the top or ridge of fixed-weirs or operable gates, over which water may flow.

Comparison of the control point elevation with the normal pool elevation is typically used to determine if a lake has been structurally altered. If the control point elevation is below the normal pool, the lake is classified as a structurally altered system. If the control point elevation is above the normal pool or the lake has no outlet, then the lake is not considered to be structurally altered.

Guidance Levels, the Historic P50 and Reference Lake Water Regime Statistics

The Ten Year Flood Guidance Level is provided as an advisory guideline for lakeshore development and is the level of flooding expected with a frequency of not less than the ten-year recurring interval, or at a frequency of not greater than a ten percent probability of occurrence in any given year. The Ten Year Flood Guidance Level is developed using standard engineering approaches applicable for use on open or closed-basin lakes, *i.e.,* lakes with or without, respectively, surface water conveyance systems that are connected to or are part of an ordered surface water conveyance system.

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 expected Historic P10 of the lake, and is established using historic data if it is available, or is estimated using the Current P10, the control point and the normal pool elevation. If historic data are not available, but current data are available and the lake is structurally altered, the High Guidance Level is established as the higher of the control point elevation or the Current P10. If only current data are available and the lake is not structurally altered, the High Guidance Level is established as the higher of the normal pool elevation or the Current P10. If historic or current data are unavailable, and the lake has been structurally altered, the High Guidance Level is established at the control point elevation. If historic and current data are unavailable and the lake has not been structurally altered, the High Guidance Level is established at the normal pool elevation.

The Historic P50 elevation is the elevation that the lake surface is expected to equal or exceed fifty percent of the time on a long-term basis. The level 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 statistics are used when adequate historic or current data are not available. These statistics represent differences between P10, P50 and P90 lake stage elevations for typical, regional lakes that exhibit little or no impacts associated with water withdrawals (*i.e*., reference lakes). Reference lake water regime statistics include the

RLWR50, RLWR90 and RLWR5090, which are, respectively, median differences between P10 and P50, P50 and P90, and P10 and P90 lake stage percentiles for a set of reference lakes.

For lakes with historic data, the Historic P50 elevation is established using the historic data. If only current data are available and the difference between the Current P10 and Current P50 is greater than or equal to the regional RLWR50, the Historic P50 is established at an elevation corresponding to the High Guidance Level minus the RLWR50. If only current data are available, and the difference between the Current P10 and the Current P50 is less than or equal to the RLWR50, the Historic P50 is established at an elevation corresponding to the High Guidance Level minus the difference between the Current P10 and the Current P50. If historic or current data are unavailable, the Historic P50 is established at an elevation corresponding to the High Guidance Level minus the RLWR50.

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, and is established using historic data if it is available. If historic data are not available, the Low Guidance Level is established using the Current P10 and P90, the High Guidance Level, and the RLWR90 for the region. If only current data are available, and the difference between the Current P10 and the Current P90 is greater than or equal to the RLRW90, the Low Guidance Level is established at an elevation corresponding to the High Guidance Level minus the RLWR90. If only current data are available, and the difference between the Current P10 and Current P90 is less than the RLWR90, the Low Guidance Level is established at an elevation corresponding to the High Guidance Level minus the difference between the Current P10 and Current P90. If historic or current data are unavailable, the Low Guidance Level is established at an elevation corresponding to the High Guidance Level minus the RLWR90.

Lake Classification

Lakes are classified as Category 1, 2 or 3 for the purpose of Minimum Levels development. Systems with fringing cypress wetlands greater than 0.5 acres in size where water levels regularly rise to an elevation expected to fully maintain the integrity of the wetlands (*i.e.,* the Historic P50 is not more than 1.8 feet below the normal pool elevation) are classified as Category 1 Lakes. Lakes with fringing cypress wetlands greater than 0.5 acres in size that have been structurally altered such that the Historic P50 is more than 1.8 feet below the normal pool elevation are classified as Category 2 Lakes. Lakes without fringing cypress wetlands or with less than 0.5 acres of fringing cypress wetlands are classified as Category 3 Lakes.

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 identify thresholds for preventing significant harm to cultural and natural system values associated with lake ecosystems, in accordance with guidance provided in the Florida Water Resources Implementation Rule (Chapter 62-40.473, F.A.C.). Potential changes in the coverage of herbaceous wetland vegetation and aquatic plants are also taken into consideration for development of Category 3 Lake minimum levels.

For Category 1 or 2 Lakes, a significant change standard is established 1.8 feet below the normal pool elevation. This standard identifies a desired median lake stage that if achieved, may be expected to preserve the ecological integrity of lake-fringing wetlands. Although not identified by name in the District's Minimum Flows and Levels rule, the elevation 1.8 feet below normal pool is typically referred to as the Cypress Standard in District documents pertaining to minimum levels development.

For Category 3 lakes, six significant change standards associated with dock-use, aesthetics, basin connectivity, recreation/ski use, water column mixing, and maintenance of species diversity, are developed. These standards identify desired median lake stages that if achieved, are intended to preserve various natural system and human-use lake values.

A Dock-Use Standard is developed to ensure that water depth at the end of existing docks is sufficient 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 two-foot water depth requirement for boat mooring, and use of Historic lake stage data (the difference between the Historic P50 and P90) or region-specific reference lake water regime statistics.

An 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 diminishing beyond the values associated with the lake when it is staged at the Low Guidance Level. To achieve this goal, the Aesthetics Standard is established at the Low Guidance Level.

A 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% reduction in lake surface area relative to the lake area at the Historic P50 elevation.

A 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 lake-use. The standard is based on the elevation of lake sediments at a critical high spot between lake basins or lake sub-basins, identification of water depths sufficient for movement of aquatic biota (one foot) or powerboats and other watercraft (two feet) across the critical high spots, and use of Historic lake stage data or region-specific reference lake water regime statistics.

A 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 surface water elevation (the Ski Elevation) within the basin that would contain a five-foot deep ski corridor delineated as a circular area with a radius of 418 ft, or a rectangular ski 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. The Recreation/Ski Standard is only considered appropriate for development of minimum levels in cases where the standard elevation equal to, or lower than the Historic P50 elevation.

The Lake Mixing Standard is developed to prevent significant changes in natural 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 (a statistic relating lake area to mean water depth), shifts from a value of <0.8 to a value >0.8, or from a value >0.8 to a value of <0.8.

Development of Minimum Lake Levels

Minimum Lake Levels are typically developed using specific lake-category significant change standards, but may also be established using other available information or unique factors, including: potential 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, 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. For Category 1 Lakes (Figure 1, Box A), the Minimum Lake Level is established at the standard (Cypress Standard) elevation 1.8 feet below the normal pool elevation. The Minimum Lake Level for Category 2 Lakes (Figure 1, Box B) is established at the Historic P50 elevation, *i.e.*, at the median lake stage that would be expected in the absence of withdrawal impacts, with existing structural alterations in place. For Category 3 Lakes, the Minimum Lake Level is established at the elevation corresponding to the standard with the highest elevation (Figure 2, Box A), except in cases where the standard elevation is above the Historic P50 elevation. The latter situation may occur for lakes where the Historic P50 has been lowered as a result of structural alterations (Figure 2, Box B) and may also occur for lakes where the Historic P50 has not been impacted by structural alterations (Figure 2, Box C). In both of these cases, the Minimum Lake Level is established at the Historic P50 elevation.

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. For Category 1 Lakes, the High Minimum Lake Level is established 0.4 feet below the normal pool elevation. The High Minimum Lake Level for Category 2 Lakes is established at the High Guidance Level, *i.e.*, at the elevation water levels would be expected to equal or exceed ten percent of the time, given existing structural alterations and the absence of withdrawal impacts. For Category 3 Lakes, the High Minimum Lake Level is developed using the Minimum Lake Level, Historic data or reference lake water regime statistics. If historic Data are available, the High Minimum Lake Level is established at an elevation corresponding to the Minimum Lake Level plus the difference between the Historic P10 and Historic P50. If historic data are not available, the High Minimum Lake Level is set at an elevation corresponding to the Minimum Lake Level plus the region-specific RLWR50.

Minimum Levels and Structural Alteration

District methods for establishing minimum levels for lakes with fringing cypress wetlands explicitly incorporate evaluation of lake-basin structural alterations. For cypress-wetland fringed lakes where structural alterations have not prevented the Historic P50 from equaling or rising above the Cypress Standard elevation 1.8 feet below the normal pool, the Minimum Lake Level is established at the standard elevation (Figure 1, Box A). Establishment of the Minimum Lake Level below the Historic P50 for these lakes, which are referred to as Category 1 Lakes, implies that their hydrologic regimes may be altered to some extent, without resulting significant harm. The extent of alteration that is not expected to result in significant harm is defined by the difference between the Historic P50 and the significant change standard. The Minimum Lake Level for lakes with fringing cypress wetlands where structural alterations have lowered the Historic P50 more than 1.8 feet below the normal pool, *i.e.*, below the Cypress Standard, is established at the Historic P50 elevation (Figure 1, Box B). Establishment of the Minimum Lake Level at the Historic P50 elevation in these cases is intended to prevent additional withdrawal-associated water level reductions that would be expected to further degrade wetlands which may have been compromised by structural alterations, yet still remain viable and perform functions beneficial to the lake system.

Structural alterations are not explicitly considered when developing minimum levels for Category 3 Lakes. For this lake category, the Minimum Lake Level is established at the highest appropriate significant change standard, if all standard elevations are lower than the Historic P50 elevation (Figure 2, Box A). If, however, either the Dock-Use or Basin Connectivity Standards are higher than the Historic P50 elevation, the Minimum Lake Level is established at the Historic P50. The Minimum Lake Level may, therefore, be established at the Historic P50 elevation if structural alterations have lowered the Historic P50 below either the Dock-Use or Basin Connectivity Standard (Figure 2, Box B), or if the Historic P50 has not been affected by structural alterations (Figure 2, Box C).

Consistency in the Use of Structural Alteration Status: Suggested Methodological Revisions

Use of the Historic P50 for establishing the Minimum Lake Level for Category 3 Lakes where the structural alterations have lowered the Historic P50 elevation below either the Dock-Use or Basin Connectivity Standard (Figure 2, Box B) is analogous to the approach used for Category 2 Lakes (Figure 1, Box B). In both cases, use of the Historic P50 for the Minimum Lake Level is intended to limit further degradation of values associated with appropriate significant change standards.

Establishment of the Minimum Lake Level at the Historic P50 elevation for Category 3 Lakes where structural alterations have not lowered the Historic P50 elevation (Figure 2, Box C) is not, however, consistent with the approach used for establishing minimum levels for lakes with fringing cypress wetlands. For cypress-wetland fringed lakes, the Historic P50 elevation is used to establish the Minimum Lake Level only for situations where structural alterations have lowered the Historic P50 below a significant change standard. This inconsistency in use of the Historic P50 elevation for minimum levels development is best illustrated by example. Consider a Category 3 Lake that has not been structurally altered and which has a Dock-Use or Basin Connectivity Standard that is higher than the Historic P50 elevation. The Minimum Lake Level for this lake would be established at the Historic P50 to protect attributes associated with the Dock-Use or Basin Connectivity Standard, even though these standards would not be met by the hydrologic regime that would be expected in the absence of withdrawal impacts.

The discrepant or inconsistent use of the Historic P50 for establishing the Minimum Lake Level for lakes with and without fringing cypress wetlands can be remedied by a simple change in the methods used for establishing levels for Category 3 Lakes (Figure 3). For this lake category, it is suggested that a methodological step be included which stipulates that for lakes where appropriate significant change standard elevations are higher than the Historic P50, the Historic P50 should be considered for the Minimum Lake Level only if the system has been structurally altered. Determination of structural alteration status in these situations would be contingent upon identification and review of lake-basin drainage features and water level records. Lakes without man-made or altered drainage features would not be considered to be structurally altered. For these lakes, the Minimum Lake Level would be established at the highest appropriate significant change standard that is lower than the Historic P50 elevation (Figure 3, Box C). However, for systems with modified outlets and where the Historic P50 elevation is lower than either the Dock-Use or Basin Connectivity Standard, the Minimum Lake Level would be established at the Historic P50 (Figure 3, Box B).

No methodological changes are proposed for Category 3 Lakes where the Historic P50 elevation is higher than all appropriate significant change standards. For these situations, the Minimum Lake Level would be established at the highest significant change standard (Figure 3, Box A). Similarly, no changes are recommended for the methods currently used to establish the High Minimum Lake Level for Category 3 Lakes. Finally, it should be noted that no changes are recommended for the adopted lake level methods that allow for consideration of unique factors, in addition to

significant change standards and the Historic P50 elevation, when establishing minimum levels for all lake categories.

Figure 1. Establishment of the minimum lake level (MLL) for lakes that are contiguous with fringing cypress wetlands 0.5 acres or greater in size is based on comparison of a single significant change standard (Cypress Std) with the Historic P50 elevation. If the standard is lower than the Historic P50, the lake is classified as a Category 1 Lake and the MLL is established at the standard elevation (Box A). If structural alterations have resulted in a Historic P50 elevation that is lower than the standard, the lake is classified as a Category 2 Lake and the MLL is established at the Historic P50 (Box B).

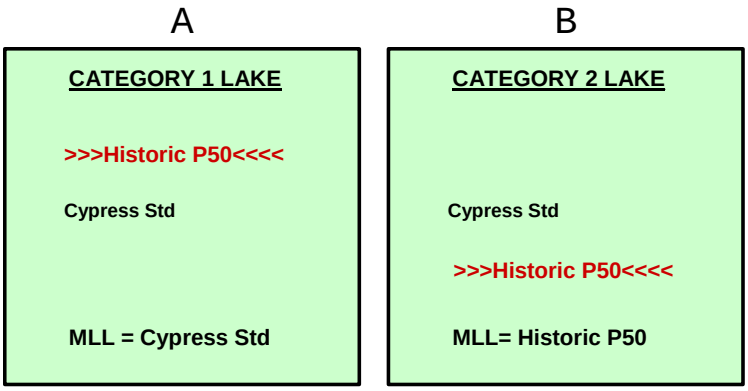


Figure 2. Establishment of the minimum lake level (MLL) for Category 3 Lakes, which are lakes that are not contiguous with fringing cypress wetlands of 0.5 acres or more in size, is based on comparison of the Historic P50 elevation with six significant changes standards (Dock-Use, Basin Connectivity, Species Richness, Recreation/Ski, Mixing and Aesthetics Stds). If all standards are below the Historic P50 elevation, the MLL is established at the highest standard elevation (Box A). If structural alterations have lowered the Historic P50 elevation below either of the two standards (Dock-Use Std, Basin Connectivity Std) that can occur at elevations higher than the Historic P50, the MLL is established at the Historic P50 elevation (Box B). If structural alterations have not resulted in the lowering of the Historic P50 and either the Dock-Use or Basin Connectivity Standards occur above the Historic P50 elevation, the MLL is established at the Historic P50 (Box C).

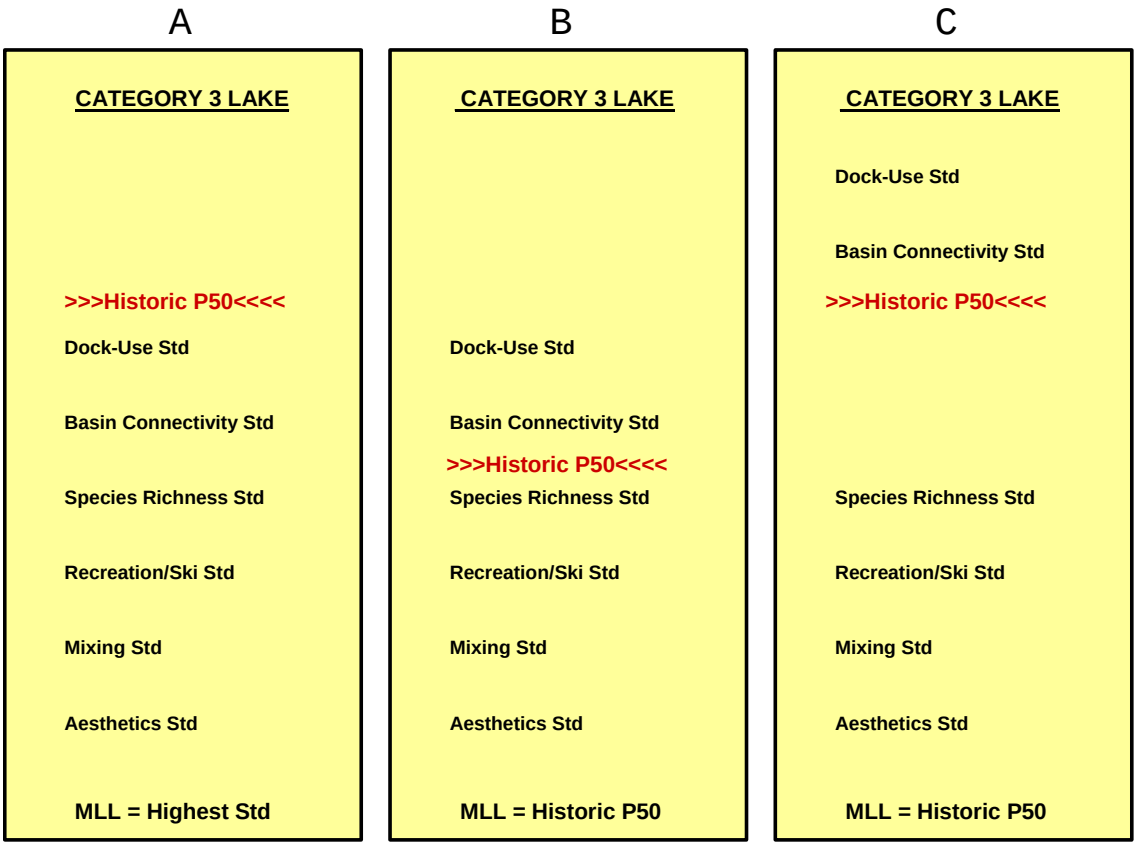
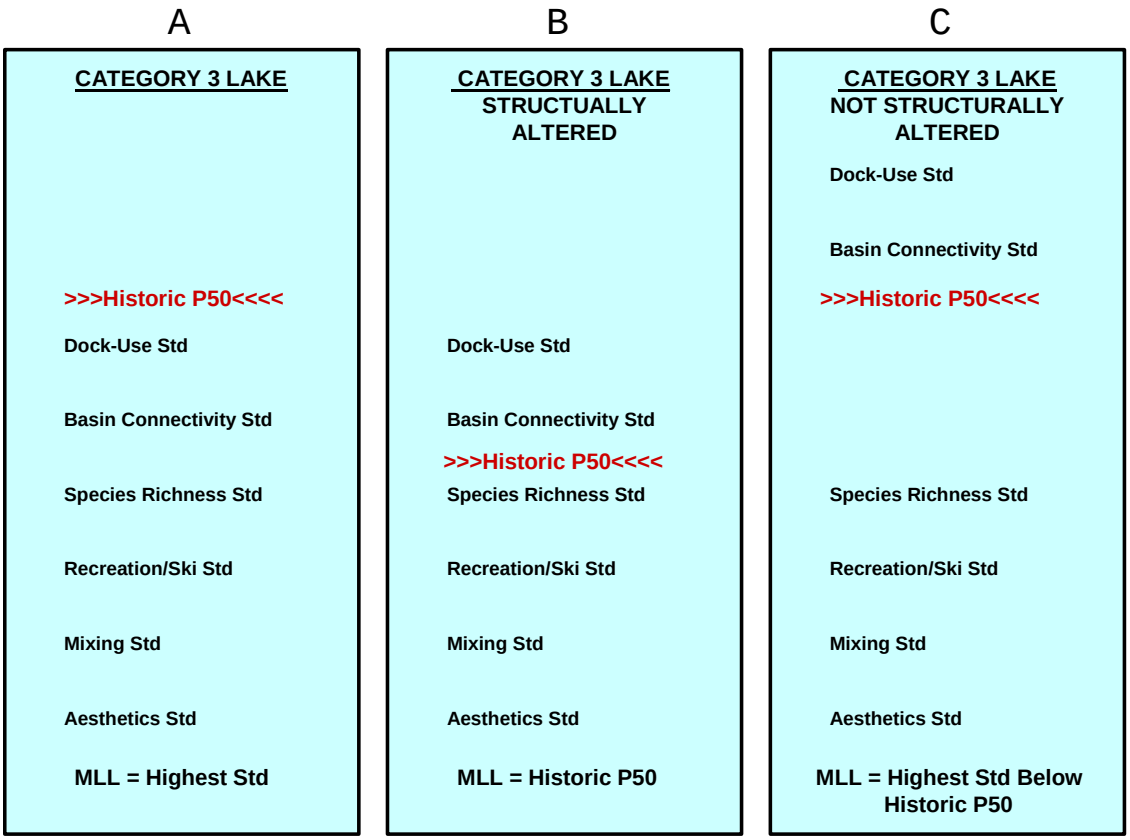


Figure 3. Proposed approach for establishing the Minimum Lake Level (MLL) for Category 3 Lake is based on comparison of the Historic P50 elevation with six significant change standards (Dock-Use, Basin Connectivity, Species Richness, Recreation/Ski, Mixing and Aesthetics Stds). If all standards are below the Historic P50 elevation, the MLL is established at the highest standard elevation (Box A). If structural alterations have lowered the Historic P50 elevation below either of the two standards (Dock-Use Std, Basin Connectivity Std) that can occur at elevations higher than the Historic P50, the MLL is established at the Historic P50 elevation (Box B). If either the Dock-Use or Basin Connectivity Standards occur above the Historic P50 elevation, but structural alterations have not resulted in the lowering of the Historic P50, the MLL is established at the highest significant change standard that is below the Historic P50 elevation (Box C).



Section 3
Case Studies

Lake Pasadena and Buddy Lake

General Lake Description

Lake Pasadena and Buddy Lake (Figure 4) are Category 3 Lakes located in eastern Pasco County, Florida. The lakes lie within the Brooksville Ridge physiographic region and are surrounded by high sand hills. Lake Pasadena and Buddy Lake were grouped for development of minimum and guidance levels because they have been connected by surface water approximately 39% of the time during the past twenty years and lake stage data are available for Lake Pasadena, but not Buddy Lake. Uplands surrounding the lakes have, for the most part, been cleared of native vegetation and are used for residential development, citrus production, or livestock grazing.

There are no major inflows to either lake, although small basins to the north or Lake Pasadena may occasionally discharge into the lake system. Lake Pasadena and Buddy Lake are connected when water levels within the basin exceed 91-92 ft above NGVD. Although the lakes are typically internally drained, surface outflow from the southeast corner of Buddy Lake may occur when the basin water level exceeds 99.9 ft above NGVD.

Minimum and Guidance Levels

Minimum and Guidance levels for the Lake Pasadena and Buddy Lake (Figure 5) were developed in April 2004 (Leeper 2004a) and approved for incorporation into District rules by the Governing Board in December 2004. Based on the relatively high outflow elevation, the lake system was not considered to be structurally altered, and a control point elevation was not established. Stage data for Lake Pasadena collected through January 2003 were used for levels development. Summary elevation and area data associated with development of minimum and guidance levels for the Lake Pasadena/Buddy Lake system are listed in Table 1.

The Minimum Lake Level for the Lake Pasadena/Buddy Lake system was established at the Historic P50 elevation, 87.3 ft above NGVD, because the Dock-Use and Basin Connectivity Standards were higher than the Historic P50. The High Minimum Lake Level was established at 93.7 feet above NGVD by summing the Minimum Lake Level and the difference between the Historic P10 and Historic P50 elevations.

Application of the proposed approach for establishing minimum levels for Category 3 Lakes that are not structurally altered could yield an alternative Minimum Lake Level of 86.0 feet above NGVD for the Lake Pasadena/Buddy Lake system. This level, based on use of the Species Richness Standard, is 1.3 feet lower than the adopted Minimum Lake Level. An alternative High Minimum Lake Level could be established at 92.4 feet

above NGVD, by summing the alternative Minimum Lake Level elevation and the difference between the Historic P10 and Historic P50 elevations. This alternative High Minimum Lake Level is 1.3 feet lower than the adopted High Minimum Lake Level. It should be noted that the alternative minimum levels represent levels based on review of significant change standards and the Historic P50 elevation, and could be modified based on consideration of unique factors associated with the lake-system basin.

The alternative minimum levels along with adopted guidance levels and available water level records for the Lake Pasadena/Buddy Lake system are shown in Figure 6. At the alternative Minimum Lake Level, the inundated portion of the Lake Pasadena/Buddy Lake basin would be 15% smaller than the area inundated when the water level is at the adopted Minimum Lake Level. Similarly, the inundated area would be 15% less when the water surface is at the alternative High Minimum Lake Level versus when the lake is staged at the adopted High Minimum Lake Level. Potential wetland area, *i.e.*, the portion of the basin inundated with up to four feet of water, would be reduced by 20% when the lake is staged at the alternative High Minimum Lake Level rather than the adopted High Minimum Lake Level.

Figure 4. Aerial photograph of Lake Pasadena and Buddy Lake in 2005 (USGS 2005).

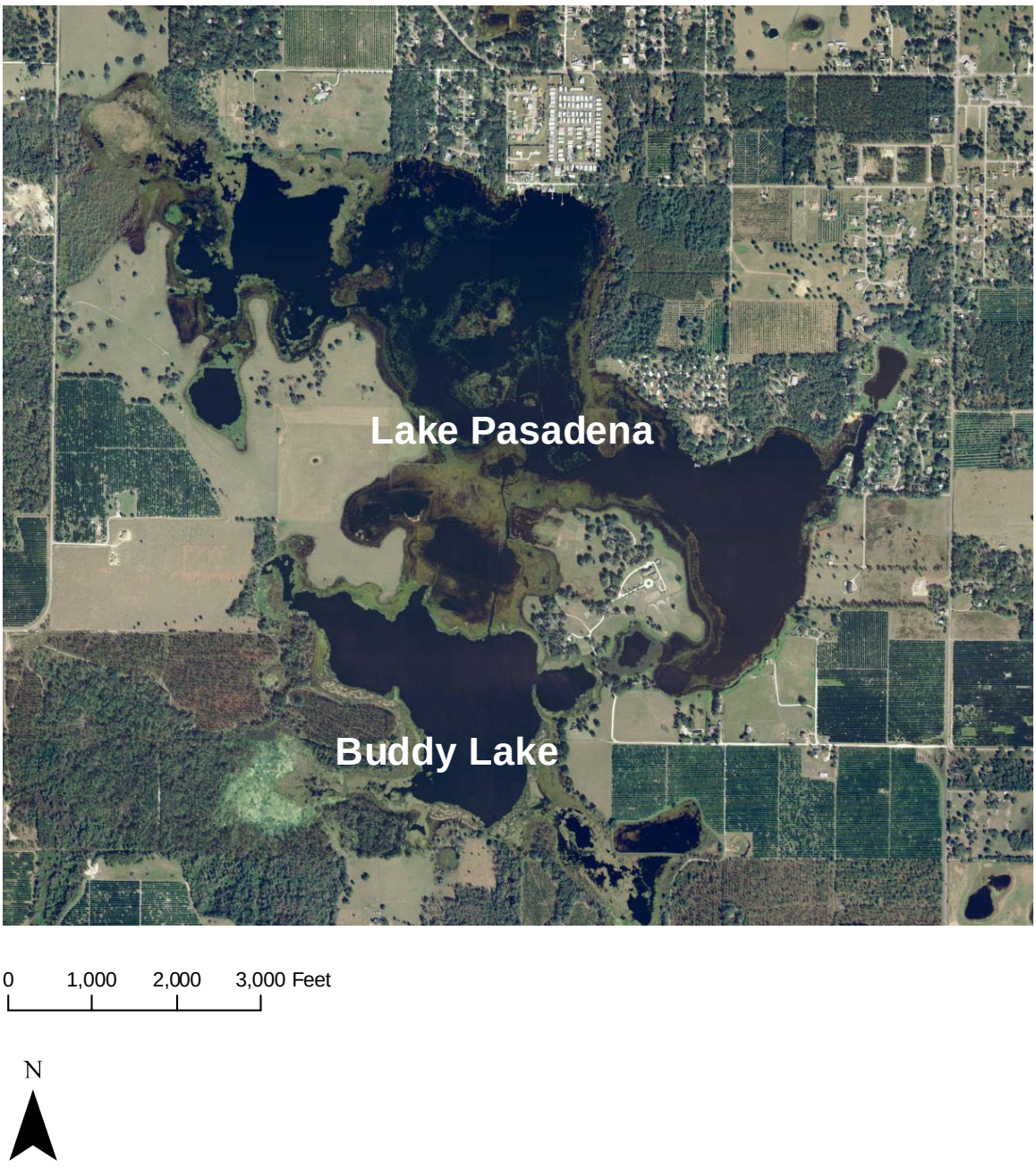


Table 1. Elevation data and associated area values used for establishing adopted minimum and guidance levels and alternative minimum levels for Lake Pasadena and Buddy Lake.

Level or Feature	Elevation (ft above NGVD)	Lake Area (acres)
Lake Stage Percentiles		
Historic P10	93.7	860
Historic P50	87.3	376
Historic P90	83.9	223
Other Levels		
Normal Pool	NA	NA
Control Point	NA	NA
Adopted Guidance Levels		
Ten Year Flood Guidance Level	96.9	NA
High Guidance Level	93.7	860
Low Guidance Level	83.9	223
Significant Change Standards *		
Basin Connectivity Standard	96.4	NA
Dock-Use Standard	94.4	904
Species Richness Standard	86.0	320
Aesthetics Standard	83.9	223
Mixing Standard	77.4	6
Adopted Minimum Levels		
High Minimum Lake Level	93.7	860
Minimum Lake Level	87.3	376
Alternative Minimum Levels		
Alternative High Minimum Lake Level	92.4	731
Alternative Minimum Lake Level	86.0	320

NA = not available/not applicable

* A Recreation/Ski Standard was established at 90.4 feet above NGVD, but was not considered appropriate for minimum levels development because the standard elevation exceeds the Historic P50 elevation.

Figure 5. Mean monthly surface water elevations (through December 2005) at Lake Pasadena, and adopted guidance and minimum levels for Lake Pasadena and Buddy Lake. 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).

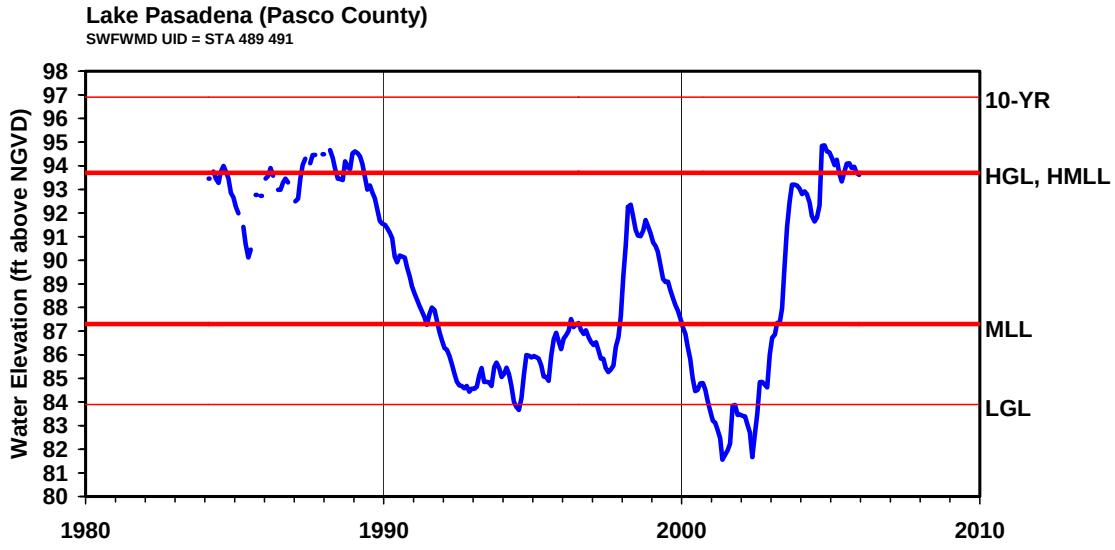
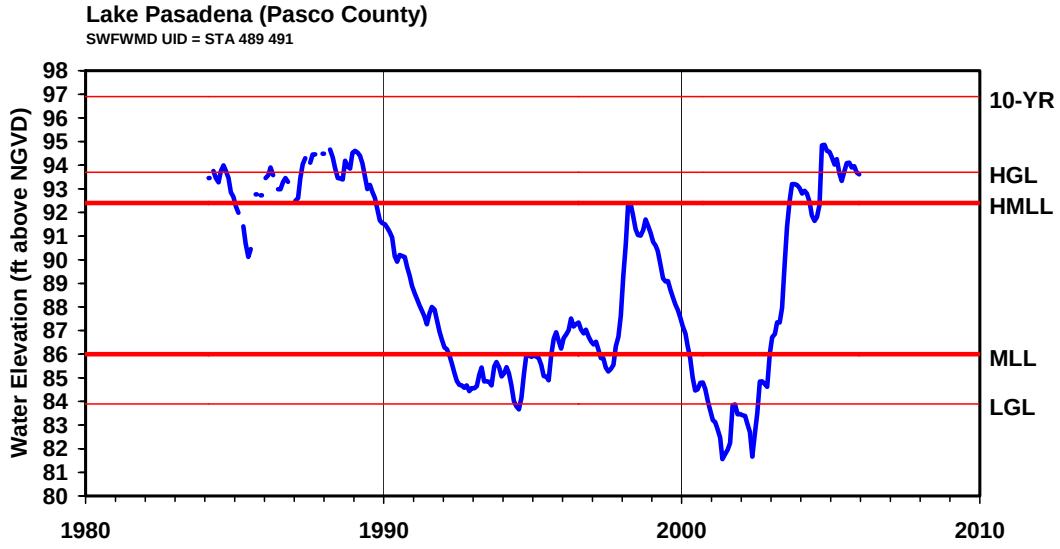


Figure 6. Mean monthly surface water elevations (through December 2005) at Lake Pasadena, adopted guidance levels and alternative minimum levels for Lake Pasadena and Buddy Lake. Levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level, HMLL) and Minimum Lake Level (MLL).



Neff Lake

General Lake Description

Neff Lake is a Category 3 Lake located in south-central Hernando County, Florida (Figure 7). The lake lies within the Brooksville Ridge physiographic region and is surrounded by high, sandy hills. Although the lake basin has been highly modified, little of the lake shoreline has been cleared for residential development.

Surface inflow to Neff Lake occurs on the lake's eastern shore through a ditch and culvert system that originates along the western shore of Mountain Lake. The drainage system may convey water to Neff Lake when the level of Mountain Lake exceeds 102.54 ft above NGVD. Neff Lake does not have a surface outlet, although significant drainage from the basin occurs periodically to underlying aquifers through a sink system located along the eastern lakeshore. In an effort to minimize this drainage, an earthen berm has been constructed around the sink area.

Minimum and Guidance Levels

Minimum and Guidance levels for the Neff Lake (Figure 8) were developed in April 2004 (Munson 2004), and were approved for incorporation into District rules by the Governing Board in December 2004. Because Neff Lake does not have a surface water outflow system, a control point elevation was not established. Lake stage data collected through February 2003 were used for levels development. Summary elevation and area data associated with development of minimum and guidance levels for Neff Lake are listed in Table 2.

The Minimum Lake Level for Neff Lake was established at the Historic P50 elevation, 94.5 ft above NGVD, because the Basin Connectivity Standard was higher than the Historic P50. The High Minimum Lake Level was established at 102.2 feet above NGVD by summing the Minimum Lake Level elevation and the difference between the Historic P10 and Historic P50 elevations.

Application of the proposed approach for establishing minimum levels for Category 3 Lakes that are not structurally altered could yield an alternative Minimum Lake Level of 93.4 feet above NGVD for Neff Lake. This level, based on use of the Species Richness Standard, is 1.1 feet lower than the adopted Minimum Lake Level. An alternative High Minimum Lake Level could be established at 101.1 feet above NGVD by summing the alternative Minimum Lake Level and the difference between the Historic P10 and Historic P50 elevations. This alternative High Minimum Lake Level is 1.1 feet lower than the adopted High Minimum Lake Level. It should be noted that the alternative minimum levels represent levels based on review of significant change standards and the Historic P50 elevation, and could be modified based on consideration of unique factors associated with the lake basin.

The alternative minimum levels along with adopted guidance levels and available water level records for Neff Lake are shown in Figure 9. At the alternative Minimum Lake

Level, the inundated portion of the lake basin would be 14% less than the area inundated when the water level is at the adopted Minimum Lake Level. The area inundated when the lake is staged at the alternative High Minimum Lake Level would be 7% less than when the water level equals the adopted High Minimum Lake Level. When the lake is staged at the alternative High Minimum Lake Level, potential wetland area, *i.e.*, portions of the basin inundated with up to four feet of water, would be 2% less when the water level is at the adopted High Minimum Lake Level.

Figure 7. Aerial photograph of Neff Lake in 2005 (USGS 2005).

Table 2. Elevation data and associated area values used for establishing adopted minimum and guidance levels and alternative minimum levels for Neff Lake.

Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Lake Stage Percentiles		
Historic P10	102.2	255
Historic P50	94.5	105
Historic P90	87.4	31
Other Levels		
Normal Pool	110	NA
Control Point	NA	NA
Adopted Guidance Levels		
Ten Year Flood Guidance Level	104.1	302
High Guidance Level	102.2	255
Low Guidance Level	87.4	31
Significant Change Standards *		
Connectivity Standard	101.3	239
Species Richness Standard	93.4	90
Aesthetic Standard	87.4	31
Adopted Minimum Levels		
High Minimum Lake Level	102.2	255
Minimum Lake Level	94.5	105
Alternative Minimum Levels		
High Minimum Lake Level	101.1	236
Minimum Lake Level	93.4	90

NA = not available/not applicable

* A Recreation/Ski Standard was established at 99.0 feet above NGVD, but was not considered appropriate for minimum levels development because the standard elevation exceeds the Historic P50 elevation. Basin Connectivity and Lake Mixing standards were not established for the lake.

Figure 8. Mean monthly surface water elevations (through December 2005) and adopted guidance and minimum levels for Neff Lake. 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).

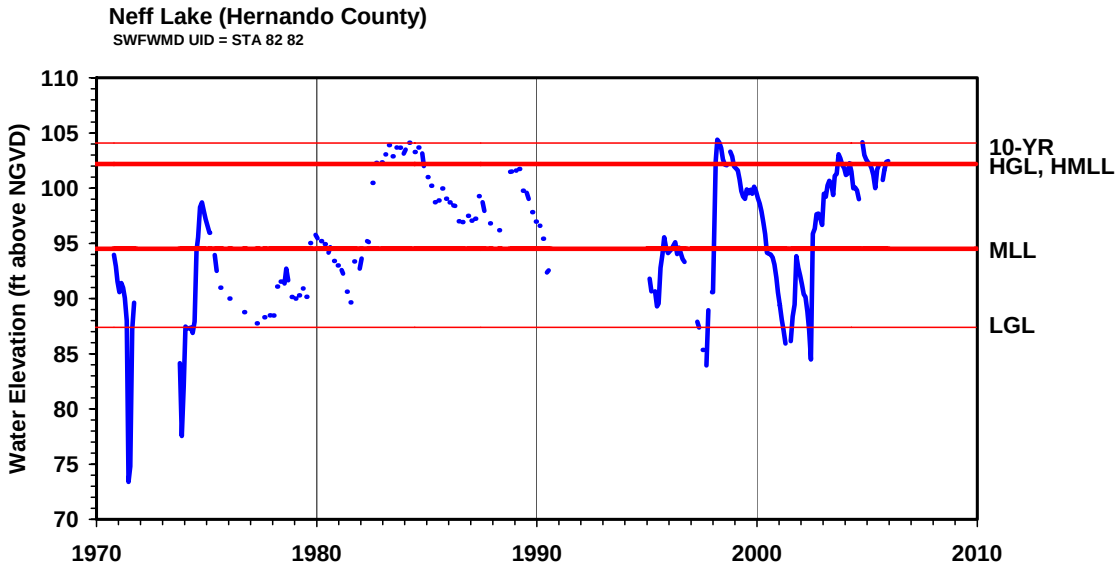
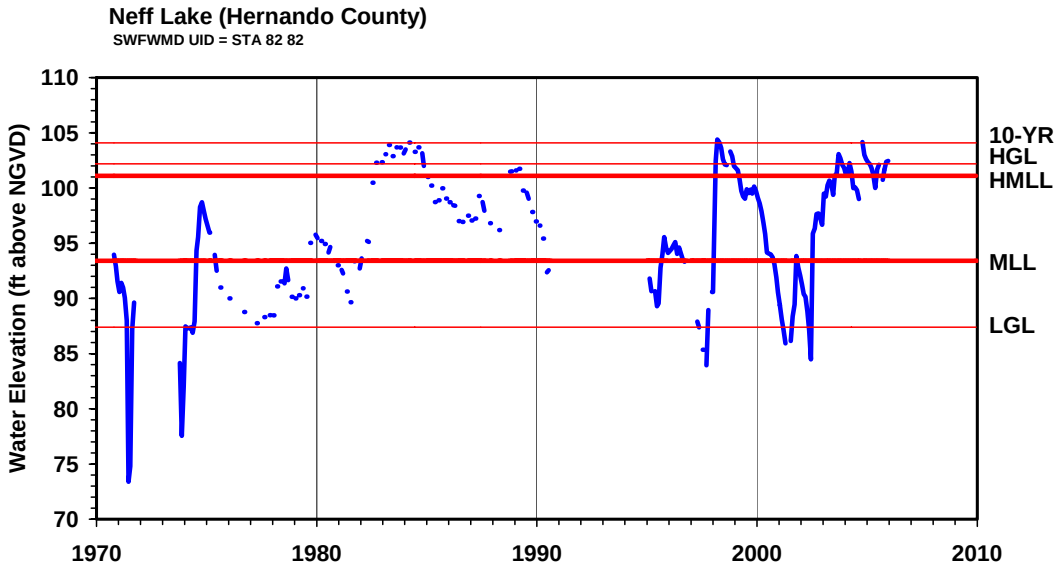


Figure 9. Mean monthly surface water elevations (through December 2005), adopted guidance levels and alternative minimum levels for Neff Lake. Levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level, HMLL) and Minimum Lake Level (MLL).



Hancock Lake

General Lake Description

Hancock Lake is a Category 3 Lake located along the border between Pasco and Hernando Counties, Florida (Figure 10). The lake is situated in a region of high, sandy hills in the Brooksville Ridge physiographic division. Uplands surrounding the lake are used primarily used for livestock grazing, citrus production and residential development.

An inlet along the southeastern lakeshore conveys water from Middle Lake to Hancock Lake when Middle Lake is staged higher than 99.5 ft above NGVD. Hancock Lake does not have a surface water outlet, but may drain to underlying aquifers through sinkholes located along the southwestern lakeshore. To curtail this internal drainage, a dyke was constructed across a portion of the lake basin in the 1970s. Based on observations by District staff, the dyke does not completely limit drainage to the sinkholes or the sub-basin where the sinkholes are located.

Minimum and Guidance Levels

Minimum and Guidance levels for the Hancock Lake (Figure 11) were developed in November 2003 (Leeper 2003), and were approved for incorporation into District rules by the Governing Board in December 2004. Because Hancock Lake does not have a surface water outlet, a control point elevation was not established and the lake is not considered to be structurally altered. Lake stage data collected through January 2003 were used for levels development. Summary elevation and area data associated with development of minimum and guidance levels for Hancock Lake are listed in Table 3.

The Minimum Lake Level was established at the Historic P50 elevation, 100.2 feet above NGVD, because the Dock-Use Standard and Basin Connectivity Standards were higher than the Historic P50. The High Minimum Lake Level was established at 102.5 feet above NGVD by summing the Minimum Lake Level and the difference between the Historic P10 and Historic P50 elevations.

Application of the proposed approach for establishing minimum levels for Category 3 Lakes that are not structurally altered could yield an alternative Minimum Lake Level of 98.2 feet above NGVD for Hancock Lake. This level, based on use of the Species Richness Standard, is 2.0 feet lower than the adopted Minimum Lake Level. An alternative High Minimum Lake Level could be established at 100.5 feet above NGVD by summing the alternative Minimum Lake Level and the difference between the Historic P10 and Historic P50 elevations. This alternative level is 2.0 feet below the adopted High Minimum Lake Level. It should be noted that the alternative minimum levels represent levels based on review of significant change standards and the Historic P50 elevation, and could be modified based on consideration of unique factors associated with the lake basin.

The alternative minimum levels along with adopted guidance levels and available water level records for Hancock Lake are shown in Figure 12. At the alternative Minimum

Lake Level, the inundated portion of the lake system would be 14% less than the area inundated when the water level is at the adopted Minimum Lake Level. The area inundated when the lake is staged at the alternative High Minimum Lake Level would be 13% less than when the water level equals the adopted High Minimum Lake Level. Potential wetland area, *i.e.*, portions of the basin inundated with up to four feet of water, would be 13% greater when the lake is staged at the alternative High Minimum Lake Level versus the adopted High Minimum Lake Level.

Figure 10. Aerial photograph of Hancock Lake in 2005 (USGS 2005).

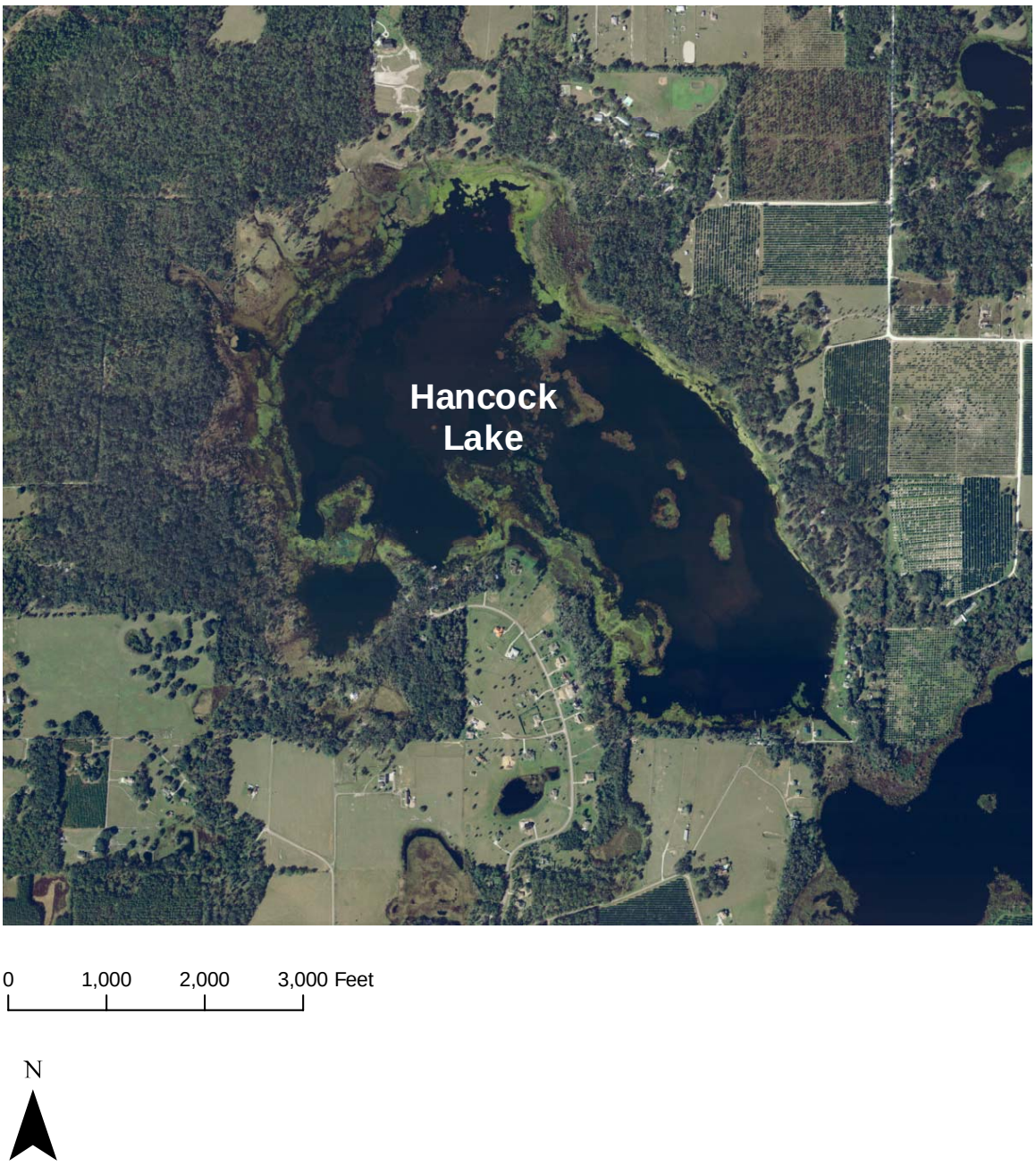


Table 3. Elevation data and associated area values used for establishing adopted minimum and guidance levels and alternative minimum levels for Hancock Lake.

Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Lake Stage Percentiles		
Historic P10	102.5	467
Historic P50	100.2	400
Historic P90	97.7	325
Other Levels		
Normal Pool	NA	NA
Control Point	NA	NA
Adopted Guidance Levels		
Ten Year Flood Guidance Level	106.9	625
High Guidance Level	102.5	467
Low Guidance Level	97.7	386
Significant Change Standards *		
Dock-Use Standard	102.3	461
Connectivity Standard	100.9	419
Species Richness Standard	98.2	343
Aesthetic Standard	97.7	325
Mixing Standard	NA	NA
Adopted Minimum Levels		
High Minimum Lake Level	102.5	467
Minimum Lake Level	100.2	400
Alternative Minimum Levels		
High Minimum Lake Level	100.5	408
Minimum Lake Level	98.2	343

NA = not available/not applicable

* A Recreation/Ski Standard was established at 100.4 feet above NGVD, but was not considered appropriate for minimum levels development because the standard elevation exceeds the Historic P50 elevation.

Figure 11. Mean monthly surface water elevations (through December 2005) and adopted guidance and minimum levels for Hancock Lake. 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).

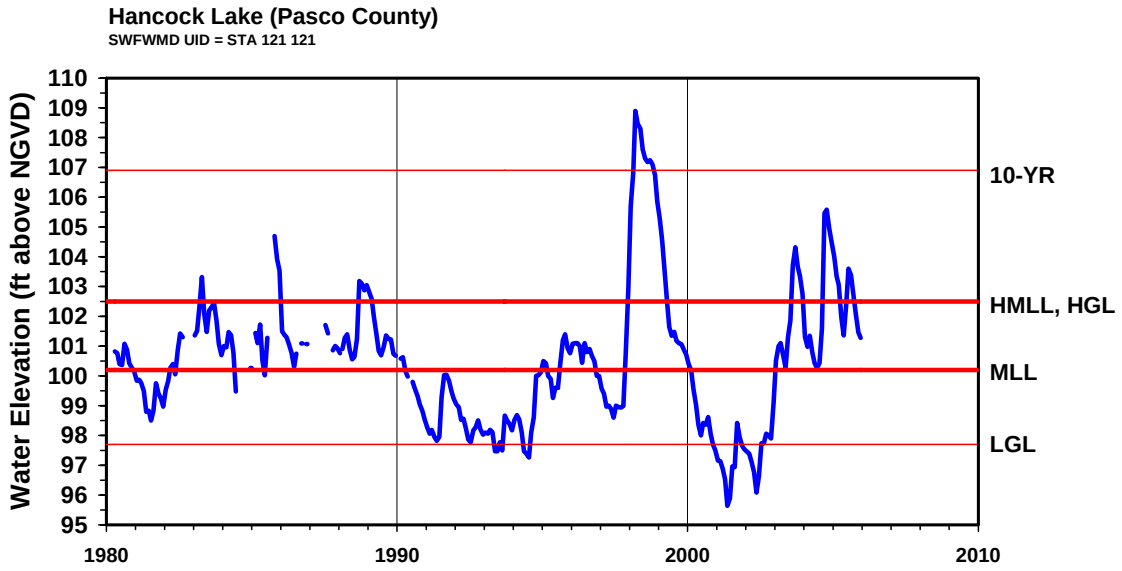
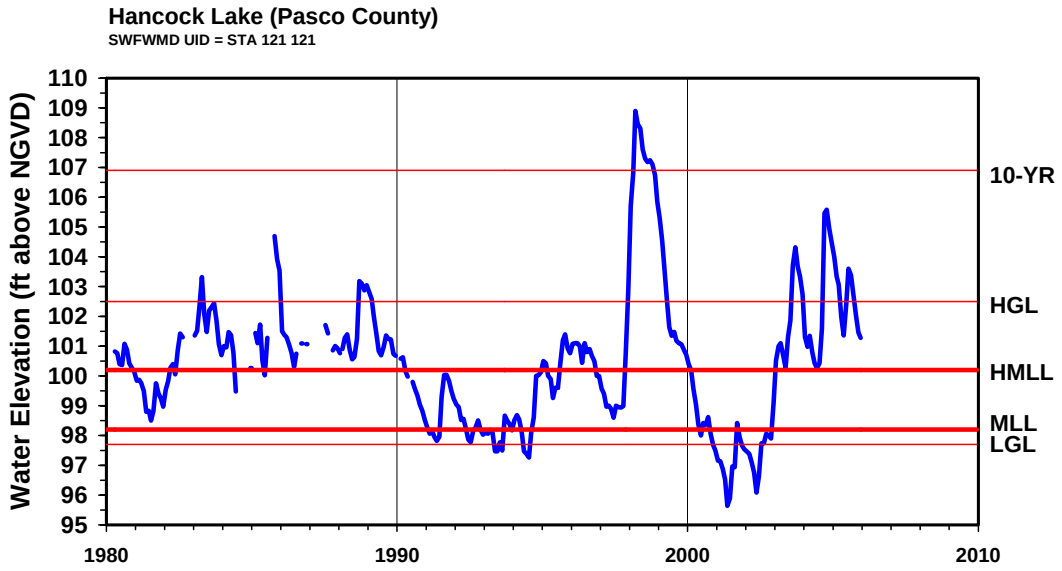


Figure 12. Mean monthly surface water elevations (through December 2005) and adopted guidance and alternative minimum levels for Hancock Lake. Levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level, HMLL) and Minimum Lake Level (MLL).



Lake Miona and Black Lake

Lake Setting and Description

Lake Miona and Black Lake are Category 3 Lakes located in Sumter County, Florida (Figure 13). The lakes are typically a contiguous water body and have been treated as a single lake system for the purpose of minimum levels development. The lake system lies within the Sumter Upland physiographic region and is surrounded by low sand hills that have been or are being cleared for residential development.

Surface water inflow to the Lake Miona/Black Lake system occurs from developed areas surrounding the lakes and from a wetland area to the north of Black Lake. There are no surface water outlets from the Lake Miona/Black Lake system.

Minimum and Guidance Levels

Minimum and Guidance levels for the Lake Miona and Black Lake (Figure 14) were developed in October 2005 (SWFWMD 2005b), but have not been presented to the Governing Board for adoption into District rules. Because the Lake Miona/Black Lake system is a closed basin, a control point elevation was not established. Lake-stage data collected through from April 1978 through June 1982 and from May 1984 through December 1999 were used for levels development. Data from other periods were excluded based on water level impacts associated with lake augmentation and area water withdrawals. Summary elevation and area data associated with development of minimum and guidance levels for the Lake Miona/Black Lake system are included in Table 4.

The proposed Minimum Lake Level was established at the Historic P50 elevation, 51.6 feet above NGVD, because the Dock-Use Standard was higher than the Historic P50. Although not included in the report outlining development of the proposed lake levels, a Basin Connectivity Standard of 54.2 feet above NGVD, which also exceeds the Historic P50, has been developed for the lake system. The proposed High Minimum Lake Level was established at 53.3 feet above NGVD by summing the proposed Minimum Lake Level and the difference between the Historic P10 and Historic P50 elevations.

Application of the proposed approach for establishing minimum levels for Category 3 Lakes that are not structurally altered could yield an alternative Minimum Lake Level of 50.4 feet above NGVD for the Lake Miona/Black Lake system. This alternative level, based on use of the Species Richness Standard, is 1.2 feet lower than the proposed Minimum Lake Level. An alternative High Minimum Lake Level could be established at 52.0 feet above NGVD, an elevation 1.3 feet below the proposed High Minimum Lake Level. This alternative High Minimum Lake Level would be established by summing the alternative Minimum Lake Level and the difference between the Historic P10 and Historic P50. It should be noted that the alternative minimum levels represent levels based on review of significant change standards and the Historic P50 elevation, and could be modified based on consideration of unique factors associated with the lake-system basin.

The alternative minimum levels along with proposed guidance levels and available water level records for the Lake Miona/Black Lake system are shown in Figure 15. At the alternative Minimum Lake Level, the inundated portion of the lake system would be 15% less than the area inundated when the water level is at the proposed Minimum Lake Level. The area inundated when the lake is staged at the alternative High Minimum Lake Level would be 13% less than when the water level equals the proposed High Minimum Lake Level. Potential wetland area, *i.e.*, portions of the basin inundated with up to four feet of water, would be 9% less when the lake is staged at the alternative High Minimum Lake Level versus the proposed High Minimum Lake Level.

Figure 13. Aerial photograph of Lake Miona and Black Lake in 2005 (USGS 2005).

Table 4. Elevation data and associated area values used for establishing proposed minimum and guidance levels and alternative minimum levels for the Lake Miona/Black Lake system.

Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Lake Stage Percentiles		
Historic P10	53.2	618
Historic P50	51.6	515
Historic P90	49.1	347
Other Levels		
Normal Pool	59.4	NA
Control Point	NA	NA
Proposed Guidance Levels		
Ten Year Flood Guidance Level	57.5	945
High Guidance Level	53.2	618
Low Guidance Level	49.1	347
Significant Change Standards		
Dock-Use Standard	54.8	734
Basin Connectivity Standard *	54.2	695
Species Richness Standard	50.4	440
Aesthetics Standard	49.2	350
Recreation/Ski Standard	47.5	281
Lake Mixing Standard	44.8	258
Proposed Minimum Levels		
High Minimum Lake Level	53.3	624
Minimum Lake Level	51.6	515
Alternative Minimum Levels		
High Minimum Lake Level	52.0	543
Minimum Lake Level	50.4	440

NA = not available/not applicable

* A Basin Connectivity Standard was not included in the draft report outlining proposed minimum levels for the Lake Miona/Black Lake system. The listed standard elevation was developed following preparation of the draft report.

Figure 14. Mean monthly surface water elevations (through December 2005) and proposed guidance and minimum levels for Lake Miona and Black Lake. 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).

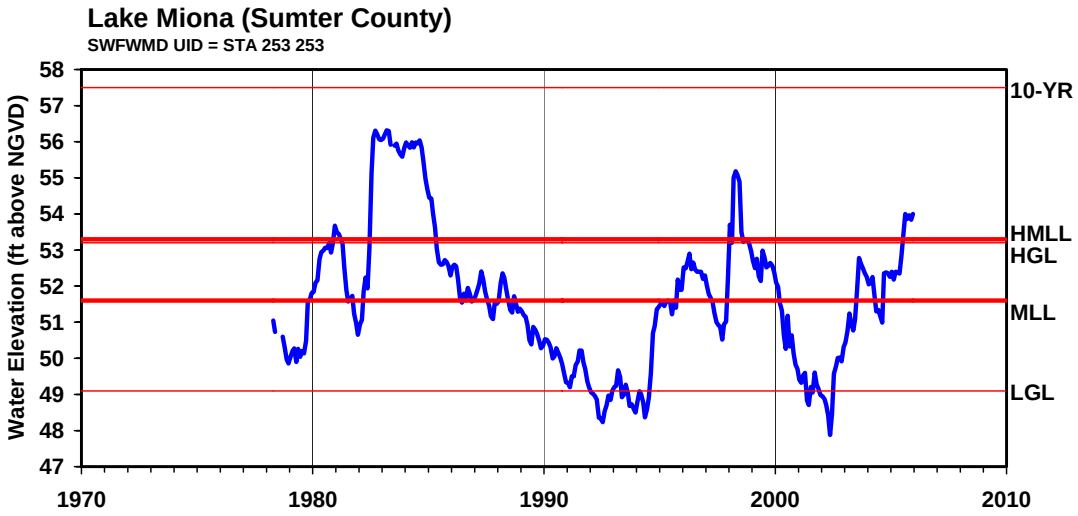
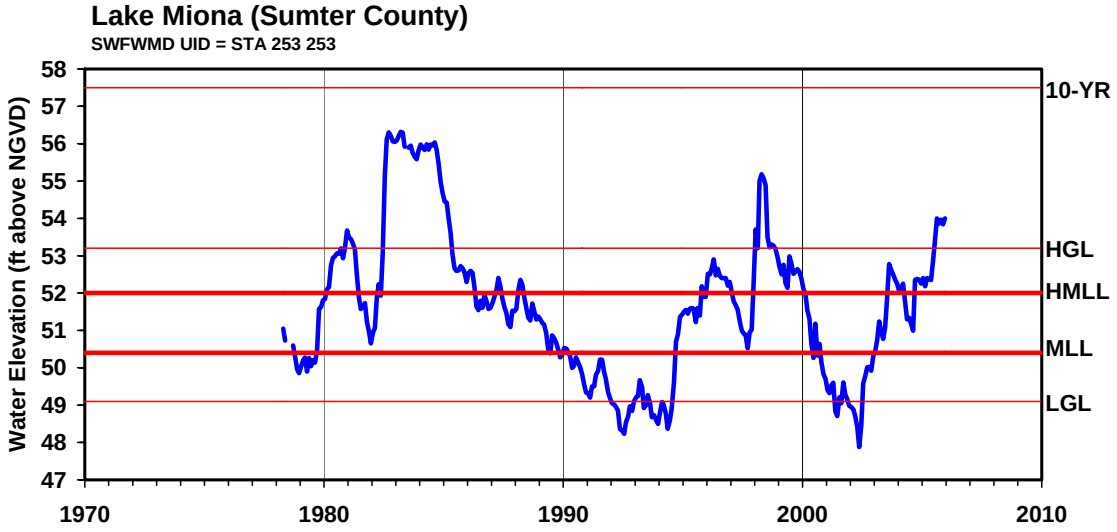


Figure 15. Mean monthly surface water elevations (through December 2005) and proposed guidance and alternative minimum levels for Lake Miona and Black Lake. Levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level, HMLL) and Minimum Lake Level (MLL).



Lake Marion

Lake Setting and Description

Lake Marion is a Category 3 Lake located in east-central Levy County, Florida (Figure 16). The lake lies within the Brooksville Ridge physiographic region and is surrounded by high sand hills. Uplands in the immediate lake basin have been cleared of most native vegetation and are currently used for row crop and pine production, pastureland, and low-density residential development.

Surface water inputs include direct precipitation on the lake and runoff from immediately adjacent upland areas. No surface water drainage occurs from the lake basin.

Minimum and Guidance Levels

Minimum and Guidance levels (Figure 17) for the Lake Marion were developed in October 2005 (SWFWMD 2005a), but have not been presented to the Governing Board for adoption into District rules. Based on the relatively high elevation required for discharge from the basin, a control point elevation was not established. Lake stage data collected through May 2005 were used for levels development. Summary elevation and area data associated with development of minimum and guidance levels for Lake Marion are listed in Table 5.

The proposed Minimum Lake Level for Lake Marion was established at the Historic P50 elevation, 48.4 feet above NGVD, because the Basin Connectivity Standard was higher than the Historic P50. The proposed High Minimum Lake Level was established at 52.8 feet above NGVD by summing the proposed Minimum Lake Level and the difference between the Historic P10 and Historic P50 elevations.

Application of the proposed alternative approach for establishing minimum levels for Category 3 Lakes that are not structurally altered could yield a Minimum Lake Level of 47.6 feet above NGVD for Lake Marion. This level, based on use of the Species Richness Standard, is 0.8 feet lower than the proposed Minimum Lake Level. An alternative High Minimum Lake Level could be established at 52.0 feet above NGVD by summing the alternative Minimum Lake Level and the difference between the Historic P10 and Historic P50. This alternative level is 0.8 feet below the proposed High Minimum Lake Level. It should be noted that the alternative minimum levels represent levels based on review of significant change standards and the Historic P50 elevation, and could be modified based on consideration of unique factors associated with the lake basin.

The alternative minimum levels along with proposed guidance levels and available water level records for Lake Marion are shown in Figure 18. At the alternative Minimum Lake Level, the inundated portion of the lake system would be 14% less than the area inundated when the water level is at the proposed Minimum Lake Level. The area inundated when the lake is staged at the alternative High Minimum Lake Level would be 13% less than when the water level equals the proposed High Minimum Lake Level.

Potential wetland area*, i.e.*, portions of the basin inundated with up to four feet of water, would be 10% less when the lake is staged at the alternative High Minimum Lake Level versus the proposed High Minimum Lake Level.

Figure 16. Aerial photograph of Lake Marion in 2005 (USGS 2005).

Table 5. Elevation data and associated area values used for establishing proposed minimum and guidance levels and alternative minimum levels for Lake Marion.

Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Lake Stage Percentiles		
Historic P10	52.8	69
Historic P50	48.4	28
Historic P90	46.0	16
Other Levels		
Normal Pool	57.1	110
Control Point	NA	NA
Proposed Guidance Levels		
Ten Year Flood Guidance Level	56.6	105
High Guidance Level	52.8	69
Low Guidance Level	46.0	16
Significant Change Standards *		
Connectivity Standard	52.4	65
Species Richness Standard	47.6	24
Aesthetic Standard	46.0	16
Proposed Minimum Levels		
High Minimum Lake Level	52.8	69
Minimum Lake Level	48.4	28
Alternative Minimum Levels		
High Minimum Lake Level	52.0	61
Minimum Lake Level	47.6	24

NA = not available/not applicable

* Dock-Use, Recreation/Ski and Lake Mixing Standards were not established for the lake.

Figure 17. Mean monthly surface water elevations (through December 2005) and proposed guidance and minimum levels for Lake Marion. 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).

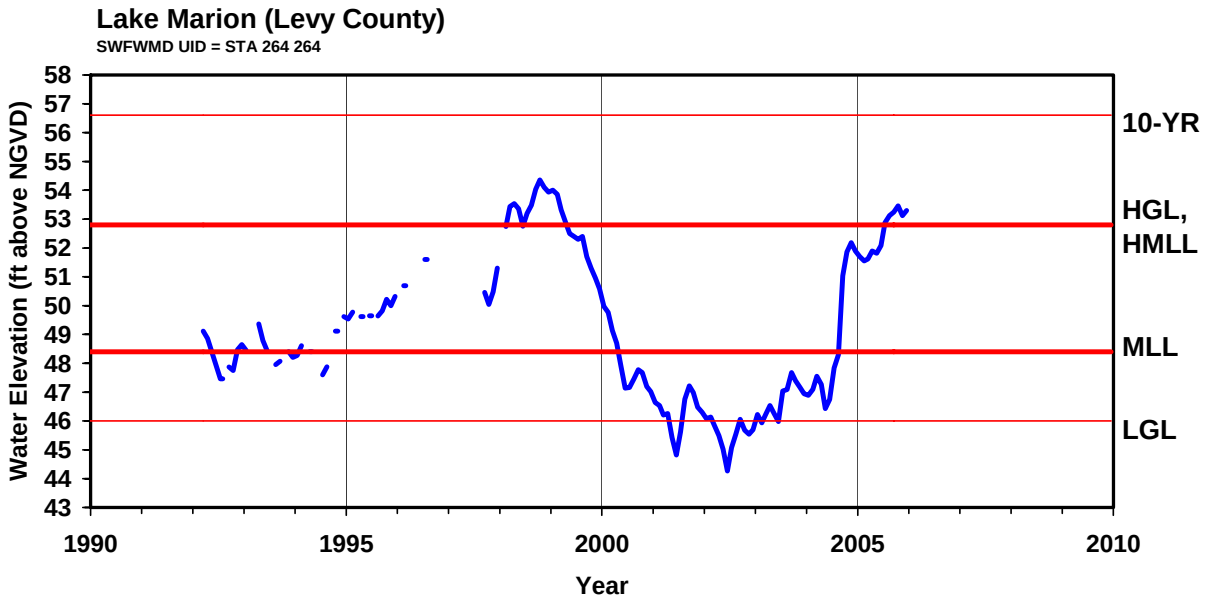
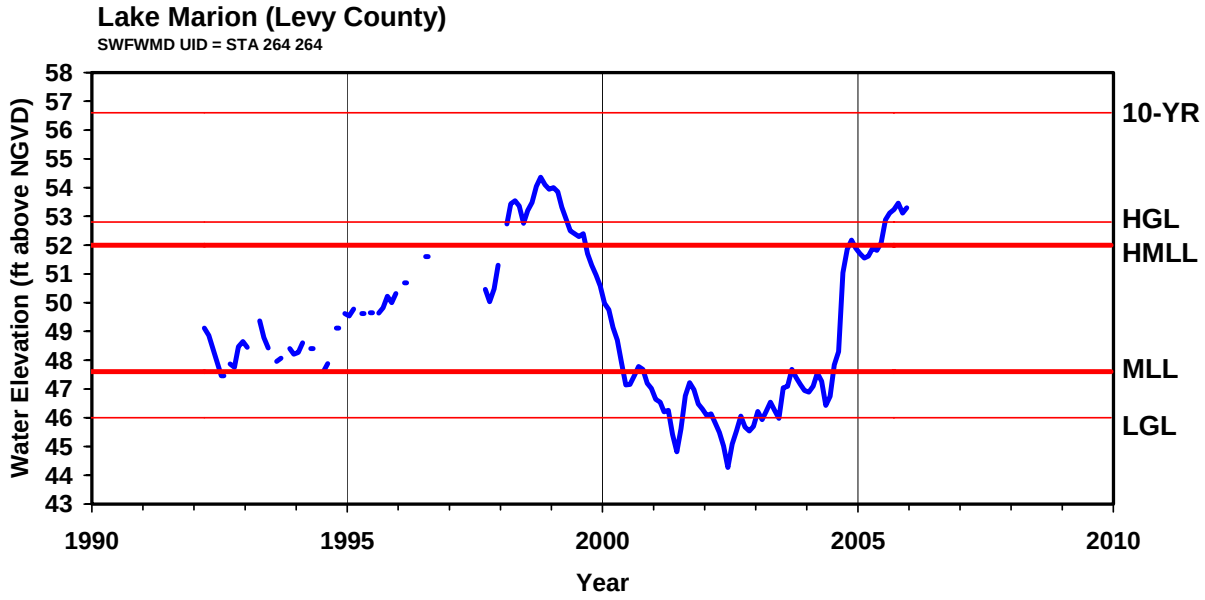


Figure 18. Mean monthly surface water elevations (through December 2005) and proposed guidance levels and alternative minimum levels for Lake Marion. Levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level, HMLL) and Minimum Lake Level (MLL).



Lake Wimauma

Lake Setting and Description

Lake Wimauma (Figure 19) is a Category 3 Lake located in Hillsborough County, Florida. The lake lies at the western edge of the Polk Upland physiographic region. Most of the lake shoreline has been cleared as a result of agricultural or residential development, although some shrubby, wetland vegetation occurs in the area between the two main lake basins. Lake Wimauma has no inlets or outlets.

Minimum and Guidance Levels

Minimum and Guidance levels for the Lake Wimauma (Figure 20) were developed in October 2004 (SWFWMD 2004a), but have not been presented to the Governing Board for adoption into District rules. Because the lake does not have an outlet, a control point elevation was not established. Lake stage data collected through May 2004 and reference lake water regime statistics developed using stage data available for nearby Carlton Lake (SWFWMD 2004a) were used for levels development. Summary elevation and area data associated with development of minimum and guidance levels for Lake Wimauma are listed in Table 6.

The proposed Minimum Lake Level was established at the Historic P50 elevation, 82.1 feet above NGVD, because the Basin Connectivity Standard was higher than the Historic P50. The proposed High Minimum Lake Level was established at 83.8 feet above NGVD by summing the proposed Minimum Lake Level and the appropriate regional RLWR50 value.

Application of the proposed alternative approach for establishing minimum levels for Category 3 Lakes that are not structurally altered could yield a Minimum Lake Level of 79.8 feet above NGVD for Lake Wimauma. This level, based on use of the Species Richness Standard, is 2.3 feet lower than the proposed Minimum Lake Level. An alternative High Minimum Lake Level could be established at 81.5 feet above NGVD by summing the alternative Minimum Lake Level and the regional RLWR50. This alternative level is 2.3 feet below the proposed High Minimum Lake Level. It should be noted that the alternative minimum levels represent levels based on review of significant change standards and the Historic P50 elevation, and could be modified based on consideration of unique factors associated with the lake basin.

The alternative minimum levels along with proposed guidance levels and available water level records for Lake Wimauma are shown in Figure 21. At the alternative Minimum Lake Level, the inundated portion of the lake system would be 13% less than the area inundated when the water level is at the proposed Minimum Lake Level. The area inundated when the lake is staged at the alternative High Minimum Lake Level would be 10% less than when the water level equals the proposed High Minimum Lake Level. Potential wetland area*, i.e.*, portions of the basin inundated with up to four feet of water, would be increased by 12% when the lake is staged at the alternative High Minimum Lake Level versus the proposed High Minimum Lake Level.

Figure 19. Aerial photograph of Lake Wimauma in 2005 (USGS 2005).

Table 6. Elevation data and associated area values used for establishing proposed minimum and guidance levels and alternative minimum levels for Lake Wimauma.

Level or Feature	Elevation (feet above NGVD)	Lake Area (acres)
Lake Stage Percentiles		
Current P10	81.24	122
Current P50	77.60	95
Current P90	72.95	66
Historic P50	82.1	127
Other Levels		
Normal Pool	83.8	137
Control Point	NA	NA
Proposed Guidance Levels		
Ten Year Flood Guidance Level	87.2	NA
High Guidance Level	83.8	137
Low Guidance Level	79.6	110
Significant Change Standards *		
Connectivity Standard	84.0	138
Species Richness Standard	79.8	111
Aesthetic Standard	79.6	110
Recreation/Ski Standard	71.2	57
Mixing Standard	59.4	2
Proposed Minimum Levels		
High Minimum Lake Level	83.8	137
Minimum Lake Level	82.1	127
Alternative Minimum Levels		
High Minimum Lake Level	81.5	123
Minimum Lake Level	79.8	111

NA = not available/not applicable

* A Dock-Use Standard was not established for the lake.

Figure 20. Mean monthly surface water elevations (through December 2005) and proposed guidance and minimum levels for Lake Wimauma. 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).

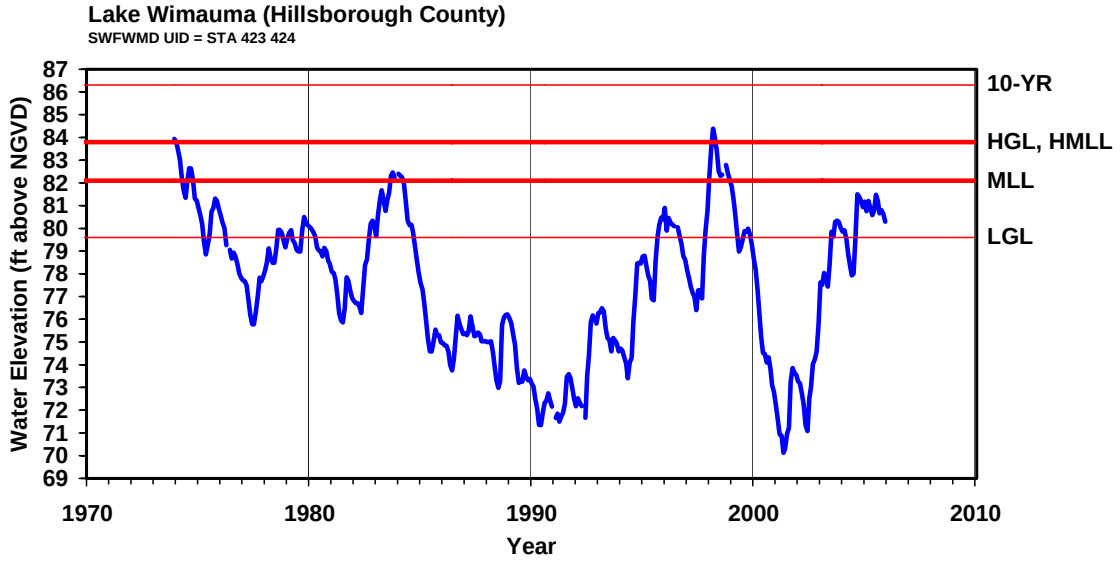
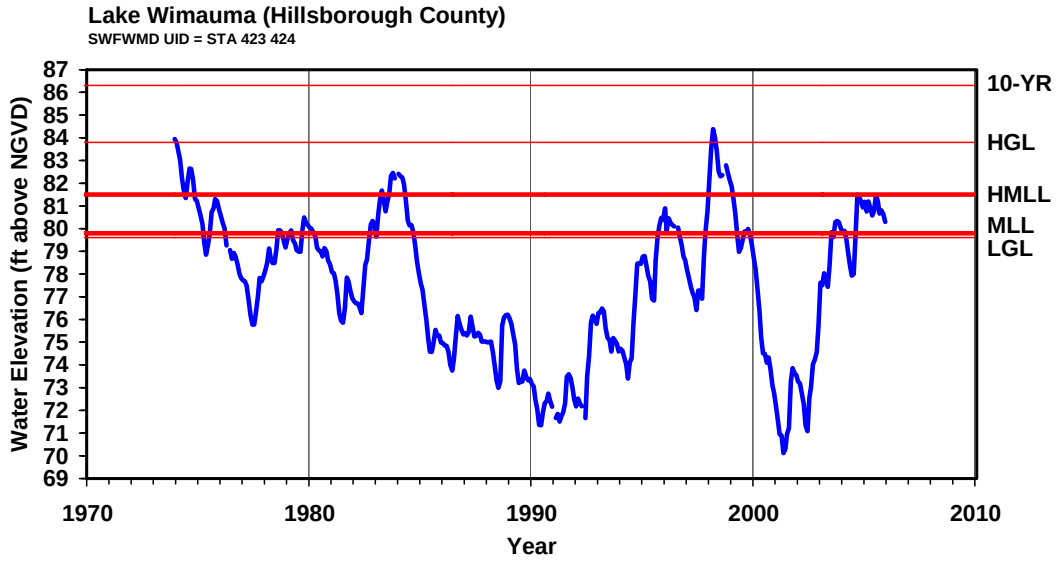


Figure 21. Mean monthly surface water elevations (through December 2005) and proposed guidance and alternative minimum levels for Lake Wimauma. Levels include the Ten Year Flood Guidance Level (10-YR), High Guidance Level (HGL), Low Guidance Level (LGL), High Minimum Lake Level, HMLL) and Minimum Lake Level (MLL).



Section 4
Literature Cited

Bedient, P., Brinson, M. Dierberg, F., Gorelick, S. Jenkins, K., Ross, D., Wagner, K. and Stephenson, D. 1999. Report of the scientific peer review panel on the data, theories and methodologies supporting the minimum flows and levels rules for the northern Tampa Bay area. Prepared for the Southwest Florida Water Management District, Environmental Confederation of Southwest Florida, Hillsborough County and Tampa Bay Water. Brooksville, Tampa and Clearwater, 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, R. Gant. Prepared for the Southwest Florida Water Management District. Brooksville, Florida.

Florida Department of Environmental Protection. 2006. Rules of the Department of Environmental Protection, Florida Administrative Code, Chapter 62-40, Water resources implementation rule; Sub-section 62-40.473, Minimum flows and levels.

Leeper, D.A. 2003. Draft memorandum to file, dated November 13, 2003. Subject: proposed minimum and guidance levels for Hancock Lake in Pasco and Hernando Counties, Florida. Southwest Florida Water Management District. Brooksville, Florida.

Leeper, D.A. 2004a. Draft memorandum to file, dated April 8, 2004. Subject: proposed minimum and guidance levels for Lake Pasadena and Buddy Lake in Pasco County, Florida. Southwest Florida Water Management District. Brooksville, Florida.

Leeper, D.A. 2004b. Memorandum to file, dated January 8, 2004. Subject: proposed minimum and guidance levels for Mountain Lake in Hernando County, Florida. Southwest Florida Water Management District. Brooksville, Florida.

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

Munson, A. 2004. Memorandum to file, dated April 27, 2004. Subject: proposed minimum and guidance levels for Neff Lake in Hernando County, Florida. Southwest Florida Water Management District. Brooksville, Florida.

Southwest Florida Water Management District. 1999. Northern Tampa Bay minimum flows & levels white papers: establishment of minimum levels for Category 1 and Category 2 Lakes. Prepared by the Resource Conservation and Development Department. Brooksville, Florida.

Southwest Florida Water Management District. 2004a. Minimum and guidance levels for Lake Wimauma in Hillsborough County, Florida, October 2004 draft. Brooksville, Florida.

Southwest Florida Water Management District. 2004b. Minimum and guidance levels for Middle Lake in Pasco County, Florida, draft – October 2004. Brooksville, Florida.

Southwest Florida Water Management District. 2005a. Minimum and guidance levels for Lake Marion in Levy County, Florida, October 2005 draft. Brooksville, Florida.

Southwest Florida Water Management District. 2005b. Minimum and guidance levels for Lake Miona in Sumter County, Florida, draft – October 2005. Brooksville, Florida.

Southwest Florida Water Management District. 2006. Rules of the Southwest Florida Water Management District, Florida Administrative Code, Chapter 40D-8, Water levels and rates of flow. Brooksville, Florida.

State of Florida. 2005. The 2005 Florida statutes; Title XXVIII, Natural resources, conservation, reclamation and use; Chapter 373, Water Resources; Part 1, State water resources plan; Sub-section 373.042, Minimum flows and levels. Tallahassee, Florida.

State of Florida. 2005. The 2005 Florida statutes; Title XXVIII, Natural resources, conservation, reclamation and use; Chapter 373, Water Resources; Part 1, State water resources plan; Sub-section 373.0421, Establishment and implementation of minimum flows and levels. Tallahassee, Florida.

United States Geological Survey. 2005. 2005 1 meter natural color digital orthophoto quarter quadrangles. United States Department of the Interior Geological Survey. Reston, VA. Prepared by EarthData International, Frederick, Maryland. Available from the Southwest Florida Water Management District, Mapping and GIS Section. Brooksville, Florida.

Appendix A
Excerpts from Chapter 40D-8, Florida Administrative Code

RULES OF THE
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
CHAPTER 40D-8
WATER LEVELS AND RATES OF FLOW

40D-8.011 Policy and Purpose.
40D-8.021 Definitions.
40D-8.031 Implementation.
40D-8.624 Guidance and Minimum Levels for Lakes.

40D-8.011 Policy and Purpose.

(1) The purpose of Chapter 40D-8, F.A.C., is to establish Minimum Flows and Levels at specific locations throughout the District pursuant to Sections 373.042 and 373.0421, F.S., to describe Guidance Levels for lakes, and to describe how the Minimum Flows and Levels will be used by the District. Minimum Flows and Levels are intended to prevent significant harm to the water resources or ecology of the area as provided in Section 373.042, F.S. In those areas where the Long-term flow or water level is below the Minimum Flow or Level the District will implement a recovery strategy which will be contained within the District's Water Management Plan and, if required by law, portions or all shall be adopted by rule.

(2) Where appropriate, Minimum Flows and Levels may reflect seasonal variations and may include a schedule of variations and other measures appropriate for the protection of non-consumptive uses and the water resources.

(3) A further purpose of Chapter 40D-8, F.A.C., is to establish Guidance Levels for surface waters which are anticipated to occur on a somewhat regular basis, and which shall serve as a precautionary warning to all persons who would propose to construct facilities which may be damaged by periodic high or low water levels.

(4) Minimum Flows and Levels prescribed in Chapter 40D-8, F.A.C., are used in water resource planning as one of the criteria in evaluating applications for water use permits under Chapter 40D-2, F.A.C., and in the design, construction and management of surface water management systems as specified in Rule 40D-8.031(3), F.A.C. The existence of a Minimum Flow or Level for a water body, where that water body is proposed to be impacted by an activity that requires a permit under Chapter 40D-2, F.A.C., Consumptive Use Permitting, or Chapter 40D-4, F.A.C., Environmental Resource Permits, does not override the applicability of all other permitting criteria nor alter the manner in which the District evaluates compliance with permitting criteria, except to the extent that the MFL criteria is supplemental to all other criteria.

(5) The Minimum Flows and Levels established in this Chapter 40D-8, F.A.C., are based on the best information available at the time the Flow or Level was

established. The best available information in any particular case will vary in type, scope, duration, quantity and quality and may be less than optimally desired. In addition, in many instances the establishment of a Minimum Flow or Level requires development of methodologies that previously did not exist and so are applied for the first time in establishing the Minimum Flow or Level. The District has many ongoing environmental monitoring and data collection and analysis programs, and will develop additional programs over time. The District intends to coordinate with local governments, Tampa Bay Water, government-owned and privately owned utilities, environmental regulation agencies, Tampa Bay Estuary Program, public interest groups and other affected and interested parties to design, create, and implement the program. Together with all the parties' designated experts, a Long-term independent scientific peer review shall be included in the programs. These programs will supplement the District's available information upon which Minimum Flows and Levels can be established and reviewed. These programs collectively provide information to assist in 1) characterizing water regimes in wetland systems, and the relationships between and among surficial features, the surficial aquifer, and the Floridan aquifer; and 2) evaluating the measures available to prevent significant harm to the water resources and ecology, in addition to withdrawal management, and the effectiveness of those measures. Therefore, to apprise the Governing Board of advancements made under those programs, the District shall annually update the Governing Board regarding:

(a) The status of the water levels for those water bodies for which Minimum Flows or Levels have been established; and

(b) Any additional information or methodologies, as appropriate, that could be applied to:

1. Assess established Minimum Flows or Levels; or,
2. Establish Minimum Flows or Levels for additional water bodies; or
3. Determine compliance with Minimum Flows or Levels.

Specific Authority 373.044, 373.113, 373.171, F.S. Laws Implemented 373.0395, 373.042, 373.0421, 373.216, 373.219, 373.223, 373.413, 373.414, 373.416, F.S. History – New 6-7-78, Amended 1-22-79, Formerly 16J-8.01, Amended 8-7-00.

40D-8.021 Definitions.

The terms set forth herein shall have the meanings ascribed to them unless the context clearly indicates otherwise, and such meanings shall apply throughout these rules. The terms defined in Rule 40D-1.102, F.A.C., shall also apply throughout Chapter 40D-8, F.A.C., and the terms defined in this 40D-8.021, F.A.C., apply throughout the District rules except that where there is a conflict or a difference between 40D-1.102, F.A.C., and this 40D-8.021, F.A.C., the definition in this Chapter 40D-8, F.A.C., will control.

(1) “Closed Basin Lake” means a lake that does not connect to, or is not part of an ordered surface water conveyance system. Reasonable scientific judgment shall be used to classify a lake as a closed basin lake where hydrology or hydraulic characteristics (*e.g.* intermittent or periodic discharge) are associated with a lake such that the lake does not clearly meet the definition of a closed basin lake nor open basin lake.

(2) “Control Point Elevation” means the elevation of the highest stable point along the outlet profile of a surface water conveyance system that principally controls lake water level fluctuations.

(3) “Current” means a recent Long-term period during which Structural Alterations and hydrologic stresses are stable.

(4) “Guidance Levels” means Levels, determined by the District using the best available information and expressed in feet relative to National Geodetic Vertical Datum (of 1929), or in feet relative to the North American Vertical Datum (of 1988), used as advisory information for the District, lake shore residents and local governments, or to aid in the management or control of adjustable structures. For lakes with levels adopted during or after August 7, 2000, Guidance Levels include: Ten-Year Flood Guidance Level; High Guidance Level; and Low Guidance Level as explained in Rule 40D-8.624, F.A.C. For lakes with levels adopted before August 7, 2000, Guidance Levels are the Ten-Year Flood Guidance Level, the High Level, the Low Level, and, if adopted for the lake, the Extreme Low Level.

(5) “Historic” means a Long-term period when there are no measurable impacts due to withdrawals and Structural Alterations are similar to current conditions.

(6) “Hydrologic Indicators” means those biological and physical features, which are representative of previous water levels as listed in Section 373.4211(20), F.S.

(7) “Long-term” means an evaluation period utilized to establish Minimum Flows and Levels, to determine compliance with established Minimum Levels and to assess withdrawal impacts on established Minimum Flows and Levels that represents a period which spans the range of hydrologic conditions which can be expected to occur based upon historical records, ranging from high water levels to low water levels. In the context of a predictive model simulation, a Long-term simulation will be insensitive to temporal fluctuations in withdrawal rates and hydrologic conditions, so as to simulate steady-state average conditions. In the context of an average water level, the average will be based upon the historic expected range and frequency of levels. Relative to Minimum Flow establishment and Minimum Level establishment and compliance, where there are six years or more of competent data, a minimum of a six year evaluation period will be used, but the available data and reasonable scientific judgment will dictate whether a longer period is used. Where there are less than six years of competent data, the period used will be dictated by the available data and a determination, based on reasonable scientific judgment, that the period is sufficiently representative of Long-term conditions.

(8) “Minimum Flow” means the flow for a surface watercourse at which further withdrawals would be significantly harmful to the water resources or ecology of the area and which may provide for the protection of non-consumptive uses (*e.g.*, recreational, aesthetic, and navigation).

(9) “Minimum Lake Level” means the Long-term level of surface water, water table, or potentiometric surface at which further withdrawals would be significantly harmful to the water resources of the area and which may provide for the protection of non-consumptive uses (*e.g.*, recreational, aesthetic, and navigation). Such level shall be expressed as an elevation, in feet relative to National Geodetic Vertical Datum (1929) or in feet relative to the North American Vertical Datum (1988) and includes Minimum Wetland Levels, High Minimum Lake Levels, Minimum Lake Levels, and Salt Water Intrusion Minimum Aquifer Levels.

(10) “Management Range” means, for those lakes with levels adopted during or after August 7, 2000, the difference between the applicable Low Guidance Level and High Guidance Level which are explained in Rule 40D-8.624, F.A.C. For lakes with levels adopted prior to August 7, 2000, Management Range means the difference between the High Level and Low Level, or Extreme Low Level, if adopted for the lake.

(11) “Open Basin Lake” means a lake that has a surface water conveyance system that by itself, or in series with other lakes, connects to or is part of an ordered surface water conveyance system.

(12) “P10” means the percentile ranking represented by the elevation of the water surface of a lake or wetland that is equaled or exceeded 10 percent of the time as determined from a Long-term stage frequency analysis.

(13) “P50” means the percentile ranking represented by the elevation of the water surface of a lake or wetland that is equaled or exceeded 50 percent of the time as determined from a Long-term stage frequency analysis.

(14) “P90” means the percentile ranking represented by the elevation of the water surface of a lake or wetland that is equaled or exceeded 90 percent of the time as determined from a Long-term stage frequency analysis.

(15) “Reference Lake Water Regime 50” (RLWR 50) means the median value of the difference between the P10 and P50 lake stages for all lakes with Historic data with similar hydrogeologic condition as the lake of concern.

(16) "Reference Lake Water Regime 5090" (RLWR 5090) means the median value of the difference between the P50 and P90 lake stages for all lakes with Historic data with similar hydrogeologic conditions as the lake of concern.

(17) “Reference Lake Water Regime 90” (RLWR 90) means the median value of the difference between P10 and P90 lake stages for all lakes with Historic data with similar hydrogeologic conditions as the lake of concern.

(18) “Structural Alteration” means man's physical alteration of the control point of a lake or wetland that affects water levels.

(19) “Structurally Altered” means a lake or wetland where the control point has been physically altered by man such that water levels are affected.

Specific Authority 373.044, 373.113, 373.171 FS. Law Implemented 373.036, 373.0361, 373.0395, 373.042, 373.0421, 373.086, 373.216, 373.219, 373.223, 373.229, 373.413, 373.414, 373.416, FS. History – New 6-7-78, Amended 1-22-79, Formerly 16J-8.02, Amended 8-7-00, 1-8-04.

40D-8.031 Implementation.

(1) No Guidance Levels shall be prescribed for any reservoir or other artificial structure which is located entirely within lands owned, leased, or otherwise controlled by the user, and which require water only for filling, replenishing, and maintaining of the water level thereof, provided however:

(a) That Chapter 40D-2, F.A.C., shall apply to the use of water for such filling, replenishing, and maintaining of the water level and

(b) That the High Guidance Level and the Ten-Year Flood Guidance Level, determined pursuant to the procedures set forth in Rule 40D-8.624, F.A.C., may be established for any lake determined by the Board to be in the public interest.

(2) No Guidance Levels shall be prescribed for Lake Manatee in Manatee County, Evers Reservoir in Manatee County, the City of Tampa Reservoir on the Hillsborough River in Hillsborough County, and the Peace River/Manasota Regional Water Supply Authority Reservoir in DeSoto County.

(3) New water use or surface water management activity shall not cause an existing water level or flow to be reduced or suppressed below an established Minimum Flow or Level. The manner in which the Minimum Flows and Levels established in this Chapter 40D-8, F.A.C., are implemented in the District's Consumptive Use and Environmental Resource Permitting Programs is described in Rule 40D-2.301, F.A.C., and Section 4.3 of the Basis of Review described in Rule 40D-2.091, F.A.C., and Sections 3.2.2.4, 4.6.1 and 4.6.2 of the Basis of Review described in Rule 40D-4.091, F.A.C.

(4) Where the actual flow or level of a water body is below the Minimum Flow or Level, pursuant to Section 373.0421(2), F.S., the District shall expeditiously implement a recovery strategy with the intent to achieve recovery to the established Minimum Flow and Level as soon as practicable. Where required by law, the portion of the recovery strategy containing criteria that must be met by permittees and applicants under Chapters 40D-2 and 40D-4, F.A.C., shall be adopted by rule. The entire recovery strategy shall be contained in the District's applicable Regional Water Supply Plan for the area, and the District's Water Management Plan.

(5) Establishment of a Minimum Flow or Level shall not be deemed to supercede or replace any other permitting criteria unless specifically provided for by such permitting criteria nor to be a determination by the Governing Board that any quantity above the established Minimum Flow or Level is available for allocation to consumptive uses. For example, the District may by regulation or order reserve such quantities as it deems necessary pursuant to Section 373.223(3), F.S.

Specific Authority 373.044, 373.113, 373.171, F.S. Law Implemented 373.0395, 373.042, 373.0421, 373.216, 373.219, 373.223, 373.413, 373.414, 373.416, F.S. History – New 6-7-78, Amended 10-16-78, 1-22-79, Formerly 16J-8.03, Amended 3-23-81, 8-7-00.

40D-8.624 Guidance and Minimum Levels for Lakes.

(1) Levels for lakes adopted during or after August 7, 2000, are set forth in Table 8-2 in subsection 40D-8.624(13), F.A.C. There are three Guidance Levels for lakes, the Ten-Year Flood Guidance Level, the High Guidance Level and the Low Guidance Level. There are two Minimum Levels for lakes, the High Minimum Lake Level and the Minimum Lake Level. After the High Minimum Lake Level and Minimum Lake Level for each lake is a designation indicating which of the categories described below applied and, therefore, which method was used to determine the High Minimum Lake Level and the Minimum Lake Level.

(2) Levels for lakes adopted prior to August 7, 2000, are set forth in the table in subsection 40D-8.624(14), F.A.C.

(3) Renaming of Levels.

(a) Lake Levels adopted prior to August 7, 2000, were referred to in the District's rules as management levels and alternatively as minimum levels. These levels were the Ten-Year Flood Warning Level, the Minimum Flood Level, the Low

Management Level and, for some lakes, Extreme Low Management Level. As of August 7, 2000, these levels are now referred to as Guidance Levels. For those lakes with levels adopted prior to August 7, 2000, the Ten-Year Flood Warning Level is now named the Ten-Year Flood Guidance Level, the Minimum Flood is now named the High Level, the Low Management Level is now named the Low Level and the Extreme Low Management Level is now named the Extreme Low Level.

(b) For lakes with levels adopted before August 7, 2000, a reference within the District's rules to the applicable minimum level or to established minimum water levels shall refer to the Low Level, or, if adopted for the lake, the Extreme Low Level. Such Low Level or Extreme Low Level shall not be deemed a minimum level pursuant to Section 373.042, F.S.

(c) For lakes with levels adopted during or after August 7, 2000, a reference in the District's rules to the applicable minimum level or to established minimum water levels shall refer to the adopted High Minimum Lake Level and Minimum Lake Level described in this Rule 40D-8.624, F.A.C.

(4) The High Guidance Level (HGL).

(a) The High Guidance Level (HGL) is provided as an advisory guideline for construction of lake shore development, water dependent structures, and operation of water management structures. Figure 8-2 depicts the method described below for calculating the HGL. The High Guidance Level is the expected Historic P10 of the lake. For Category 2 lakes as described in paragraph 40D-8.624(8)(b), F.A.C., below, the HGL and the High Minimum Lake Level may be calculated to be the same elevation.

(b) The HGL is established using best available information, including:

1. Hydrologic data;

2. Hydrologic Indicators;

3. Where the lake has been Structurally Altered, the apparent effectiveness of the Structural Alterations in controlling water levels; and

4. Other information indicative of previous water levels.

(c) Unless the best available information indicates that a different elevation more accurately approximates the Historic P10 of the lake, the HGL shall be established using the following procedure:

1. The HGL shall be established at the Historic P10, if competent Historic data are available.

2. For a Structurally Altered lake with no Historic data, but with Current data, the HGL shall be the higher of the Current P10 or the Control Point Elevation.

3. For a Structurally Altered lake without Historic or Current data, the HGL shall be the Control Point Elevation.

4. For a lake that is not Structurally Altered without Historic or Current data, the HGL is equal to the higher of the Current P10 or the Hydrologic Indicators.

5. For a lake that is not Structurally Altered with no Historic data, but with Current data, the HGLs shall be the higher of the Hydrologic Indicators of normal pool or the Current P10.

(5) Historic P50.

(a) The Historic P50 is derived to support development of minimum lake levels. Figure 8-3 depicts the method described below for calculating the Historic P50.

(b) The Historic P50 shall be established using competent Historic data, if it is available.

(c) In those cases where competent Historic data are unavailable, but Current data are available, the Historic P50 is determined by first calculating the difference between the Current P10 and the Current P50 (P10-P50) and comparing this to the region-specific Reference Lake Water Regime 50 (RLWR 50), then:

1. If the Current lake specific P10-P50 difference is greater than the RLWR 50, it is assumed the lake is impacted by water withdrawals, therefore, the Historic P50 is estimated by subtracting the RLWR 50 from the HGL.

2. If the Current lake specific P10-P50 difference is less than the RLWR 50 then the Historic P50 is estimated by subtracting the Current lake specific P10-P50 difference from the HGL.

3. If Current data does not exist for the lake, the Historic P50 is estimated by subtracting the RLWR 50 from the HGL.

(6) (a) The High Minimum Lake Level (HML) is the elevation that a lake's water levels are required to equal or exceed 10 percent of the time (P10) on a Long-term basis. This level is used in the evaluation of compliance with Chapter 40D-2, F.A.C., Consumptive Use of Water, and Chapter 40D-4, F.A.C., Environmental Resource Permits. The High Minimum Lake Level is established to ensure that a lake reaches higher levels on a periodic basis.

(b) Lake levels are deemed to be below the High Minimum Lake Level when the Long-term P10 of the lake fails to equal or exceed the High Minimum Lake Level. If insufficient data exists to determine if the lake level is below the High Minimum Lake Level, the lake level can be determined to be below the High Minimum Lake Level based on a comparison with lakes that are hydrologically or hydrogeologically similar, or located in close proximity or in the same drainage basin, or by use of aerial photographs or by evaluation of hydrologic data of Hydrologic Indicators.

(7) (a) The Minimum Lake Level is the elevation that the lake's water levels are required to equal or exceed 50 percent of the time on a Long-term basis. This level is used in the evaluation of applications for water use permits pursuant to Chapter 40D-2, F.A.C., and Environmental Resource Permits pursuant to Chapter 40D-4, F.A.C.

(b) Lake levels are deemed to be below the Minimum Lake Level when the Long-term P50 lake elevation is below the Minimum Lake Level. If insufficient data exists to determine if the lake level is below the Minimum Lake Level, the lake level can be determined to be below the Minimum Lake Level based on a comparison with lakes that are hydrologically or hydrogeologically similar or, located in close proximity or in the same drainage basin or, by use of aerial photographs or evaluation of Hydrologic data or Hydrologic Indicators.

(8) The method for establishing the High Minimum Lake Level and the Minimum Lake Level pursuant to 40D-8.624(6) and (7), F.A.C., above, will depend on the category within which the subject lake falls, as follows:

(a) Category 1 Lakes – Those lakes with lake-fringing cypress swamp(s) greater than 0.5 acres in size where Structural Alterations have not prevented

the Historic P50 from equaling or rising above an elevation that is 1.8 feet below the normal pool of the cypress swamp(s). Figure 8-3 depicts the method for calculating the Historic P50.

1. The High Minimum Lake Level for Category 1 lakes is established 0.4 feet below the normal pool elevation in the cypress swamp(s) contiguous with the lake.

2. The Minimum Lake Level for Category 1 lakes shall be 1.8 feet below the normal pool elevation in the cypress swamps contiguous with the lake. Figure 8-1 depicts the method for calculating the minimum lake levels for Category 1 lakes.

(b) Category 2 Lakes – Those lakes with lake-fringing cypress swamp(s) greater than 0.5 acres in size where Structural Alterations have prevented the Historic P50 from equaling or rising above an elevation that is equal to an elevation that is 1.8 feet below normal pool and the lake-fringing cypress swamp(s) remain viable and perform functions beneficial to the lake in spite of the Structural Alterations. Figure 8-3 depicts the method for calculating the Historic P50.

1. The High Minimum Lake Level shall be established at the HGL.

2. The Minimum Lake Level shall be established at the Historic P50 elevation. Figure 8-3 depicts the method for calculating the Historic P50. Figure 8-1 depicts the method for calculating the Minimum Lake Level for Category 2 lakes.

(c) Category 3 Lakes – Those lakes where there are no lake-fringing cypress swamp(s) greater than 0.5 acre in size.

1. High Minimum Lake Level. Once the Minimum Lake Level is identified as described in subparagraph 40D-8.624(8)(c)2., F.A.C., below, the High Minimum Lake Level may be established, using the region-specific reference lake water regime statistic, or Historic hydrologic data. If Historic data are available, the High Minimum Lake Level may be established at the elevation corresponding to the Minimum Lake Level plus the difference between the Historic P10 and the Historic P50. If Historic data are not available, the High Minimum Lake Level may be established at the elevation corresponding to the Minimum Lake Level plus the region-specific RLWR50 value.

2. The Minimum Lake Level for Category 3 lakes is established utilizing a process that considers, applying professional experience and judgment, multiple parameters including changes in lake mixing and susceptibility to sediment resuspension, changes in water depth associated with docks, change in basin connectivity, changes in species richness, change in coverage of herbaceous wetland vegetation, change in coverage of aquatic macrophytes, and change in cultural (aesthetic and recreational) values as described below.

a. Lake Mixing Standard and Information for Consideration

(I) Step 1.

(A) Establish stage specific dynamic ratio values (square root of the lake surface area in square kilometers divided by the mean depth in meters).

(B) Establish the Mixing Standard at the highest elevation at or below the Historic P50 elevation where the dynamic ratio shifts from a value of <0.8 to a value >0.8 or from a value of >0.8 to a value of <0.8.

(II) Step 2. Develop water column depth profiles of water temperature, and dissolved oxygen concentration during summer months.

(III) Step 3. Based on professional experience and judgment, review all relevant information pertaining to water column mixing and stratification in the lake (including the Mixing Standard and stability of water column thermal stratification) for development of minimum levels.

b. Dock-Use Standard and Information for Consideration

(I) Step 1. If boats or other watercraft are used on the lake, determine the elevation of sediments at the end of existing docks, and establish the elevation exceeded by 10 percent of the sediment elevation values.

(II) Step 2.

(A) If Historic data are available, derive the Dock-Use Standard by adding 2 feet and the difference (in feet) between the Historic P50 and Historic P90 elevation to the elevation exceeded by 10 percent of the sediment elevations at the end of existing docks.

(B) If Historic data are not available, derive the Dock-Use Standard by adding 2 feet and the region-specific RLWR5090 value (in feet) to the elevation exceeded by 10 percent of the sediment elevations at the end of existing docks.

(III) Step 3. Based on professional experience and judgment, review relevant information pertaining to dock use and dock elevations at the lake (including the Dock-Use Standard) for development of minimum levels.

c. Basin Connectivity Standard and Information for Consideration.

(I) Step 1. Determine elevations for areas of potential surface water connectivity among sub-basins within the lake basin or between the lake and other lakes.

(II) Step 2. Identify the highest elevation (or other appropriate elevation in the areas of connectivity) as the critical high-spot elevation.

(III) Step 3.

(A) If powerboats are used at the lake and Historic data are available, derive the Basin Connectivity Standard by adding 2 feet and the difference (in feet) between the Historic P50 and Historic P90 elevations to the critical high spot elevation.

(B) If powerboats are used at the lake, and Historic data are not available, derive the Basin Connectivity Standard by adding 2 feet and the region-specific RLWR5090 value (in feet) to the critical high spot elevation.

(C) If powerboats are not used at the lake and Historic data are available, derive the Basin Connectivity Standard by adding 1 foot and the difference (in feet) between the Historic P50 and Historic P90 elevations to the critical high spot elevation.

(D) If powerboats are not used at the lake, and Historic data are not available, derive the Basin Connectivity Standard by adding 1 foot and the region-specific RLWR5090 value (in feet) to the critical high spot elevation.

(IV) Step 4. Based on professional experience and judgment, review relevant information pertaining to inter- and intra-basin connections for the lake basin (including the Basin Connectivity Standard) for development of minimum levels.

d. Species Richness Standard and Information for Consideration.

(I) Step 1. Determine the lake surface area associated with the Historic P50 elevation.

(II) Step 2. Establish the Species Richness Standard at an elevation corresponding to the lowest elevation associated with less than a 15 percent reduction in lake surface area relative to the area at the Historic P50 elevation.

(III) Step 3. Based on professional experience and judgment, review relevant information pertaining to biological diversity within the lake basin (including the Species Richness Standard) for development of minimum levels.

e. Herbaceous Wetland Information for Consideration

(I) Step 1. Determine stage-specific potential wetland area values (*i.e.*, lake area with a water depth less than or equal to four feet) for the lake basin.

(II) Step 2. Identify elevations at which change in lake stage would result in substantial change in potential wetland area within the lake basin.

(III) Step 3. Based on professional experience and judgment, review relevant information pertaining to herbaceous wetlands in the lake basin (including elevations at which change in lake stage would result in substantial change in potential wetland area, and elevations of connections between the lake basin and contiguous wetland areas) for development of minimum levels.

f. Submersed Aquatic Macrophyte Information for Consideration.

(I) Step 1. Determine lake-specific maximum depth of colonization values for submersed aquatic macrophytes using a representative, lake-specific Secchi Disk depth value and an empirically-derived relationship between Secchi Disk depth and maximum depth of macrophyte colonization.

(II) Step 2. Determine stage-specific lake area available for submersed aquatic macrophyte colonization using the lake-specific maximum depth of colonization value.

(III) Step 3. Identify elevations at which change in lake stage would result in substantial change in the area available for colonization by submersed aquatic macrophytes.

(IV) Step 4. Based on professional experience and judgment, review relevant information pertaining to aquatic macrophyte

coverage in the lake basin (including elevations at which change in lake stage would result in substantial change in the area available for colonization by submersed aquatic macrophytes, and coverage that could hinder navigation) for development of minimum levels.

g. Aesthetics Standard and Information for Consideration

(I) Step 1. Establish the Aesthetics Standard at the Low Guidance Level.

(II) Step 2. Based on professional experience and judgment, review relevant information pertaining to aesthetic values associated with the lake basin (including the Aesthetics Standard) for development of minimum levels.

h. Recreation/Ski Standard and Information for Consideration

(I) Step 1. Determine whether the lake basin can contain a ski corridor delineated as a circular area with a radius of 418 feet or a rectangular or polygonal area 200 feet in width and 2,000 feet in length.

(II) Step 2. If the lake basin can contain a ski corridor, identify the minimum elevation at which the lake basin can contain a ski corridor with a depth of five feet (Ski Elevation) by adding 5 feet to the elevation at which the basin can contain the ski corridor.

(III) Step 3.

(A) If Historic data are available, derive the Recreation/Ski Standard by adding the difference (in feet) between the Historic P50 and Historic P90 elevations to the Ski Elevation.

(B) If Historic data are not available, derive the Recreation/Ski Standard by adding the region specific RLWR5090 value (in feet) to the Ski Elevation.

(IV) Step 4.

(A) Compare the Recreation/Ski Standard to the Historic P50 elevation.

(B) If the Recreation/Ski Standard is less than or equal to the Historic P50 elevation, use of the standard for development of the Minimum Lake Level is appropriate.

(C) If the Recreation/Ski Standard is greater than the Historic P50 elevation, use of the standard for development of the Minimum Lake Level is not appropriate.

(V) Step 5. Based on professional experience and judgment, review relevant information pertaining to skiing and other recreational activities within the lake basin (including the Recreation/Ski Standard) for development of minimum levels.

i. Establish Minimum Lake Level - Following development of lake-specific standards (Mixing Standard, Dock-Use Standard, Basin Connectivity Standard, Species Richness Standard, Recreation/Ski Standard, Aesthetics Standard) and compilation of other relevant information, the Minimum Lake Level for Category 3 lakes shall be established at the elevation corresponding to the most conservative, *i.e.*, the highest standard, except where that result is an elevation

above the Historic P50, in which case the Minimum Lake Level shall be established at the Historic P50 elevation.

(9) Where the Governing Board determines that there are unique factors to be addressed at a particular lake such that the Minimum Lake Level that would be established based upon subsection 40D-8.624(8), F.A.C., above is inappropriate, the Governing Board shall determine the High Minimum Lake Level and the Minimum Lake Level, as applicable, considering the appropriate category standards described above, and the lake's unique factors. Unique factors include:

(a) Elevations associated with residential dwellings, roads or other structures,

(b) Substantial changes in the coverage of herbaceous wetland vegetation or submersed aquatic macrophytes,

(c) Frequent submergence of dock platforms,

(d) Information relating to protection of nonconsumptive uses, including lake vegetation maps, faunal surveys, bathymetric maps, aerial photographs, elevations of docks, seawalls, house slabs, other structures, typical uses of a lake (*e.g.* recreation, aesthetics, navigation, irrigation, and surrounding land uses), socio-economic effects of the minimum level and public health, safety and welfare matters.

(10) Low Guidance Level – 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 on a Long-term basis. Therefore, this is also the elevation that a lake's water levels are expected to be below 10 percent of the time on a Long-term basis.

(a) The Low Guidance Level (LGL) is established as:

1. The Historic P90 elevation, if competent Historic data are available.

2. In those cases where competent Historic data are unavailable, but Current data are available, the Low Guidance Level is determined by first calculating the difference between the Current P10 and the Current P90 and comparing this to the region-specific Reference Lake Water Regime 90 (RLWR90), then:

a. If the Current lake specific P10-P90 difference is greater than the RLWR 90, it is assumed the lake is impacted by water withdrawals, therefore, the Low Guidance Level is estimated by subtracting the RLWR 90 from the HGL.

b. If the Current lake specific P10-P90 difference is less than the RLWR 90, then the Low Guidance Level is estimated by subtracting the Current lake specific P10-P90 difference from the HGL.

3. The HGL minus the region-specific RLWR 90 value if competent Historic or Current data are not available.

(11) (a) The Ten-Year Flood Guidance Level is provided as an advisory guideline for lakeshore development. The Ten-Year Flood Guidance Level incorporates 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 10 percent probability of occurrence in any given year. The Ten-Year Flood Guidance Level is established using methods that correspond to the hydrology and type of conveyance system of the lake being evaluated.

(b) Open Basin Lakes That Discharge.

1. Data Available – If lake stage records of sufficient quality and quantity are available, the Ten-Year Flood Guidance Level for open-basin lakes will be established using statistics derived from frequency analysis of the stage records (statistical method). Annual peak stages will be ranked and fit to a distribution or plotted to estimate the ten–year peak stage. At least thirty years of hydrologic data are preferred for establishment of the Ten-Year Flood Guidance Level using the statistical method.

2. Data Not Available – Storm event modeling of open-basin lakes will be utilized when sufficient stage data for use of a statistical method are not available. Rainfall depths used for the process are taken from sources such as the National Weather Service Technical Paper 49, and Part D of the District's Environmental Resource Permitting Information Manual described and incorporated by reference in Rule 40D-4.091, F.A.C. Runoff volumes used for the modeling are computed using conventional methods such as the Natural Resources Conservation Service (NCRS) curve number method, or with standard infiltration formulas (*e.g.* Horton's Equation, Green-Ampt Equation). Runoff distributions are computed using conventional methods including the NRCS method or other unit hydrograph methods, or the kinematic wave overland flow method. Modeling programs that account for tailwater and compute backflow (dynamic models) are preferred for the hydraulic routing component of the stormwater event modeling. Methods described in subparagraph 40D-8.624(11)(c)2., F.A.C., "Closed Basin Lakes – Not Available" below can also be applied when the probability of the 10-year flood elevation being exceeded in any given year is influenced by serial correlation to annual peak elevations.

(c) Closed Basin Lakes.

1. Data Available – If lake stage records of sufficient quality and quantity are available, the Ten-Year Flood Guidance Level for closed-basin lakes will be established using statistics derived from frequency analysis of the stage record (statistical method). Annual peak stages will be ranked and fit to a distribution or plotted to estimate the ten-year peak stage. As a general rule, at least thirty years of hydrologic data are preferred for establishment of the Ten-Year Flood Guidance Level using the statistical method.

2. Data Not Available – Numerical or empirical modeling of closed-basin lakes will be utilized when sufficient stage data for use of a statistical method are not available. Simulation periods of thirty or more years are preferred for either numerical or empirical modeling techniques. A composite record of rainfall records from more than one rainfall station in the region in which the subject lake is located may be used for the process. Calibration of the simulation model shall be based on stage records, Hydrologic Indicators of water level, and eye-witness accounts of peak stages. Model simulations to determine the Ten-Year Flood Guidance Level will exclude effects of water withdrawals.

(12) Posted Notice.

(a) Staff gauges will be installed in prominent locations on each lake for which Guidance Levels or Minimum Levels have been established. A notice shall be posted in the immediate proximity of the staff gauge indicating that Levels have been established.

(b) The notice shall indicate the elevations of the Guidance Level(s) and the established Minimum Level(s).

Specific Authority 373.044, 373.113, 373.171, F.S. Law Implemented 373.036, 373.0361, 373.0395, 373.042, 373.0421, 373.086, F.S. History – New 6-7-78, Amended 1-22-79, 4-27-80, 10-21-80, 12-22-80, 3-23-81, 4-14-81, 6-4-81, 10-15-81, 11-23-81, 1-5-82, 3-11-82, 5-10-82, 7-4-82, 9-2-82, 11-8-82, 1-10-83, 4-3-83, 7-5-83, 9-5-83, 10-16-83, 12-12-83, 5-8-84, 7-8-84, 12-16-84, 2-7-85, 5-13-85, 6-26-85, 11-3-85, 3-5-86, 6-16-86, Formerly 16J-8.678, Amended 9-7-86, 2-12-87, 9-2-87, 2-18-88, 6-27-88, 2-22-89, 3-23-89, 9-26-89, 7-26-90, 10-30-90, 3-3-91, 9-30-91, 10-7-91, 7-26-92, 3-1-93, 5-11-94, 6-6-96, 2-23-97, 8-7-00, 1-8-04, 12-10-04, 6-05-05.