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Southern Water Use Caution Area Recovery Strategy, March 2006

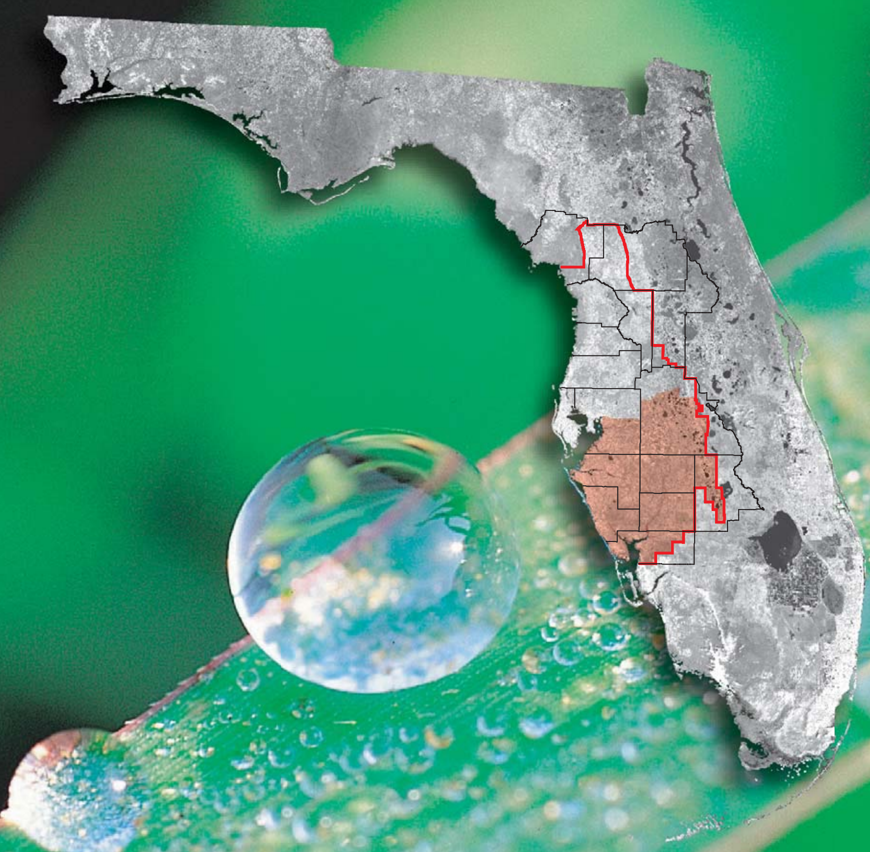
Errata

1. The title page for Appendix 4 date was corrected and changed from *"…2001 Withdrawals…"* to *"…2002 Withdrawals..."*

2. The last page of Appendix 4, incorrectly a duplicate of "*Page 2 of 4*," was replaced with the correct "*Page 4 of 4*."

Reissue Date: October 29, 2012

Southern Water Use Caution Area
RECOVERY STRATEGY



Southwest Florida
Water Management District

March 2006
Final Report

Southern Water Use Caution Area

Recovery Strategy

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Section One
Introduction

The Southern Water Use Caution Area (SWUCA) encompasses approximately 5,100 square miles, including all or part of eight counties in the southern portion of the Southwest Florida Water Management District (District). In response to growing demands from public supply, agriculture, mining, power generation and recreational uses, groundwater withdrawals steadily increased for nearly a century before peaking in the mid-1970s. These withdrawals resulted in declines in aquifer levels throughout the groundwater basin, which in some areas exceeded 50 feet. Although groundwater withdrawals have since stabilized as a result of management efforts, depressed aquifer levels continue to cause saltwater intrusion and contribute to reduced flows in the upper Peace River and lowered lake levels of some of the more "leaky" lakes in the upland areas of Polk and Highlands counties.

In response to these concerns and in compliance with Section 373.036, Florida Statutes, the District determined that regional water supply planning was needed to ensure sustainable growth, in terms of water resources. Florida law requires regional water supply planning in areas where the District determines that sources of water are not adequate for all existing and projected reasonable-beneficial uses, and to sustain the water resources and related natural systems. Regional water supply planning includes quantification of the water needs during a 1-in-10-year drought event for all existing and projected reasonable and beneficial uses within a planning horizon of not less than 20 years. The required planning also includes development of water supply options, including traditional and alternative sources, from which local governments, government-owned and privately owned utilities, self-suppliers and others may choose. The quantities available through the various options must exceed the identified needs. Consideration must also be given to how the above options serve the public interest or save costs by preventing the loss of natural resources or avoiding greater future expenditures for water resource or supply development.

Regional water supply plans also include establishment of minimum flows and levels for priority water bodies pursuant to Section 373.036, Florida Statutes. A minimum flow for a watercourse is the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. A minimum level is the level in an aquifer or surface water body, such as a lake, at which further withdrawals would be significantly harmful to the water resources of the area. If the existing flow or level of a water body is below, or is projected to fall below the applicable minimum flow or level within 20 years, then as part of the regional water supply plan the District shall expeditiously implement a recovery or prevention strategy. This strategy shall include the development of additional water supplies and other actions to achieve recovery to the established minimum flow or level as soon as practicable, or prevent the existing flow or level from falling below the established minimum flow or level. The recovery or prevention strategy shall include phasing or a timetable, which will allow for the provision of sufficient water supplies for all existing and projected reasonable-beneficial uses. This includes development of additional water supplies and implementation of conservation and other efficiency measures concurrent with, and to the extent practical, to offset reductions in permitted withdrawals.

The District is establishing minimum flows and levels for priority water bodies in the SWUCA including the Floridan aquifer in coastal Hillsborough, Manatee and Sarasota counties, the upper Peace River and eight lakes in the Lake Wales Ridge and adjacent areas (Ridge area) in Polk and Highlands counties. Since nearly all of these proposed minimum flows or levels are not currently being met, the District is preparing a Recovery Strategy.

This report, in its entirety, comprises the Recovery Strategy. It is designed to restore minimum flows to the upper Peace River and minimum levels to lakes in Highlands and Polk counties as soon as practical. It will also slow the inland movement of saltwater intrusion such that withdrawal infrastructure will be at minimal risk of water quality deterioration over the next century. This slowing will also make the ultimate stopping of saltwater intrusion more manageable because advances in energy sources and membrane technology should enhance the economic and environmental feasibility of desalting seawater, which could provide the necessary quantities of freshwater to create a saltwater barrier or some other appropriate solution to this long-term resource issue. Consistent with statutory direction, the Strategy also ensures that there is ample water supply for all existing and projected reasonable and beneficial uses in this eight-county area.

The Strategy furthers the progressive water resource management that has evolved in this area over the last few decades. Financial incentives are provided to encourage conservation and development of alternative supplies so that the adverse effects of competition for water from the Floridan aquifer will be minimized. Water resource development projects, such as restoring storage in headwater lakes in the Peace River watershed, will be undertaken by the District to restore perennial flow to the upper Peace River and restore lake levels in the Ridge area, a strategy consistent with the 1997 revisions to the Florida Water Resource Act of 1972. The Strategy is also designed to take advantage of long-term land and water use planning to maximize the beneficial use of alternative supplies and further reduce groundwater withdrawals. The goals of the Strategy are to accomplish the following in an economically, environmentally and technologically feasible manner:

Recovery Strategy Goals:

(1) Restore minimum levels to priority lakes in the Ridge area by 2025

(2) Restore minimum flows to the upper Peace River by 2025

(3) Reduce the rate of saltwater intrusion in coastal Hillsborough, Manatee and Sarasota counties by achieving the proposed minimum aquifer level for saltwater intrusion by 2025; once achieved, future efforts should seek further reductions in the rate of saltwater intrusion and the ultimate stabilization of the saltwater-freshwater interface

(4) Ensure that there are sufficient water supplies for all existing and projected reasonable-beneficial uses

In designing this Recovery Strategy, every effort has been made to ensure all provisions are completely consistent with Chapter 373, Florida Statutes — the District's enabling legislation. The Strategy also maximizes the use of existing District rules; and in the final analysis, very few rule changes are required. The water resource and water supply development components of the Strategy simply require "staying the course," which is how the District has addressed these issues for the past decade. For example, the District has developed a "financial engine" to encourage the development of alternative supplies and more aggressive demand management throughout the District, but emphasizes these efforts in the SWUCA and Northern Tampa Bay Water Use Caution Area. This "financial engine" also provides the necessary funding for water resource restoration projects in areas such as the upper Peace River, a critical component of the Strategy. Finally, the Strategy contemplates enhancements to how the District does business, such as streamlining collection and analysis of water use permitting data and forming staff teams to facilitate priority water use activities (e.g., reconstitution of the agricultural teams).

It is important to note that the management approaches outlined in this Recovery Strategy will be reevaluated and updated over time. The District will be updating its Regional Water Supply Plan (RWSP) at a minimum of every five years. The RWSP includes all of the SWUCA, as well as additional areas in Northern Tampa Bay. These updates will include revisiting demand projections as well as reevaluation of potential sources, using the best available information. In addition, monitoring of recovery in terms of resource trends as well as trends in permitted and used quantities of water, is an essential component of this Recovery Strategy. This monitoring will provide the District with the information necessary to determine progress in achieving recovery and protection goals. This information will enable the District to take an adaptive management approach to the resource concerns in the SWUCA to ensure the goals and objectives established by the Governing Board are ultimately achieved.

This Recovery Strategy and the 10-county RWSP are also components of the broader District Water Management Plan (DWMP). The DWMP contains long-range goals and policies for all of the District's areas of responsibility. The management approaches contained in this Recovery Strategy are consistent with and further the District's goals and policies as contained in the DWMP.

This report includes nine sections and seven appendices. Section 2 follows this introduction and provides a description of the SWUCA, including when and why it was established, how the boundaries were drawn, and how the geology, hydrology and natural systems function and react to human influences. Section 3 summarizes the establishment of minimum flows and levels for saltwater intrusion, the upper Peace River and the eight lakes in the upland areas of Highlands and Polk counties. Section 4 summarizes the SWUCA Recovery Strategy, discussing the major components, principles and elements. Section 5 presents the water supply planning component, which is paramount to designing the regulatory and non-regulatory recovery tools. Section 6 is a description of the various conservation initiatives and projects that are part of the Strategy. Section 7 includes the existing and planned water resource development projects in the upper Peace River watershed and upland areas of Highlands and Polk counties. Section 8 contains the regulatory components of the Strategy, most of which will rely on existing rules. Section 9 is a summary of the various financial tools available to assist in fully implementing the Recovery Strategy.

Appendices 1, 2 and 3 are the independent scientific peer review panel findings and recommendations for the saltwater intrusion, upper Peace River and Category 3 lakes minimum flows and levels, respectively. Appendix 4 lists existing and planned public supply sources that support the development of the water supply planning component discussed in Section 5. Appendix 5 is the District's SWUCA messaging and outreach plan. Appendix 6 contains a list of the members that comprised the SWUCA Work Group. Appendix 7 includes the summaries of Work Group meetings held in late 2003 through 2005.

Section Two
Southern Water Use Caution Area

The SWUCA covers the portion of the District generally south of I-4 and includes all of DeSoto, Hardee, Manatee and Sarasota counties, and parts of Charlotte, Highlands, Hillsborough and Polk counties (Figure 2-1). The area was designated as a water use caution area (WUCA) to manage water resources in the Southern West-Central Florida Groundwater Basin (SWCFGWB) in a comprehensive manner. The Governing Board declared the SWUCA in 1992, based on a considerable amount of data collection and numerous studies of water resources in the SWUCA.

Following the Florida Water Resources Act of 1972, the District began to invest in better understanding the effects of water use, drainage, and development on the water resources and ecology of west-central Florida. A major result of this investment was the creation of the District's Regional Observation Monitor Well Program (ROMP) to drill wells to better characterize groundwater resources and surface and groundwater interactions. About a dozen wells were drilled annually and, slowly, regional data collection emerged. In the 1980s, results of these efforts began to pay dividends because several hydrologic assessments were conducted that used these data and clearly demonstrated regional resource concerns in the District. It should also be noted that the District's regulation of water use did not commence in most of the SWUCA until 1975, pursuant to the Florida Water Resources Act of 1972. In addition, water use permitting was not fully implemented until 1979 in Manatee or Sarasota counties, or that portion of Highlands County in the District, since these areas were added to the District subsequent to the Florida Water Resources Act.

In 1978, the Peace River Basin Board directed that a hydrologic investigation be performed to assess causes of lake level declines along the Ridge area that had been occurring since the 1960s. The investigation (referred to as Ridge I) was completed in 1980 and concluded that the declines were due to below normal rainfall and groundwater pumping. In 1987, the District initiated the Ridge II study to implement the data collection that was recommended in the previous study and further assess lake level declines. The Ridge II investigation also concluded that lake level declines were a result of below-average rainfall and aquifer withdrawals. It was recognized in that study that groundwater withdrawals beyond the Ridge area, throughout the groundwater basin, also contributed to declines within the Ridge area. Additionally, it was concluded that in some cases alterations to surface drainage were significant and affecting lake level fluctuations.

During the 1980s, hydrologic and biologic monitoring from the District's expanded data collection networks began to reveal water resource impacts in other areas of the District. In the late 1980s, the District initiated detailed water resource assessment projects (WRAPs) of the Eastern Tampa Bay (ETB) and Northern Tampa Bay (NTB) areas to determine causes of water level declines and to address the issue of water supply availability. Resource concerns in these areas included lowered lake and wetland levels in NTB and saltwater intrusion in the Floridan aquifer in ETB.

In 1989, based on preliminary findings of the Ridge II and ongoing WRAP studies, and continued concern about water resource impacts, the Governing Board declared the Ridge area, ETB and NTB areas as WUCAs. In conjunction with the declaration of these areas as

WUCAs, the Governing Board implemented a strategy to address the resource concerns. The strategy consisted of short-, mid- and long-term solutions. The short-term solutions included implementing best management practices where practical and forming a citizens advisory group in each of the areas. The mid-term solutions were to be developed over a 6- to 12-month period in cooperation with the citizens advisory groups. The long-term solutions were to be a refinement of the mid-term solutions and based on comprehensive studies of the areas to determine long-term water supply availability.

From May 1989 through March 1990, there were extensive public work group meetings to develop management plans for the ETB, NTB and Ridge area WUCAs. These meetings are summarized, in detail, in the Highlands Ridge Work Group Report (November 1989) and Management Plan (March 1990), Eastern Tampa Bay Work Group Report (March 1990) and Management Plan (April 1990), and Northern Tampa Bay Work Group Report (March 1990) and Management Plan (May 1990). These deliberations led to major revisions to the District's water use permitting rules as special conditions were added that applied to each of the WUCAs. An important example of this was the declaration of the ETB Most Impacted Area (MIA). The ETB MIA is an area of about 708 square miles located along the coast of southern Hillsborough, Manatee and northwestern Sarasota counties where the concern for saltwater intrusion was greatest. Since 1990, there have been no increases in permitted groundwater withdrawals from the Floridan aquifer in the MIA in order to stabilize groundwater levels.

It was also during these deliberations that the original concept of the SWUCA emerged. The Eastern Tampa Bay Work Group, in particular, had lengthy discussions on the connectivity of the groundwater basin and how withdrawals throughout the basin were contributing to saltwater intrusion, as well as impacts to lakes in the Ridge area. A significant finding of both the Ridge II study and the ETB WRAP was that the lowering of the potentiometric surface within those areas is due to groundwater withdrawals from beyond those areas as well as withdrawals within those areas. Additionally, the ETB WRAP concluded that "… There is a need for a basinwide approach to management of the water resources." Based on results of these studies and discussions at the work groups, the Governing Board in October 1992 established the SWUCA to encompass both the ETB and Ridge area WUCAs, and the remainder of the groundwater basin.

The SWCFGWB is one of three groundwater basins in the District that were delineated based on persistent groundwater flow lines in the Floridan aquifer (Figure 2-1). Ground water in each basin is derived from recharge that originates as rainfall that falls over the respective basin area and is generally separate from adjacent basins. When the SWUCA boundaries were delineated, the goal was to approximate the boundaries of the SWCFGWB as close as possible. Since the southern boundary of the groundwater basin extends beyond the District's boundaries, the southern boundary of the SWUCA was set at the District boundaries. Management of withdrawals outside the District is accomplished through a memorandum of understanding between the St. Johns River, South Florida and Southwest Florida water management districts. It is important to note that withdrawals in those portions of Charlotte, Highlands and Polk counties not within the jurisdictional boundary of the District are minimal compared to those within (Figure 2-2). The eastern boundary of the groundwater basin is generally aligned with the north-south centerline of the Ridge area. The SWUCA boundary in this area was extended to the eastern District boundary and captured some areas that were outside the basin. These areas were included in the SWUCA, even though they were technically outside the groundwater basin, because withdrawals in those areas could affect lake levels. The northern boundary of the SWUCA generally followed the northern boundary of the groundwater basin in Polk County; however, in Hillsborough County the boundary was kept the same as was used for the ETB WUCA. The area in Hillsborough County between SR 60 and the basin boundary (reasonably approximated using I-4) was not included in the SWUCA because this area was already part of the NTB WUCA and subject to those restrictions, which were similar to those contained in the previously proposed SWUCA rule. In addition, locating the boundary at I-4 would divide a distinct water use group (strawberry growers) in that area. Establishing this boundary at U.S. Highway 60 would ensure this user group would be regulated consistently under one set of rules.

There are three aquifer systems present in the SWUCA — the surficial, intermediate and Floridan. Confining layers of variable thickness and extent separate these aquifers from one another. Figures 2-3 and 2-4 depict these aquifer systems as cross sections in the north-to-south and east-to-west directions, respectively. Recharge to these aquifers occurs from rainfall that percolates into the aquifers and is greatest along the upland areas of Highlands and Polk counties (Figure 2-5). The Floridan aquifer system is by far the most productive of the three systems. About 85 to 90 percent of all ground water used in the basin is derived from the Floridan aquifer. It is a well-confined, highly transmissive aquifer where effects of withdrawals can extend radially outward tens of miles. In southern and coastal portions of the SWUCA, water quality in the Floridan aquifer is poor and the intermediate aquifer becomes more important in terms of providing water supply in those areas.

Long-term declines in Floridan aquifer groundwater levels in the SWUCA have been occurring since the area first began to develop. An example of the declines can be seen in Figure 2-6, which depicts water levels in the Sarasota 9 Floridan aquifer monitor well located just east of the city of Sarasota. As noted by the U.S. Geological Survey (USGS), water level declines had occurred at this site prior to when water level records began in 1932. Development in other areas was also beginning to occur at a rapid pace during the early to mid-1950s. Water levels from six long-term monitoring well sites, including Sarasota 9, are shown in Figure 2-7. Locations of these wells are shown in Figure 2-8. The water level histories for each well are quite similar in their general patterns of decline and ascent. The monitor wells are responding to local effects and regional, or basin, effects. The dissimilarity is produced by local withdrawals. It is the large number of withdrawals, tens of miles distant from these monitor wells, that produce this basin signature in each hydrograph. It is reflective of the well-confined, highly transmissive nature of the Upper Floridan aquifer. All these wells showed signs of stabilizing or increasing water levels during the 1990s. Over the long-term, the more northern wells (Coley Deep, ROMP 50 and ROMP 60) have generally stabilized or increased somewhat since the mid-1970s. The southern wells (Edgeville Deep, Marshall and Sarasota 9), however, show signs of continued decline.

The relative changes in groundwater levels that have occurred throughout the SWUCA since predevelopment are illustrated in Figure 2-9. The predevelopment time period is generally considered to be that time prior to the observation of water level declines, sometime prior to the 1930s. The USGS has produced a map that estimates the potentiometric surface (water levels in Floridan aquifer wells) for predevelopment. Although the map contains some errors, especially near the edges, due to insufficient data in some areas, it is useful as a general reference of approximate conditions prior to development. The change maps

(Figure 2-9) represent the differences between the annual-average potentiometric surface maps for a year (1975 or 2000) and the predevelopment potentiometric surface map. A comparison of the two maps indicates that the total change or drawdown for the two periods (1975 and 2000) is similar, further indicating that the total quantities of groundwater withdrawals between the two periods are similar. There is, however, a shift in the center of groundwater withdrawal impact that has occurred from 1975 to 2000. In 1975, the center of drawdown was in Polk County, centered in the phosphate mining region. By 2000, the center of impact had shifted to the west into southern Hillsborough and northern Manatee counties. This trend is also apparent when looking at water levels from the key SWUCA wells shown in Figure 2-7.

Historically, the major uses of ground water in the SWUCA have been for agricultural irrigation and the mining and processing of phosphate ore. Agricultural water use tends to occur throughout the basin, but has experienced a shift over the past two decades from the north to less freeze-prone areas in the south. The distribution of water use permits for groundwater withdrawals throughout the region is shown in Figure 2-2. Withdrawals associated with mining have historically been located in the north-central portion of the SWUCA. Since the 1970s, the phosphate industry has reduced its reliance on ground water through conservation. Growth in other use sectors in other areas of the basin has offset these reductions. Figure 2-10 shows estimates of historical groundwater use in the SWUCA based on a relationship developed between groundwater level fluctuations and water use estimates since the early 1990s. In recent years, the major uses of ground water have been for agricultural irrigation and public supply. Estimated groundwater withdrawals in 2000, a period of record drought, were about 836 mgd. Of this amount, 581 mgd (69 percent) was for agriculture; 146 mgd (17 percent) was for public supply; 46 mgd (6 percent) was for industrial/commercial; 42 mgd (5 percent) was for mining/dewatering; and 21 mgd (3 percent) was for recreational uses. Surface water sources provided for an additional 92 mgd of water demand in the area.

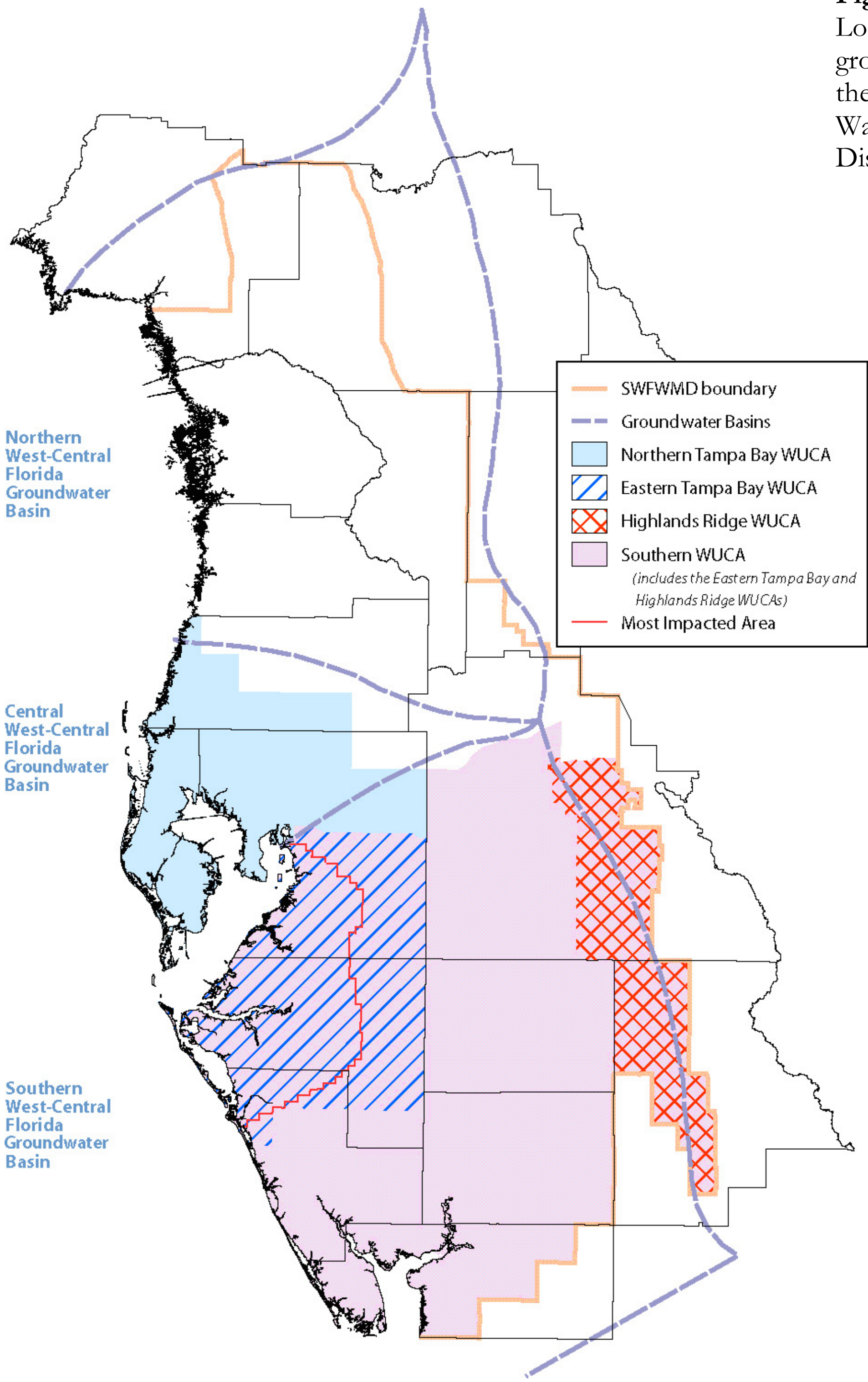
As noted above, one of the principal resource concerns in the SWUCA is saltwater intrusion in the Floridan aquifer. It is important to note that in the coastal margins of the SWUCA the Floridan aquifer generally contains poor water quality. Because the aquifer is highly productive and generally consists of good quality water in the inland areas, demand for water supply from the aquifer is high. Increased withdrawals over the years, as noted in Figure 2-10, have resulted in the regional lowering of groundwater levels and reductions in coastal groundwater discharge in the Floridan aquifer. The result has been the movement of salt water into landward portions of the aquifer. Increased data collection and analysis since the early 1990s has helped to better define the position of the saltwater interface and rates of movement that are occurring. Figure 2-11 is an example of the changes in chloride levels (an indication of saltwater intrusion) that are occurring in a coastal Floridan aquifer monitoring well. Through computer modeling and other analytical methods, estimates of the rates of movement and quantification of wells at risk to saltwater intrusion have been made for different pumping scenarios. In order to halt movement of the interface, analyses have shown that it would be necessary to reduce annual average groundwater withdrawals from 650 mgd to less than 400 mgd, and possibly close to 200 mgd. Though saltwater intrusion is continuing to occur, it is a relatively slow-moving phenomenon. This fact gives water managers the opportunity to solve this problem over the course of decades versus the need to provide an immediate solution.

Since the early 1990s, increased attention has been given to declining flows in the Peace River (2-12). Whereas the upper Peace River was a gaining stream with respect to the Floridan aquifer and believed to be a perennially flowing stream throughout the first half of the twentieth century (Figure 2-13), there are now periods of the year when there is no flow in portions of the river upstream of Fort Meade (Figure 2-14). Figures 2-15 and 2-16 illustrate the change in the relationship between the potentiometric surface of the Floridan aquifer and the river that has occurred since predevelopment. Kissengen Spring, located about four miles south of the city of Bartow (Figure 2-8), historically discharged about 15 to 20 mgd to the river. As a result of lowered groundwater levels due to groundwater withdrawals in the region, flow from the spring gradually declined until it ceased continuous flow in 1950. Though it occasionally flowed during the 1950s, there has been no measurable flow since about 1960. Estimated historical groundwater withdrawals in Polk County during this period ranged from about 30 mgd during the 1930s to about 110 mgd in 1950 (Figure 2-17). Since 1950, groundwater withdrawals in the county have ranged from about 400 mgd during the mid-1970s to about 275 mgd in recent years. In order to restore flow from Kissengen Spring, it will be necessary to increase groundwater levels in the vicinity of the spring. The only practical means of accomplishing this goal would be to reduce groundwater withdrawals. Through analysis of estimated groundwater withdrawals in Polk County alone, this would require a reduction in groundwater withdrawals of more than 225 mgd, from the current levels of 275 mgd to less than 50 mgd that occurred during the 1930s. Based on recent groundwater flow modeling, if groundwater withdrawals were uniformly reduced over the entire SWUCA, a cutback from 650 mgd to about 200 mgd would have to occur. It is also of interest to note that over the past 20 years, the USGS and others have observed and documented the loss of flow into sinkholes and sand-filled depressions in the upper river.

Though it is clear low flows in the upper Peace River have been affected by groundwater withdrawals, the affect of withdrawals on the river lessen as you go downstream. Declines in mean annual river flows can also be attributed to variations in rainfall that have occurred. During the past five years, there has been extensive study of long-term changes in rainfall and its effect on streamflow (Gray, Sheaffer and Landsea, 1997; Goldenberg, Landsea, Mestas-Nunez and Gray, 2000; Enfield, Mestas-Nunez and Trimble, 2001; Garlanger, 2002; Basso and Schultz, 2003). Figure 2-18 compares long-term median river flows of the Peace and Withlacoochee rivers. Although there are tremendous differences in the land use in these watersheds, the long-term streamflow is similar. Figure 2-19 is a comparison of the Peace and Kissimmee rivers and shows similar results. Figure 2-20 is a map of stream gauges throughout central Florida that illustrates that streamflow throughout central Florida significantly declined. The previously mentioned studies conclude that most of the declines in flow are related to long-term deficit rainfall throughout central Florida from the 1960s through the 1990s. There have also been significant land-use activities in the basin that have resulted in lower flows and levels. The District and others continue to study the impacts of these changes.

Several north-south trending sand ridges characterize the eastern portion of the SWUCA. The longest of these is the Ridge area, often referred to as the Lake Wales Ridge or Highlands Ridge. Land surface elevations in the area range from about 150 to 300 feet above sea level. The area contains numerous lakes and karst features and contributes large quantities of recharge to the underlying aquifers through these features. Figure 2-21 depicts an aerial view of the area looking toward the north from the southern end of the Ridge area in Highlands County. Figure 2-22 is the same aerial view with county and water management district boundaries superimposed. Because of the sandy, well-drained soils along the Ridge, citrus production has been prominent in the area since the early 1900s (Figure 2-23). By comparing Figures 2-21 and 2-23, it is apparent that withdrawals for citrus are also located along the sand ridges near the many lakes in the area. During the 1970s and 1980s, hydrologic monitoring in the Ridge area of Polk and Highlands counties by the SWFWMD and the USGS indicated that lake levels were declining (Figure 2-24). As illustrated in the figure by the level of Crooked Lake and the level of ground water in the Coley Deep Well near Frostproof, lake and groundwater levels in the Ridge area have declined in similar fashion over the past several decades. Figure 2-25 is a comparison of ROMP 28X and 43XX with the Coley Deep Well near Frostproof that further illustrates the lowering of water levels in the area. The timing of these declines coincided with increased groundwater withdrawals in the Ridge area and surrounding region, as well as a period of low rainfall and extensive modifications to surface drainage features. Differences in lake fluctuations over the years can be attributed to several factors, including the geologic setting, leakiness of the lake bottom, size of the area contributing flow to the lake, whether or not the lake receives surface water inflow, alterations to surface outlets, and proximity to local and regional pumping centers.

Figure 2-1.
Location of WUCAs and groundwater basins in the Southwest Florida Water Management District.



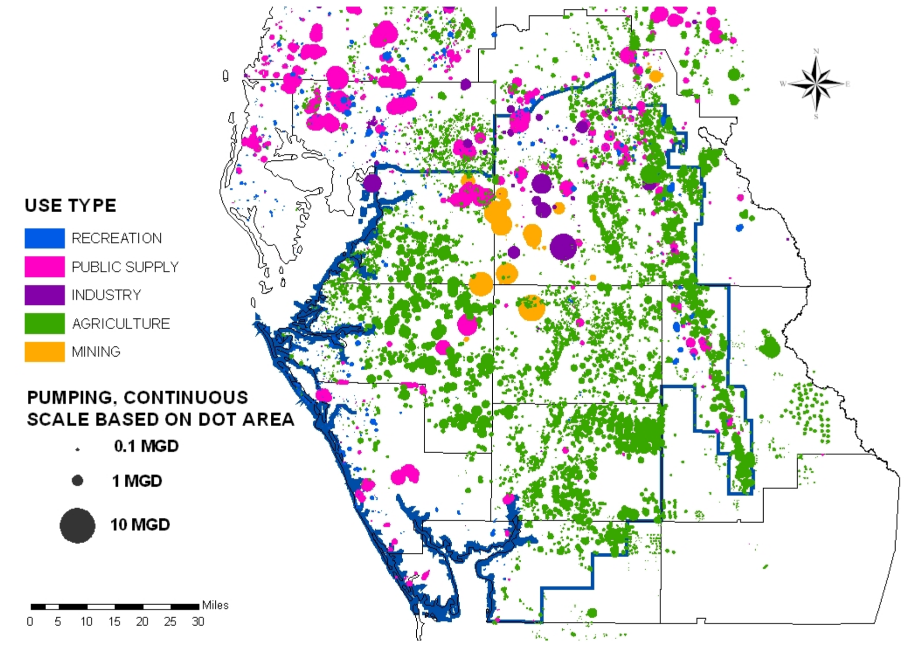


Figure 2-2.
Locations of water use permits in the SWUCA, scaled according to the estimated water use for 2000.

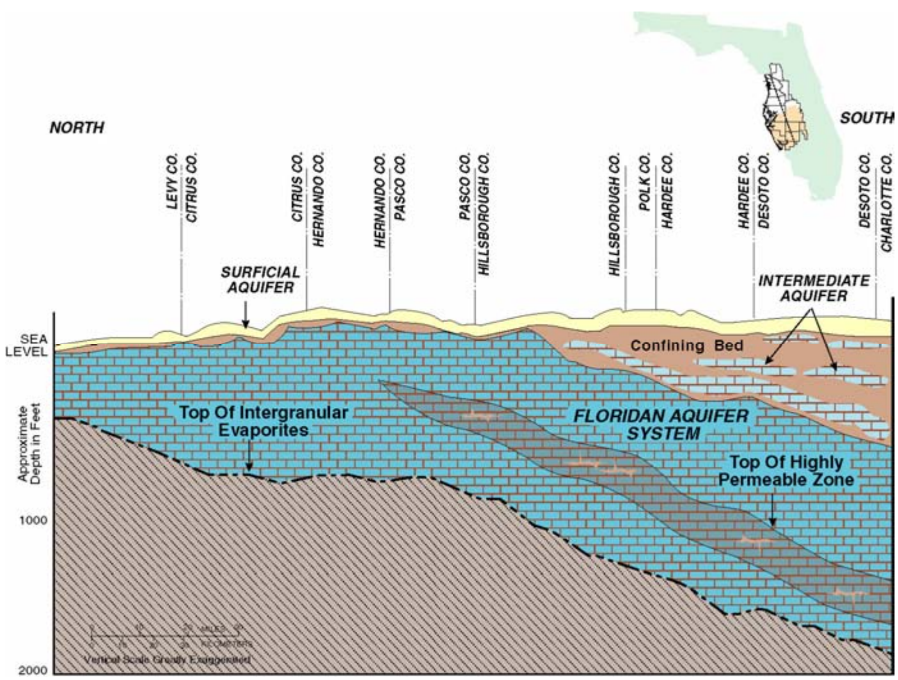


Figure 2-3.
General north-south hydrogeologic cross section of the region.

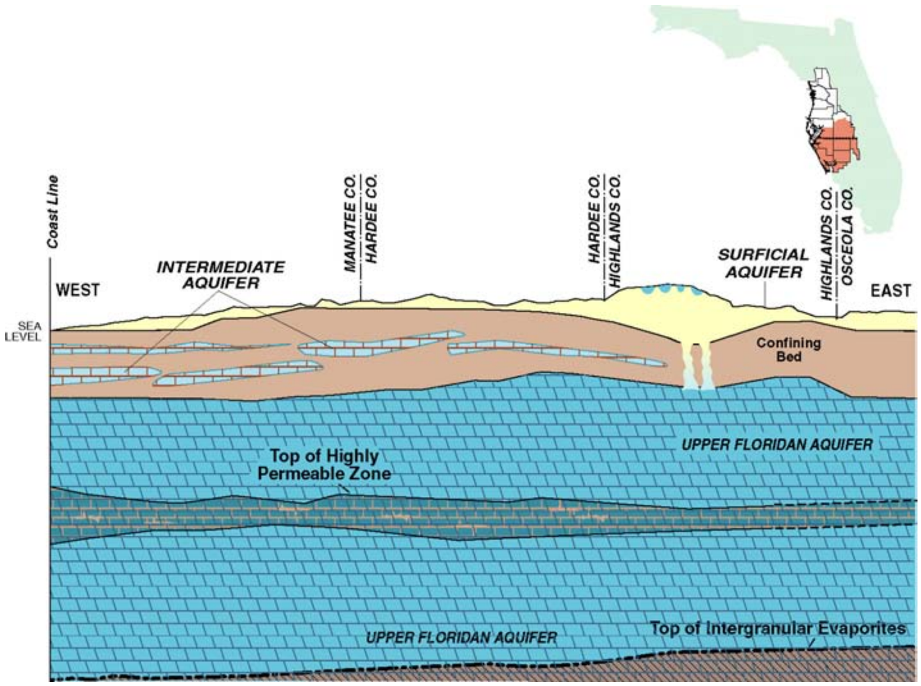


Figure 2-4.
General east-west hydrogeologic cross section of the region.

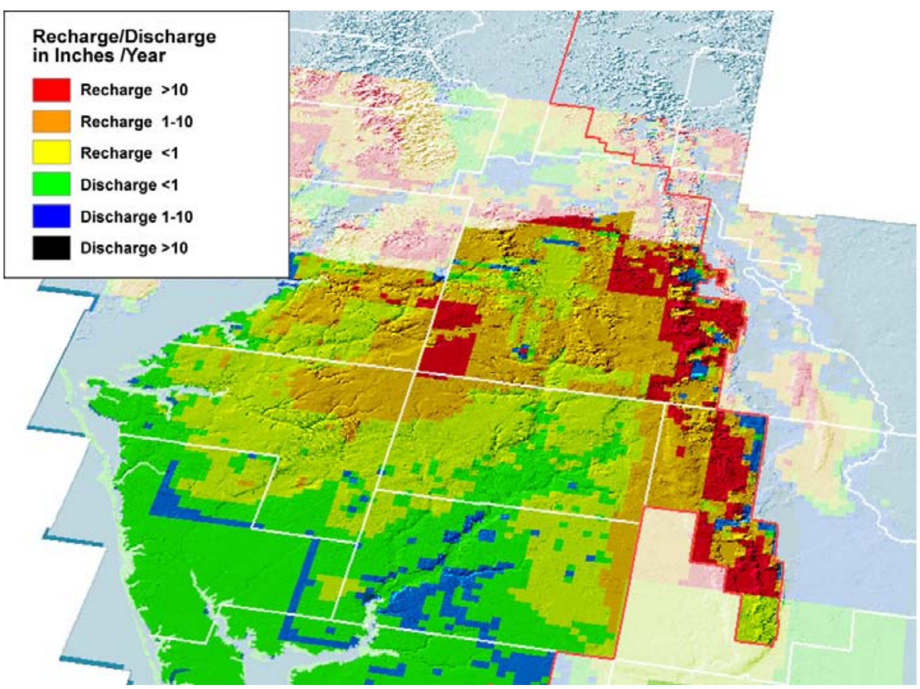


Figure 2-5.
Areas of recharge to and discharge from the Floridan aquifer in the SWUCA.

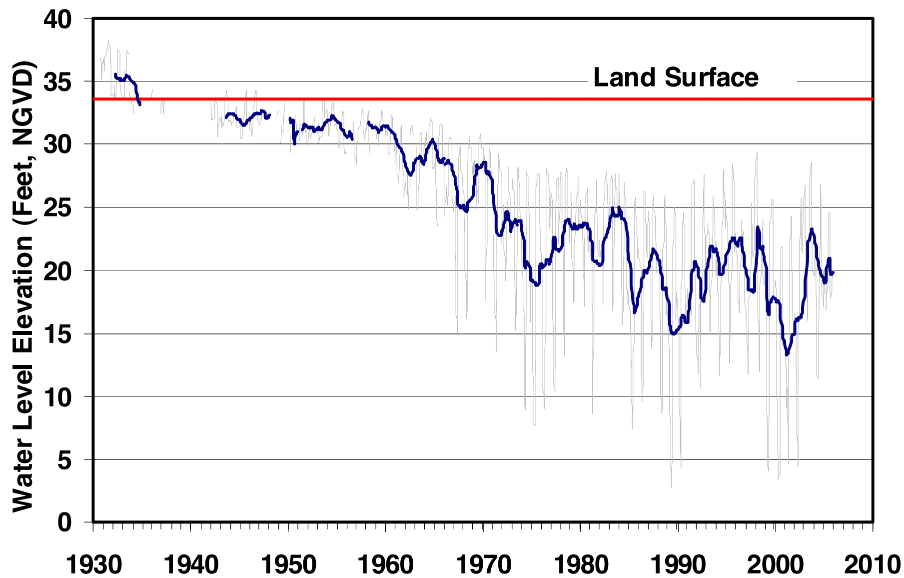


Figure 2-6.
Monthly and 12-month moving average water levels in the Upper Floridan aquifer water levels in the Sarasota 9 Deep well located east of the city of Sarasota.

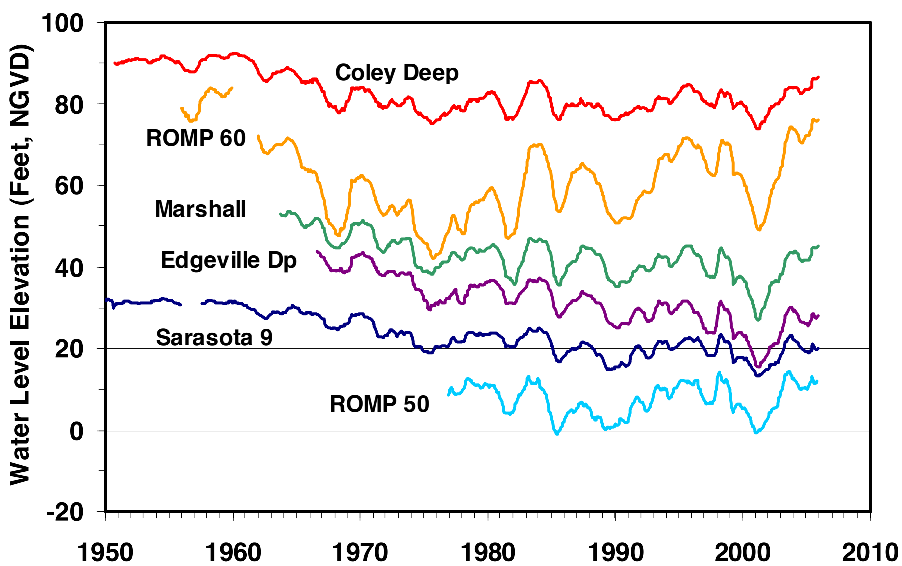


Figure 2-7.
Twelve-month moving average water levels from long-term monitor wells in the SWUCA.

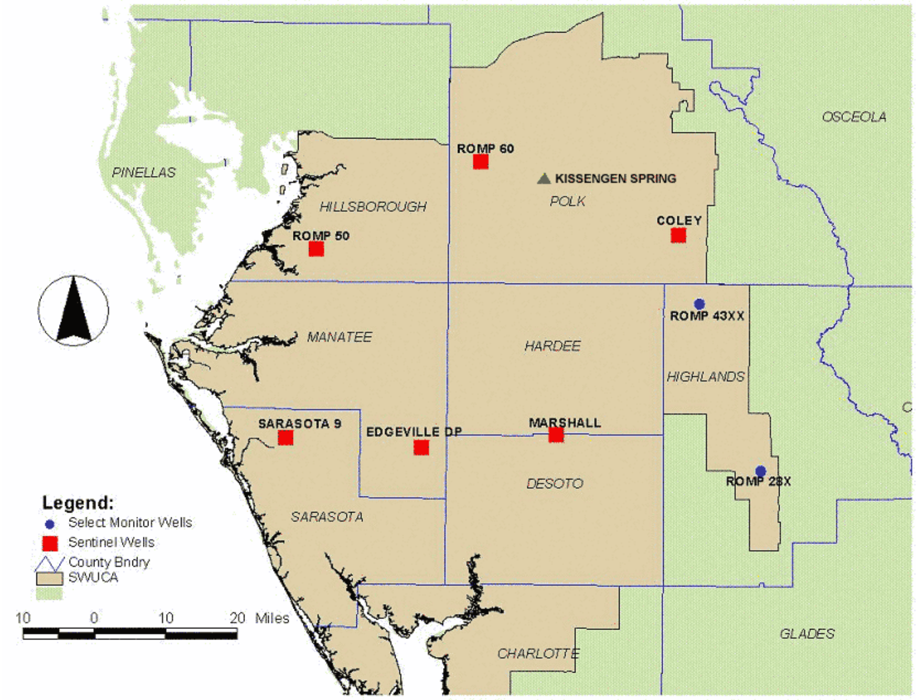


Figure 2-8. Locations of long-term monitor wells in the SWUCA, Kissengen Spring and other selected monitor wells.

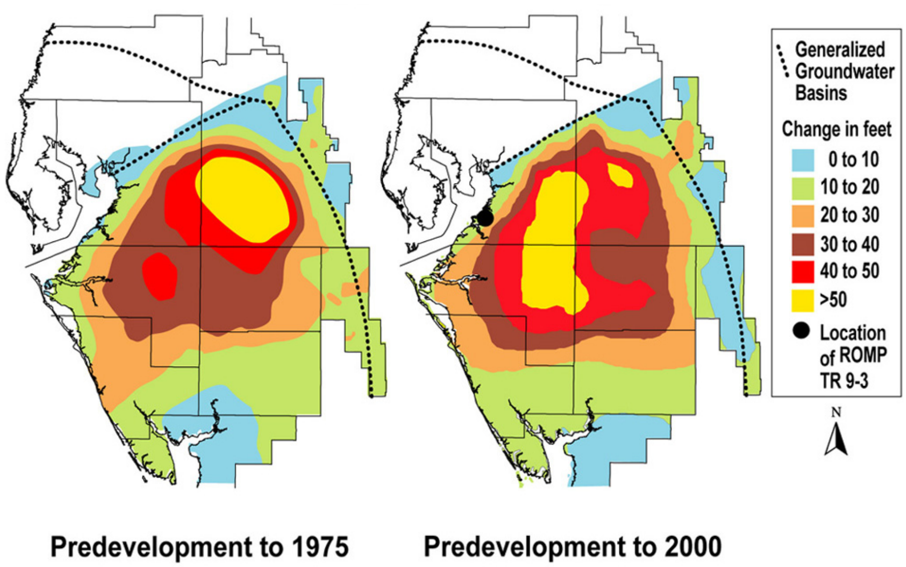


Figure 2-9. Relative, long-term changes in the potentiometric surface of the Floridan aquifer.

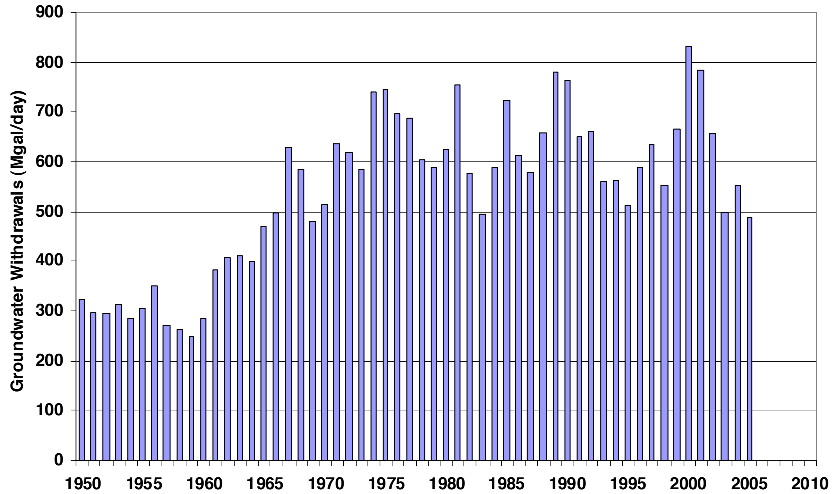


Figure 2-10. Estimated historical groundwater use in the SWUCA. Includes withdrawals from the Floridan, intermediate and surficial aquifer systems. Nearly 90 percent of these withdrawals are from the Floridan aquifer.

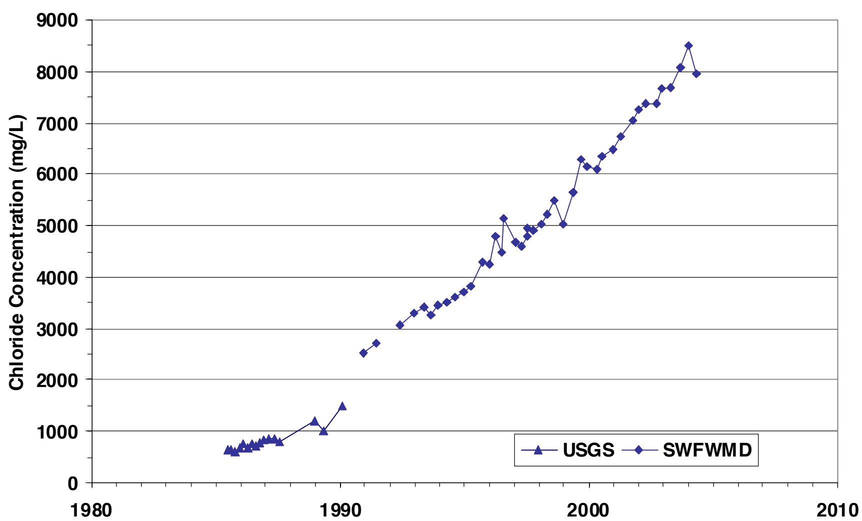


Figure 2-11. Chloride concentration versus time in the ROMP TR 9-3 observation well, which monitors water quality changes in the highly productive Avon Park Formation of the Floridan aquifer system (well location shown in Figure 9).

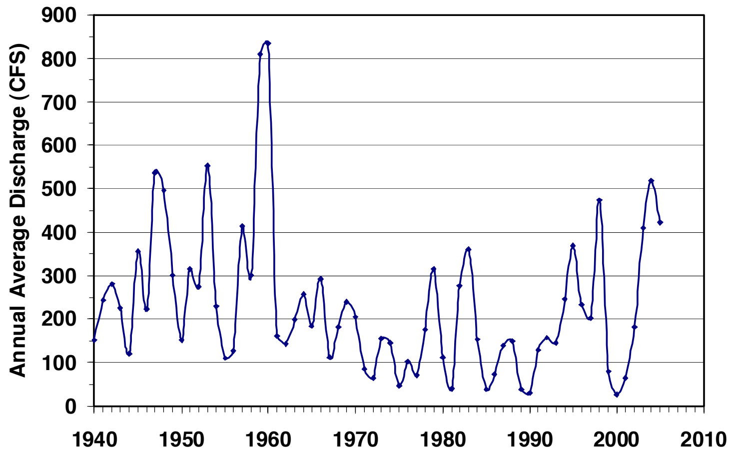


Figure 2-12.
Average-annual flow in the Peace River at Bartow in Polk County.

Figure 2-13.
Kissengen Spring, 1894.

Figure 2-14.
Flow in the upper Peace River entering a sinkhole in the riverbed.

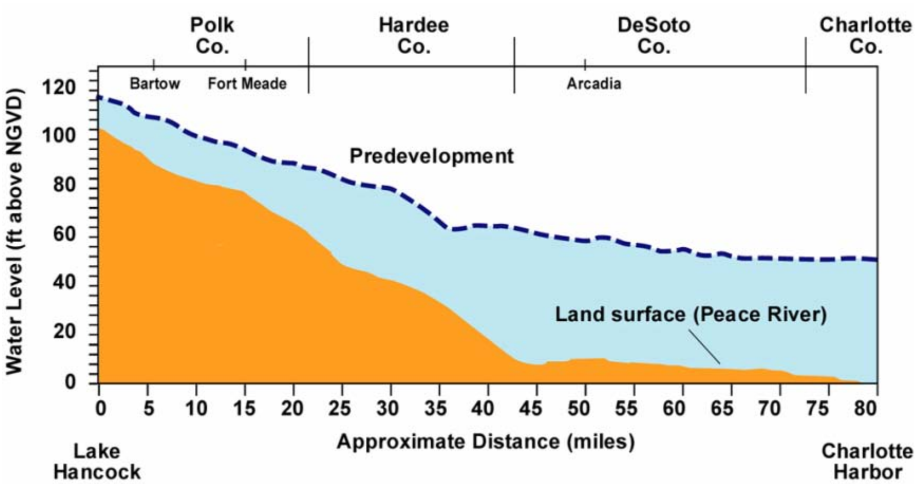


Figure 2-15.
Generalized cross section showing the potentiometric surface of the Floridan aquifer along the Peace River — predevelopment.

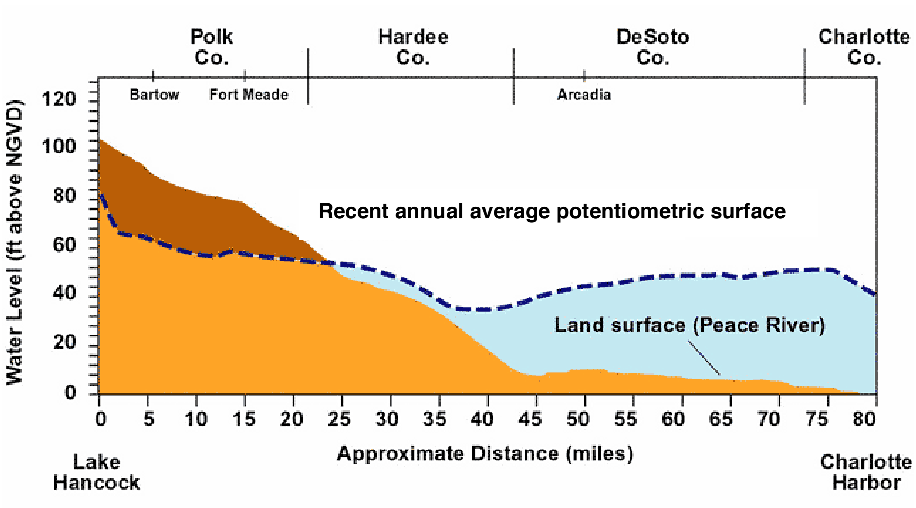


Figure 2-16. Generalized cross section showing the potentiometric surface of the Floridan aquifer along the Peace River — recent annual average potentiometric surface.

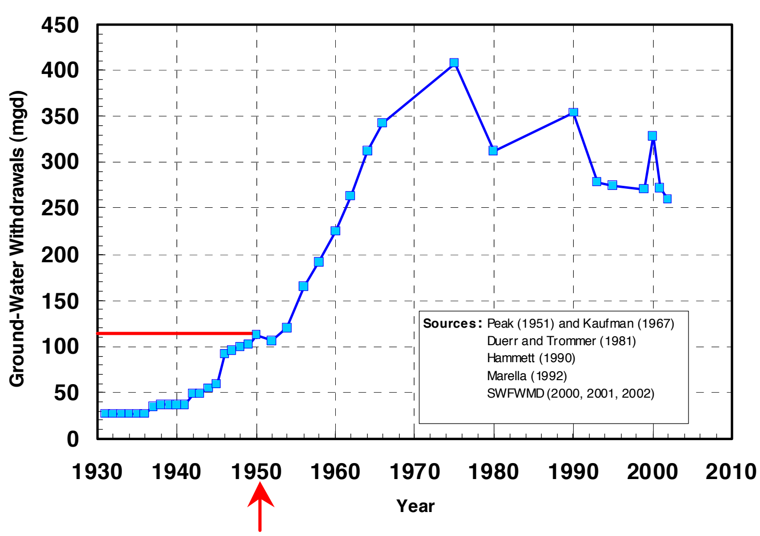


Figure 2-17. Estimated historical groundwater withdrawals in Polk County.

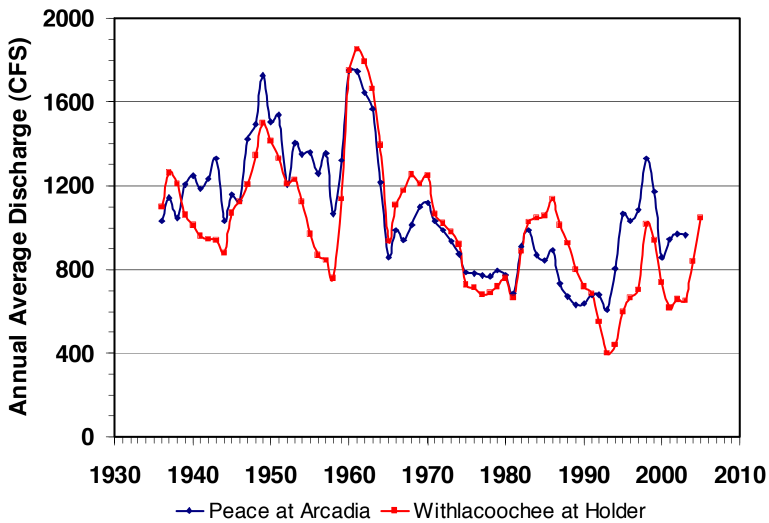


Figure 2-18. Comparison of the 5-year moving average river flows in the Peace River at Arcadia and Withlacoochee River at Holder.

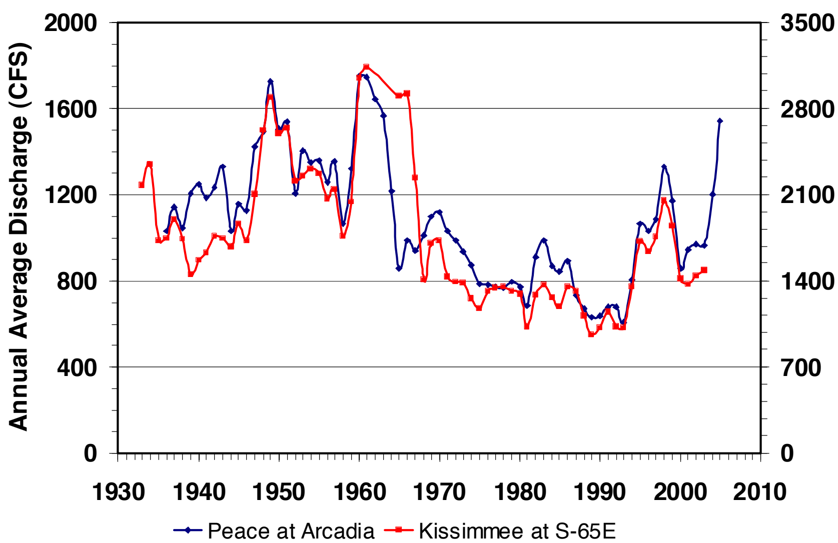


Figure 2-19. Comparison of the 5-year moving average river flows in the Peace River at Arcadia and the Kissimmee River at S-65E.

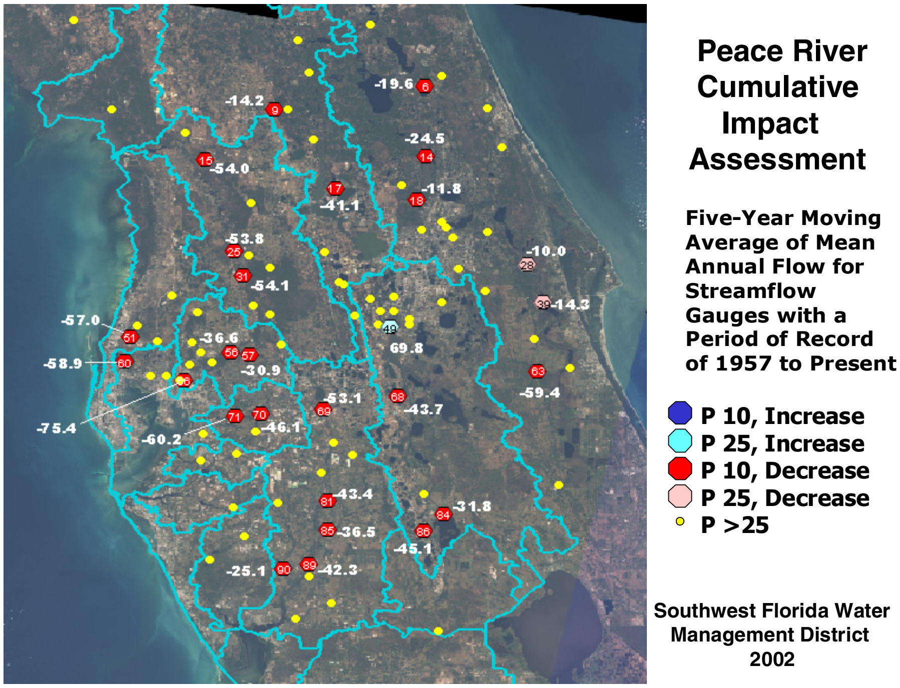


Figure 2-20.
Long-term trends in river flows in peninsular Florida.

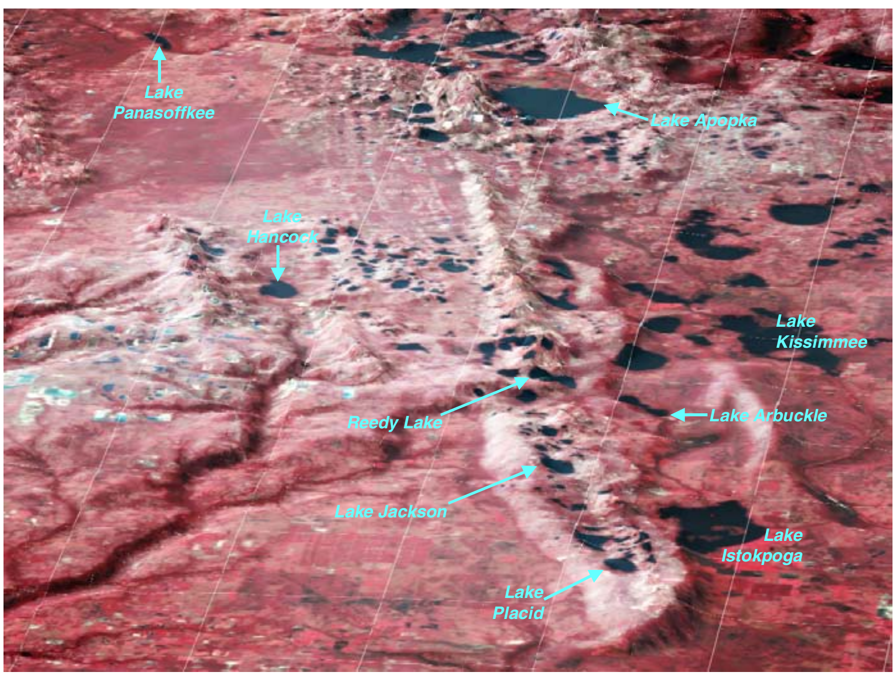


Figure 2-21.
View of the sand ridges in Highlands and Polk counties looking north from the southern end of the Ridge area in Highlands County.

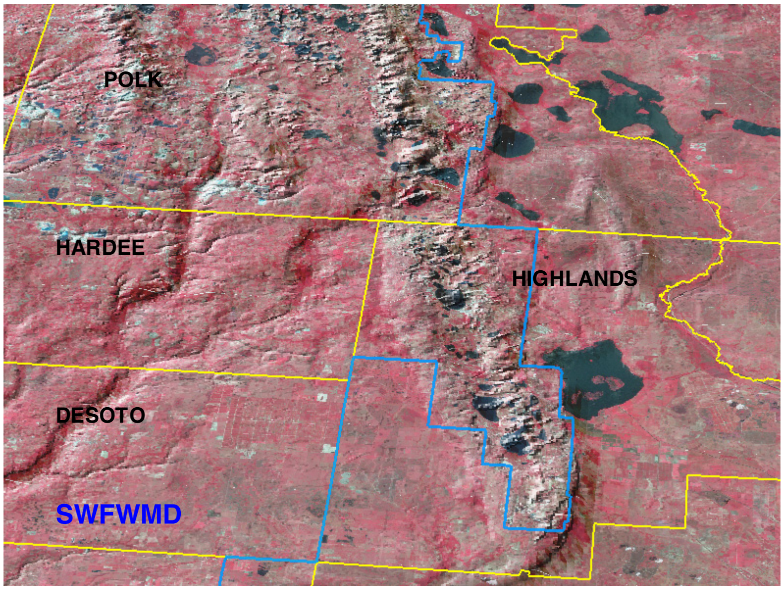


Figure 2-22.
View of the sand ridges in Highlands and Polk counties looking north from the southern end of the Ridge area in Highlands County, with county names and water management district boundaries.

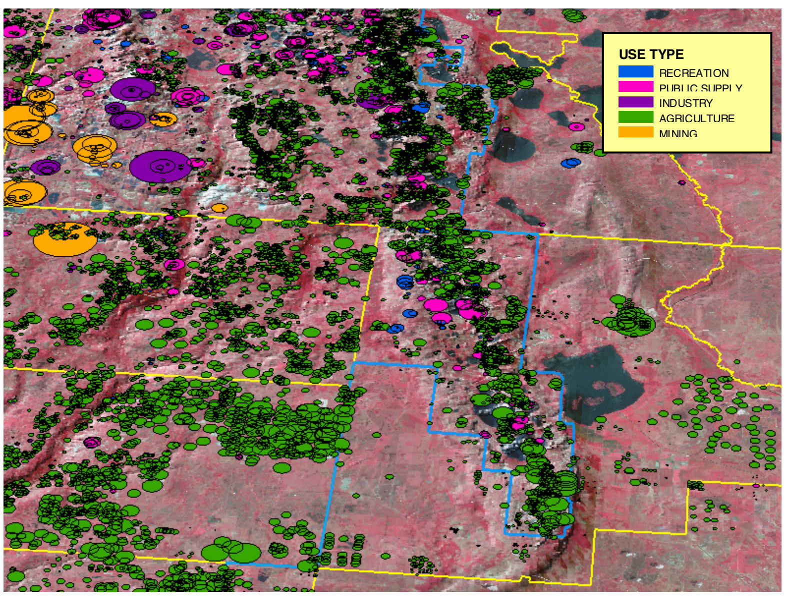


Figure 2-23.
View of the sand ridges in Highlands and Polk counties looking north from the southern end of the Ridge area in Highlands County with locations of water use permits. Most of the agricultural use is for irrigation of citrus.

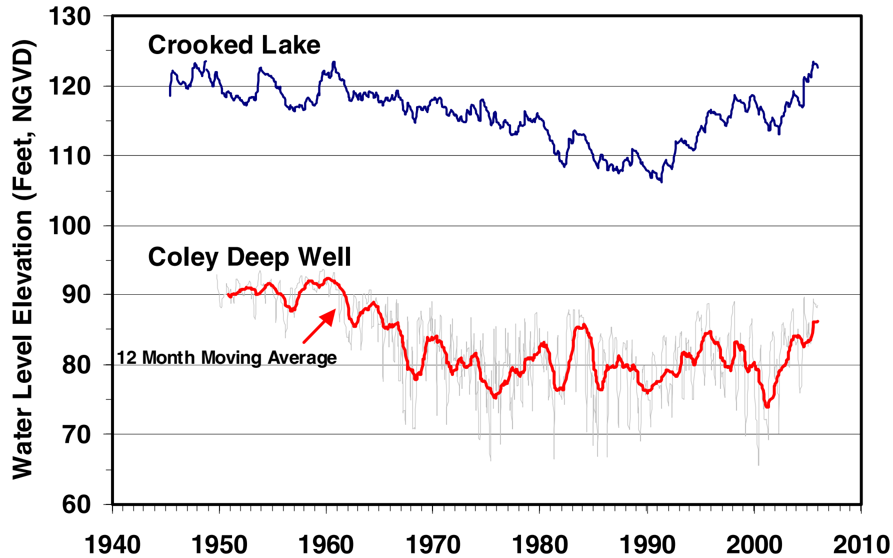
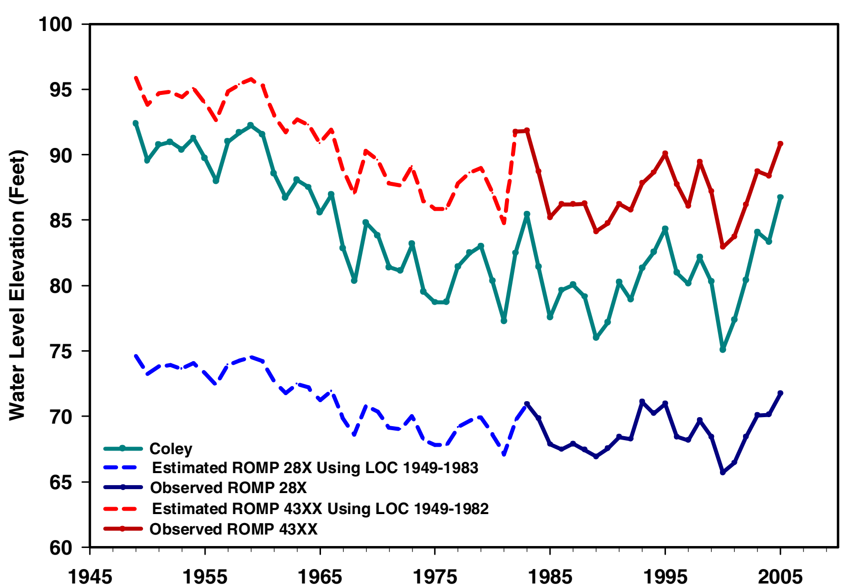


Figure 2-24. Water levels in Crooked Lake and the Coley Deep Well near Frostproof.



Note: LOC = Line of Organic Correlation

Figure 2-25. Actual and estimated historical water levels in the ROMP 28X and ROMP 43XX wells, with water levels in the Coley Deep Well near Frostproof.

Section Three
Minimum Flows and Levels
Proposed Saltwater Intrusion Minimum Aquifer Level
Proposed Upper Peace River Minimum Flows
Proposed Minimum and Guidance Ridge Lake Levels

Florida's Water Resource Act of 1972 requires the establishment of minimum flows and levels to ensure that water bodies do not experience significant harm. Specifically, minimum flows are to be established to ensure that withdrawals do not result in significant harm to the water resources and ecology of the area. Minimum levels are to be established to ensure withdrawals do not result in significant harm to the water resources of the area. The District recognizes that impacts to the resource vary according to location in the SWUCA. Therefore, the management strategies, including the effects of regulations, must vary by location as well. Consequently, the District is proposing minimum flows and levels for priority water bodies in the SWUCA including: the Floridan aquifer in coastal Hillsborough, Manatee and Sarasota counties to manage saltwater intrusion; the upper Peace River to return perennial flow; and selected lakes in the Ridge area to ensure the lakes fluctuate at levels that do not cause significant harm. The effect of regulations and recovery strategies for an area reflect how best to achieve recovery for the respective priority water bodies. For example, the only area in the SWUCA where a minimum aquifer level is being established is in the coastal regions of Hillsborough, Manatee and Sarasota counties, where it is needed to manage saltwater intrusion. Although the minimum aquifer level rule will apply to all applicants throughout the SWUCA, applicants for new or additional quantities of ground water from the Floridan aquifer in Hillsborough, Manatee and Sarasota counties, and nearby areas, will be substantially constrained, while applicants in distant areas will rarely be constrained. This is because the further an applicant is from this area, the more unlikely their projected impact on the Floridan aquifer would reach the coastal area. Conversely, due to the distance involved, the minimum levels being set for selected lakes along the Ridge area will rarely constrain requests for withdrawals in the coastal areas.

Minimum Flows and Levels
Proposed Saltwater Intrusion Minimum Aquifer Level

As discussed in the previous section, saltwater intrusion has been occurring in the coastal areas of the SWUCA for over a half century due to extensive withdrawals from the Floridan aquifer throughout the groundwater basin. Recent analysis indicates that groundwater withdrawals in the SWUCA are about 650 mgd during an average year and can exceed 800 mgd during a 1-in-10-year drought event. These withdrawals provide over 80 percent of the area's water supply and provide the lifeblood to the local economy. Detailed modeling predicts that it would take a reduction in withdrawals of more than two-thirds to cease intrusion of saltwater — a reduction that would have dire consequences. Fortunately, this same modeling verifies that saltwater intrusion is a very long-term issue that can be effectively managed in decade-long intervals.

The proposed minimum aquifer level for saltwater intrusion recognizes its long-term nature and is designed to limit its movement over the next 50 years such that a minimum number of wells are at risk of water quality degradation. The District has completed several modeling initiatives to predict the rate and extent of saltwater intrusion in the SWUCA. These initiatives were used to develop a better understanding of the consequences of saltwater intrusion for a range of regional pumping scenarios: 400 mgd, 600 mgd, 800 mgd and 1,000 mgd. Each pumping scenario was evaluated at the end of 50 years. Two basic approaches were used to quantify the number of wells and amount of water supply that are at risk to future saltwater intrusion: graphical-analytical approaches (Beach and Kelley, 1998; Beach and Shultz, 2000; and Barcelo, Beach and Kelley, 2002) and numerical modeling approaches (HydroGeoLogic, 1991a, 1993, 1994a, 1994b and 2002). Additionally, water quality trend analyses were conducted as part of the District's coastal groundwater quality monitoring program (SWFWMD 1995, 2000 and 2001).

In the graphical-analytical approach, rates of movement were obtained from two-dimensional cross-sectional modeling analyses performed for the District (HydroGeoLogic, 1994a and 1994b). Using these rates, estimates were made of the distance the interface would move in 50 years for each of the four regional pumping scenarios noted above. Changes from the current location of the interface "toe" for each scenario were mapped as shown in Figure 3-1. Wells determined to be "at risk" were all permitted wells located seaward of the interface "toe," as shown conceptually in Figure 3-2. The maximum distance the interface "toe" was projected to move ranged from about 1.25 miles at 400 mgd to about 5.5 miles at 1,000 mgd.

In order to overcome the technical limitations that are inherent in two-dimensional cross-sectional modeling, a three-dimensional density-dependent saltwater intrusion model was developed (HydroGeoLogic, 2002). The area modeled was the Eastern Tampa Bay Most Impacted Area (ETB MIA). For comparison purposes, the three-dimensional model was used to project movement of salt water into freshwater portions of the Floridan aquifer for the same withdrawal scenarios and 50-year time period. Results of the scenarios were reported as the number of wells in the model at the end of 50 years, that were withdrawing water with a chloride concentration of greater than 1,000 milligrams per liter (mg/l) (the drinking water standard is 250 mg/l). Locations of wells found to be potentially at risk to future saltwater intrusion are shown in Figure 3-3.

Results of the three-dimensional modeling analysis are shown in Table 3-1 and indicate the number of existing and projected wells that will be at risk of saltwater intrusion over the next 50 years at various levels of average annual withdrawals from the Floridan aquifer. As listed in Table 3-1, if average annual withdrawals from the Floridan aquifer in the SWUCA were maintained at 600 mgd (approximately 90 percent of current average annual withdrawals), 104 wells that have a permitted use of 17.4 mgd and an estimated use of 12.0 mgd would be at risk. Further if average annual withdrawals from the Floridan aquifer were allowed to increase to 800 mgd, an additional 22 wells with additional permitted use of 3.5 mgd and actual use of 2.0 mgd would be at risk. A review of these results could lead one to conclude that there is not much value in slowing the rate of saltwater intrusion over the next 50 years. However, actions taken during this recovery period will make it easier for future generations to ultimately halt the inland movement of saltwater intrusion through advances in technology (e.g., advances in membrane technology and development of alternative energy supplies). This long-term management can be complemented with short-term measures to address localized problems. Examples of short-term measures include backplugging wells and providing alternative sources such as surface or reclaimed water to wells that experience water quality degradation.

After a thorough discussion of the information presented above, the Governing Board approved a saltwater intrusion minimum aquifer level that is the 10-year average of levels in the aquifer for the period of 1990 through 1999. This level results in a slowing of the rate of intrusion when compared to rates associated with other recent 10-year periods. It also results in a slower movement of saltwater intrusion than the minimum intrusion aquifer level previously proposed and deemed reasonable by an administrative law judge in the mid-1990s. The actual minimum level is 13.1 feet above sea level, calculated by taking a weighted average of Floridan aquifer water levels from 10 reference wells located in or near the Most Impacted Area as shown in Figure 3-4.

Compliance with the proposed saltwater intrusion minimum aquifer level will be achieved when the 10-year moving average (the average of the current year and the nine previous years) of the Floridan aquifer water level in the 10 reference wells is at or above the minimum aquifer level for five consecutive years. The minimum aquifer level is not met when the 10-year moving average water level in the reference wells is below the minimum aquifer level for two consecutive years. These compliance mechanisms are intended to ensure long-term trends in water levels in the aquifer are the targeted goal for management of saltwater intrusion. A detailed explanation of the development of this level, the 10 reference wells and issues pertaining to compliance can be found in the District's publication titled "Saltwater Intrusion and the Minimum Aquifer Level in the Southern Water Use Caution Area, 2002," which is available from the District upon request.

Peer Review of the Proposed Saltwater Intrusion Minimum Aquifer Level

In April 2002, the Governing Board directed staff to finalize documentation of the proposed minimum aquifer level methodology to protect against saltwater intrusion and submit the document for independent scientific peer review. In June 2002, a panel of three experts in the fields of groundwater modeling, solute transport modeling, groundwater hydrology, hydrogeology and saltwater intrusion were selected. The panel consisted of Dr. John Bredehoeft, chairman, Dr. Louis Motz and Mr. Gordon Bennett. The review conducted by the panel included: evaluation of the proposed minimum level methodology; consideration of additional documents relevant to the proposed methodology; recommending alternative methodologies where appropriate; participation in a public meeting to facilitate communication between the panel, District staff and other interested parties; and completion of a final report titled "Peer Review: Saltwater Intrusion and the Minimum Aquifer Level in the Southern Water Use Caution Area: Hydrologic Evaluation Section, Southwest Florida Water Management District, September 2002," which is included as Appendix 1.

The panel complimented staff on a "job well done" and noted that the District "…presented an effective methodology for determining whether the rate of encroachment is greater or less than that prevailing during the 1990s." The panel discussed that the period from 1990 to 1999 represents the highest average water level in recent years. Use of this period supports the District's management objective of reducing the rate of saltwater intrusion in order to minimize the risk of wells and water supply to future saltwater intrusion. They concluded that the District presented a "…thoughtful procedure for establishing a minimum water-level elevation for the Upper Floridan aquifer within the MIA." As part of the review, the panel provided suggestions for additional work. One suggestion was for the District to express the average aquifer level in terms of equivalent freshwater head. The minimum aquifer level methodology has since been modified to include a correction to water level measurements made at the reference wells for the changes in fluid density that are expected to occur as a result of changes in water quality over time.

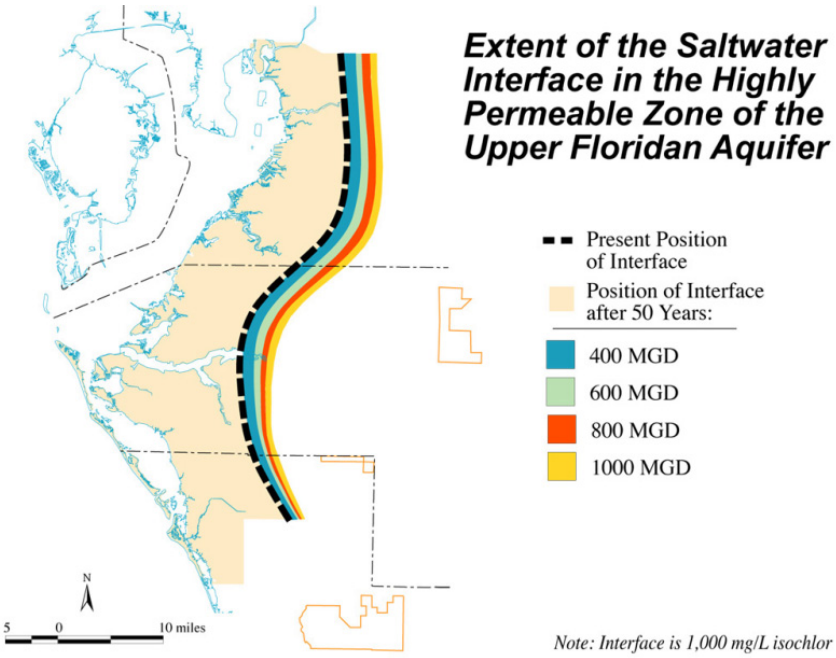


Figure 3-1.
Extent of the saltwater interface in the highly permeable zone of the Upper Floridan aquifer based on a graphical-analytical approach.

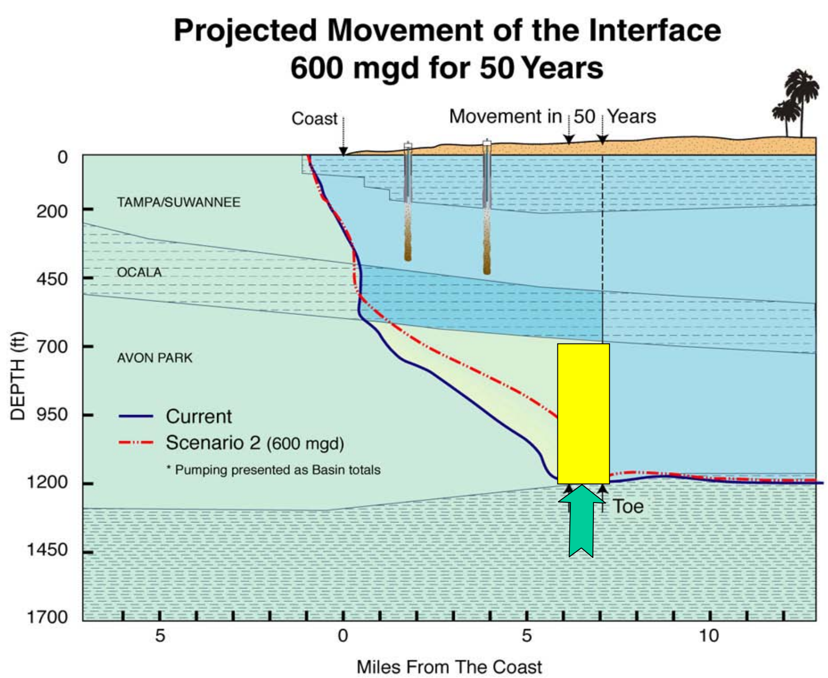


Figure 3-2.
Generalized geologic cross section in the ETB MIA showing projected movement of the interface toe in 50 years.

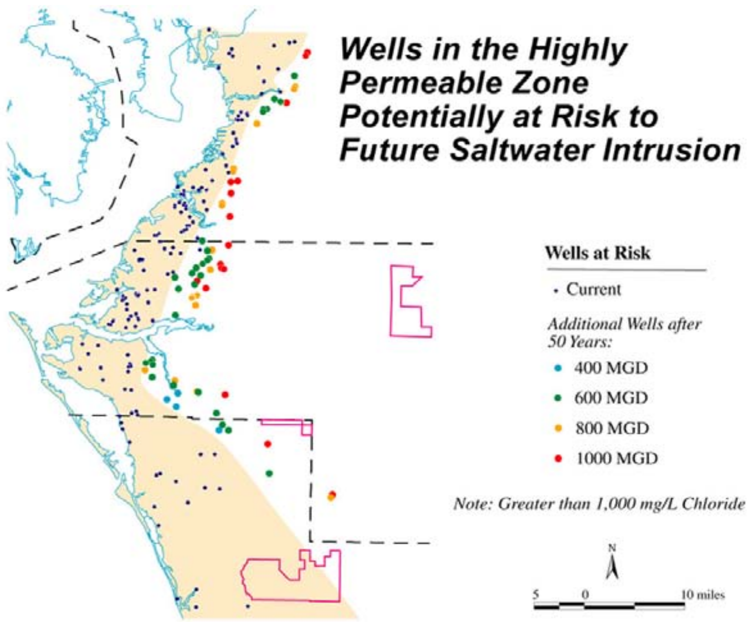


Figure 3-3.
Wells in the highly permeable zone of the Floridan aquifer potentially at risk to saltwater intrusion based on a three-dimensional saltwater intrusion model.

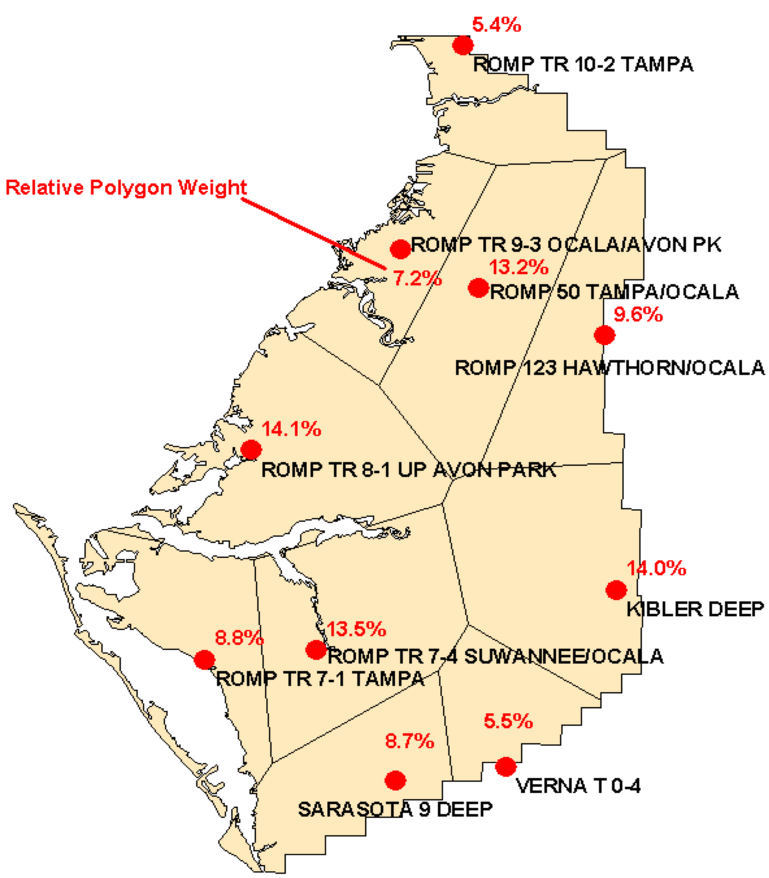


Figure 3-4.
Map showing locations of monitor wells used to calculate the minimum aquifer level and the corresponding area weights.

Table 3-1.
Results of three-dimensional saltwater intrusion modeling scenarios for saltwater intrusion in all units of the Upper Floridan aquifer.

Regional Pumping (Mgal/d)	Years	Threshold (mg/L)	Number of Wells at Risk	1995-1999 Average Annual Use (Mgal/d)	1999 Permitted Pumping (Mgal/d)	Change from Current Conditions		
						# of Wells at Risk	Ann. Use (Mgal/d)	Permitted (Mgal/d)
Current	**0**	**>500**	**154**	**15.84**	**22.20**	**0**	**0.00**	**0.00**
400	20	>500	151	15.22	21.61	-3	-0.62	-0.58
600	20	>500	162	16.02	23.18	8	0.19	0.99
800	20	>500	169	16.47	23.85	15	0.63	1.66
1000	20	>500	183	17.60	26.24	29	1.77	4.05
400	50	>500	159	15.27	21.49	5	-0.56	-0.71
600	50	>500	188	17.09	25.49	34	1.26	3.30
800	50	>500	204	18.34	27.52	50	2.50	5.33
1000	50	>500	224	19.95	31.05	70	4.11	8.86
Current	**0**	**>1000**	**63**	**6.35**	**8.31**	**0**	**0.00**	**0.00**
400	20	>1000	71	7.72	10.13	8	1.38	1.82
600	20	>1000	82	8.77	12.08	19	2.43	3.77
800	20	>1000	91	10.14	13.98	28	3.80	5.67
1000	20	>1000	104	12.22	17.99	41	5.88	9.68
400	50	>1000	79	9.18	11.83	16	2.84	3.52
600	50	>1000	104	12.02	17.40	41	5.67	9.10
800	50	>1000	126	14.00	20.90	63	7.64	12.60
1000	50	>1000	147	15.33	23.24	84	8.98	14.93

Minimum Flows and Levels
Proposed Upper Peace River Minimum Flows

The proposed minimum flows for the upper Peace River are focused on returning perennial conditions to the upper Peace River. Specifically, they are based on maintaining the higher of the water elevations needed for fish passage (0.6 feet or 7.2 inches) or the lowest wetted perimeter inflection point (as much streambed coverage as possible for the least amount of flow). This approach yielded minimum low flows of 17 cfs (10.2 mgd), 27 cfs (16.2 mgd) and 45 cfs (27 mgd) at the Bartow, Fort Meade and Zolfo Springs USGS stream gages, respectively (Figure 3-1). These flows are required to be exceeded at least 95 percent of the time on an annual basis, which is nearly 350 days per year.

The District recognizes that multiple minimum flows are necessary to maintain the flow regime and health of aquatic ecosystems. At this time, however, only minimum low flows are being established. Mid- and high- minimum flows will be established once the controlling factors that affect the mid and high flows are better understood. A detailed explanation of the development of these proposed flows can be found in the District's publication titled "Upper Peace River: An Analysis of Minimum Flows and Levels" (August 2002), which is available from the District upon request. Wetted perimeter inflection points (Figures 3-6 and 3-7) and fish passage depths (Figure 3-8) were evaluated jointly to establish minimum flows for the low end of the flow regime of the upper Peace River. There was no assumption that fish passage needs will be met by the wetted perimeter approach. Rather, both approaches were used in tandem to evaluate the low minimum flow requirement, and the higher flow of the two was used as a conservative means for establishing the low minimum flow.

For rule development purposes, flows will be established at the Bartow, Fort Meade and Zolfo Springs USGS gage sites. These sites are also where the river flows will be monitored. However, a goal of the upper Peace River Recovery Strategy is to not only achieve these minimum low flows at these individual sites, but to achieve similar flow conditions throughout the upper Peace River to attain the resource benefits of these flows (e.g., wetted perimeter, fish passage).

Compliance with the upper Peace River minimum flows is achieved when the actual river flows are at or above the established minimum flows for three consecutive years. Once the minimum low flow has been achieved and is followed by two years where the minimum low flow is not met within a rolling 10-year period (commencing with the three consecutive years of achievement), then the actual flow shall be considered below the minimum low flow. A determination of whether actual flows are meeting the established minimum flows is made at each one of the established minimums (Bartow, Fort Meade and Zolfo Springs).

From 1976 to 2000, the annual 95 percent exceedance flow met or exceeded the proposed minimum flow in 7 out of 25 years at the USGS Bartow Gage. From 1976 to 2000, the annual 95 percent exceedance flow met or exceeded the proposed minimum flow in 1 out of 25 years at the USGS Fort Meade gage. From 1976 to 2000, the annual 95 percent exceedance flow met or exceeded the minimum flow in 22 out of 25 years at the USGS Zolfo Springs gage.

Peer Review of the Upper Peace River Minimum Flows

The District engaged the services of independent consultants in the field of stream and wetland ecology and hydrology to evaluate and review the data, methodologies and models supporting the development of minimum river flows. Two nationally recognized stream ecologists, Drs. Clifford Dahm (University of New Mexico) and James Gore (Columbia State University), and one wetland ecologist, Dr. Charles Klimas (independent consultant) served on the panel. Dr. Gore served as panel chairman. The scope of this voluntary review required the panel members to review the District's publication titled: "Upper Peace River: An Analysis of Minimum Flows and Levels," that outlines methods used in the development of minimum flows and levels for the upper Peace River. The panelists were asked to address the following specific tasks: (1) determine whether the method(s) used for establishing the minimum flows is scientifically reasonable; (2) if not scientifically reasonable, describe deficiencies, remedies or alternative approaches as appropriate; or (3) if reasonable, but an alternative is preferable, the panel should describe the method(s) with a qualitative assessment of the effort required to implement the alternative method(s).

In their report titled "A Review of Upper Peace River: An Analysis of Minimum Flows and Levels" (November 2002), which is included as Appendix 2, the peer review panel concluded that the "scientific analyses used to establish these recommended flows and levels are adequately described within the report and scientifically justifiable. Consideration of channel flow characteristics under these minimum discharge recommendations would be an additional factor worth evaluating, since support of both macroinvertebrate and vertebrate populations have been linked to these conditions (Statzner et al. 1988, Heade and Rinne 1990). The recommended minimum flows and water levels in this report, however, are based upon good hydrologic data, a well-established modeling protocol, and detailed measurements of channel habitat at multiple locations. We concur that the recommended minimum flows and levels represent thorough scientific analyses of good quality, historic and present data sets, and the recommendations are scientifically defensible and justifiable to meet the stated management objectives." The peer review panelists made several recommendations and suggestions regarding additional work that could be performed in the future. They encouraged the District to take an adaptive management approach in developing minimum flows and levels and to "view the establishment of MFLs and rehabilitation goals as a dynamic process that results in improved flow criteria as new data and techniques are acquired."

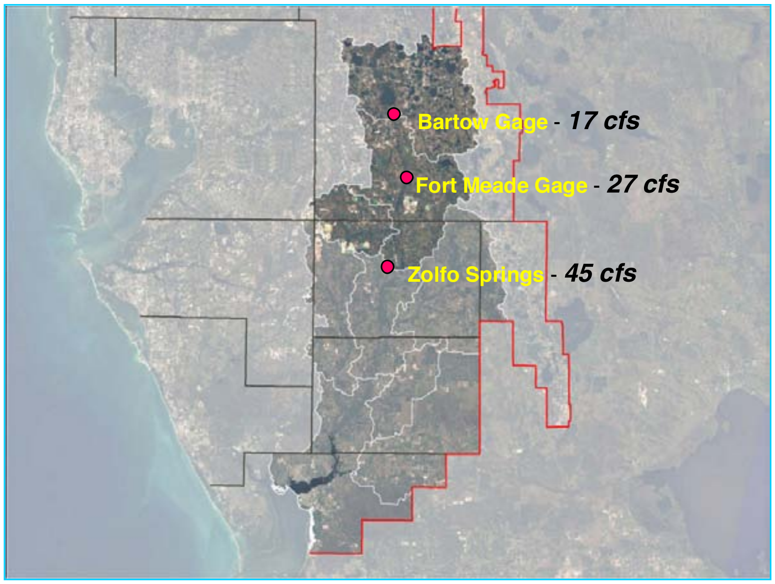
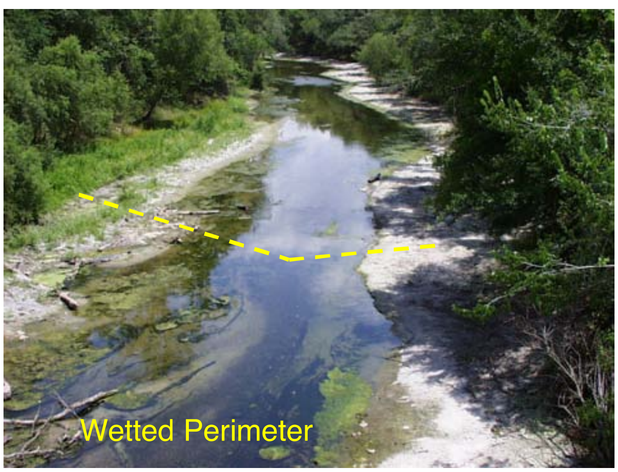
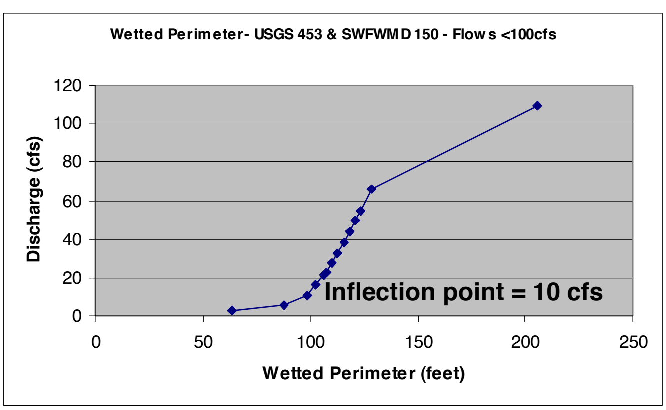


Figure 3-5.
Map showing location of USGS gage sites with corresponding minimum low flow.



A.



B.

Figure 3-6.
Wetted perimeter is defined as the distance along the streambed and banks at a cross section where there is contact with water.

By plotting the response of wetted perimeter to incremental changes in discharge, an inflection can be identified in the resulting curve where small decreases in flow result in increasingly greater decreases in wetted perimeter.

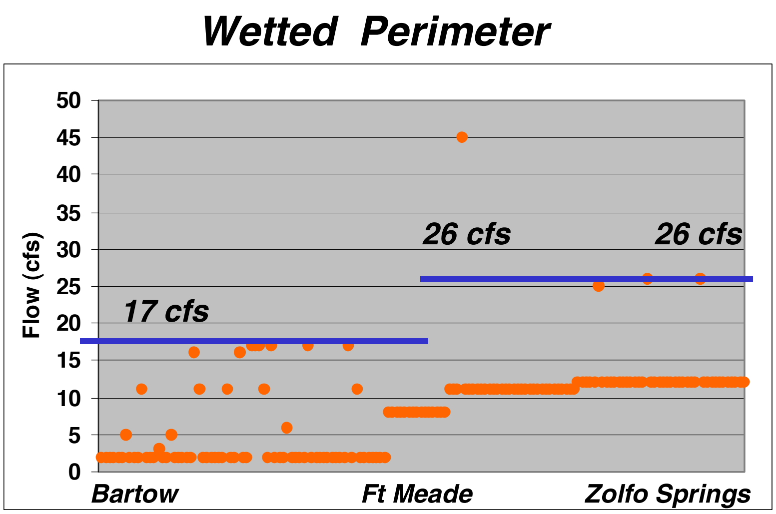


Figure 3-7.
Flow needed at each transect site on the upper Peace River to wet the lowest wetted perimeter inflection point (LWPIP). Superimposed on this plot are recommended LWPIP minimum flows.

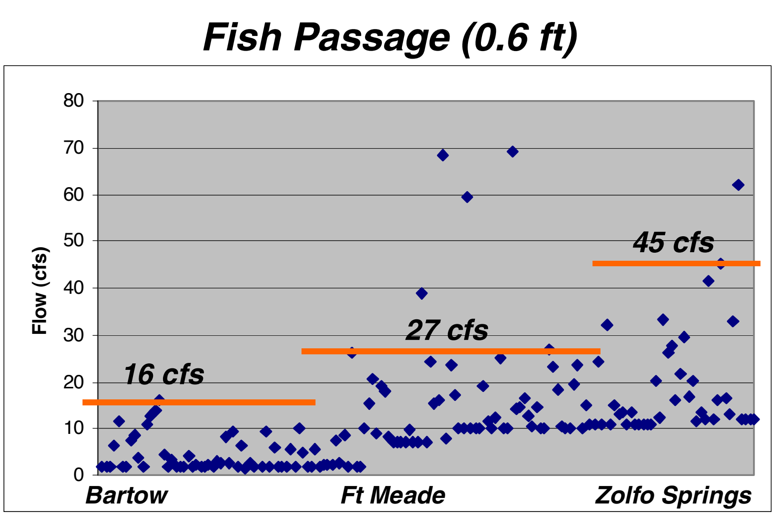


Figure 3-8.
Flow needed at each transect site on the upper Peace River to allow a maximum depth of 0.6 foot for fish passage. Superimposed on this plot are recommended minimum fish passage flows for three river segments.

Minimum Flows and Levels
Proposed Minimum and Guidance Ridge Lake Levels

Minimum levels are proposed for eight lakes in the Ridge area: Lakes Clinch, Eagle, McLeod and Wales (a.k.a. Wailes) in Polk County, and Lakes Letta, Lotela, Jackson and Little Lake Jackson in Highlands County (Figure 3-9). All eight lakes are designated "Category 3" lakes, i.e., lakes that do not have contiguous cypress-dominated wetlands. Minimum levels for Category 3 lakes are developed based on potential change in a number of parameters including: (1) lake mixing and susceptibility to sediment re-suspension, (2) water depth associated with docks, (3) basin connectivity, (4) species richness, (5) coverage of herbaceous wetland vegetation, (6) coverage of aquatic macrophytes, and (7) non-consumptive uses.

Two minimum levels are proposed for each of these lakes: (1) a "minimum lake level" will be established at an elevation that the lake surface must equal or exceed 50 percent of the time, and (2) a "high minimum lake level" that the lake surface must equal or exceed 10 percent of the time. Three guidance levels, which serve as advisory information for lakeshore residents and local governments and can aid in the management or control of adjustable structures, are also proposed. These include a "10-year flood guidance level," a "high guidance level" and a "low guidance level."

The 10-year flood guidance level identifies the elevation that the lake surface may be expected to equal or exceed at a recurrence frequency of not less than 10 years and which may be expected to occur with a 10 percent probability in any given year. The high guidance level is the expected elevation that was historically exceeded 10 percent of the time. The historic period refers to a time when there were no measurable impacts due to withdrawals and structural alterations were similar to current conditions. Structural alterations are man's physical alteration of the control point of a lake or wetland that affects water levels. The high guidance level is provided as an advisory guideline for the construction of lakeshore development, water-dependent structures and operation of water management structures. The low guidance level is the expected lake level that is exceeded 90 percent of the time based on a historic period. As with the high guidance level, the low guidance level is provided as advisory guideline for construction of water-dependent structures, information for lakeshore residents and operation of water management structures.

The minimum and high minimum lake levels for these lakes are based on levels determined to be necessary to meet the following parameters, unless other public health, safety or welfare, or adverse environmental impact considerations override these parameters: (1) lake mixing and susceptibility to sediment re-suspension, (2) water depth associated with docks, (3) basin connectivity, (4) species richness, (5) coverage of herbaceous wetland vegetation, (6) coverage of aquatic macrophytes, and (7) non-consumptive uses. When establishing minimum levels, changes and structural alterations to watersheds and surface waters (e.g., lake outlet structures, roads and buildings) are also considered.

There are two exceptions to the establishment of the minimum levels described above. Where the minimum lake level would result in a level higher than the "Historic P50," the Historic P50 will be the minimum lake level. The Historic P50 is the percentile ranking represented by the elevation of the water surface of a lake or a wetland that is equaled or exceeded 50 percent of the time as determined from a long-term stage frequency analysis for a historic period. Where the high minimum lake level is adjusted downward to prevent other public health, safety or welfare concerns or adverse environmental impacts, the minimum lake level will be adjusted downward to maintain a fluctuation regime similar to the natural regime.

Guidance levels for Category 3 lakes are determined using standard engineering approaches, analysis of lake stage records, indicators of historic water levels, elevations of existing water control structures and expected regional stage fluctuation ranges. A detailed discussion of procedures used to develop minimum and guidance levels for Category 3 lakes is provided in "A Multiple-Parameter Approach for Establishing Minimum Levels for Category 3 Lakes of the Southwest Florida Water Management District, June 14, 2001 Draft," which is available upon request from the District.

Proposed minimum and guidance levels for the eight Ridge lakes in Polk and Highlands counties are listed in Table 3-2 and shown graphically in Figures 3-10 through 3-17. A detailed account of the development of the proposed levels is available in "Proposed Minimum and Guidance Levels for Lakes Clinch, Eagle, McLeod and Wales in Polk County, Florida and Lakes Jackson, Little Lake Jackson, Letta and Lotela in Highlands County, Florida," which is available upon request from the District.

Table 3-2.
Proposed Minimum and Guidance Lake Levels (Values listed are elevations in feet above the National Geodetic Vertical Datum of 1929)

Lake	High Minimum Lake Level	Minimum Lake Level	10-Year Flood Guidance Level	High Guidance Level	Low Guidance Level
Lake Clinch	105.5	104.4	107.4	105.5	103.1
Eagle Lake	129.0	127.9	131.3	129.6	127.2
Lake McLeod	129.4	128.3	133.3	129.4	127.0
Lake Wales	107.7	106.6	114.1	ND	ND
Lake Jackson	102.4	101.3	104.1	102.6	100.2
Lake Letta	99.5	98.4	100.5	99.5	97.1
Lake Lotela	106.8	105.7	108.5	107.5	105.0
Little Lake Jackson	102.4	101.3	104.1	102.6	100.2

ND = Not Developed

Compliance with the proposed minimum levels will be achieved when the long-term P50 is at or above the minimum lake level and the long-term P10 is at or above the high minimum lake level. Long-term, as defined in 40D-8.021(7), FAC, 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 that 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.

As of late 2005, seven of the eight lakes for which minimum levels are proposed are currently staged above the proposed high minimum lake levels (Figures 3-10 through 3-17). The only exception is Lake Letta, where the water surface is currently between the proposed high minimum and minimum lake levels. However, based on 10-year periods for establishing long-term stage percentile elevations, the proposed minimum levels have been met for five consecutive years at only one of the lakes — Eagle Lake in Polk County. Water levels at the remaining seven lakes have not equaled the proposed minimum levels for at least one of the past two years.

Peer Review

For Category 3 lakes, the peer review process involved determination of the scientific reasonableness of the proposed methodologies; evaluation of deficiencies; development of suggestions for alternative approaches; interaction with District staff, the general public and other stakeholders at a public meeting; preparation of a written report on review findings; and presentation of review findings to the District Governing Board. Reviewers included two eminent limnologists: Dr. Ken Wagner and Dr. Forrest Dierberg.

In their final report titled "A Review of A Multiple-Parameter Approach for Establishing Minimum Levels for Category 3 Lakes of the Southwest Florida Water Management District," which is included as Appendix 3, the reviewers note that the District's proposal to consider a wide variety of parameters for development of minimum lake levels encompasses "the goals advanced by the current Water Resource Implementation Rule for protecting Florida's water resources and environmental values while considering natural seasonal fluctuations in water levels." Furthermore, they note "that the approaches taken by the District to determine minimum levels represent appropriate starting points for further methodological development and provide a sound basis for interim management." The reviewers found "no major significant deficiencies in the manner in which data were collected or applied" and offered a variety of suggestions for modifying or supplementing the District's proposed approach. The District has and will continue to explore the reviewers' suggestions and is committed to an adaptive management approach that will lead to the best possible minimum lake levels. As an example, the reviewers suggested that the Historic P50 elevation should be used for establishing the minimum lake level in cases where the elevation associated with one or more of the parameters used for levels development (e.g., basin connectivity) occur at an elevation greater than the Historic P50. This recommendation has been incorporated into the approach used to develop the proposed lake levels.

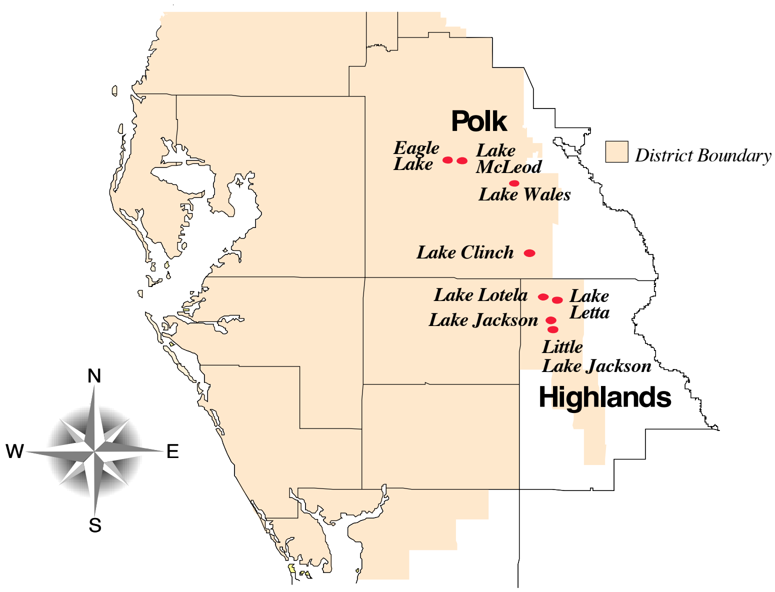


Figure 3-9. Location of eight Category 3 lakes with proposed minimum levels in Polk and Highlands counties.

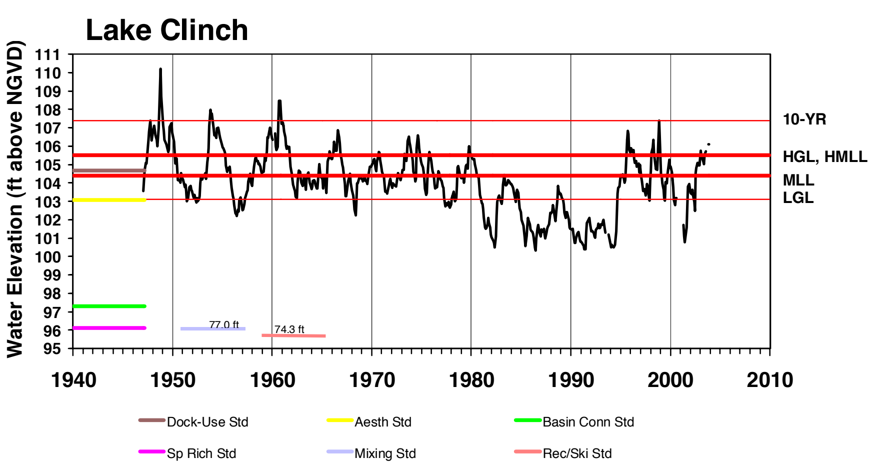


Figure 3-10. Mean monthly surface water elevations through October 31, 2003, and proposed guidance and minimum levels for Lake Clinch in Polk County. Proposed levels include the 10-year flood guidance level (10-YR), high guidance level (HGL), low guidance level (LGL), high minimum lake level (HMLL), and minimum lake level (MLL).

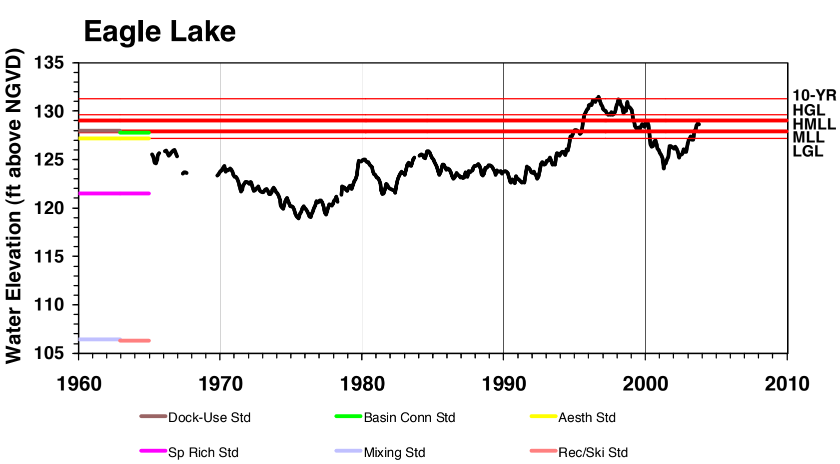


Figure 3-11. Mean monthly surface water elevations through October 31, 2003, and proposed guidance and minimum levels for Eagle Lake in Polk County. Proposed levels include the 10-year flood guidance level (10-YR), high guidance level (HGL), low guidance level (LGL), high minimum lake level (HMLL), and minimum lake level (MLL).

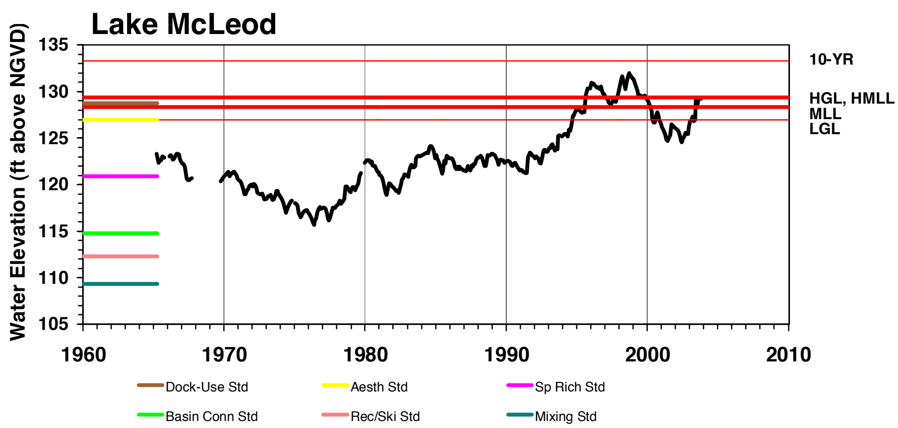


Figure 3-12. Mean monthly surface water elevations through October 31, 2003, and proposed guidance and minimum levels for Lake McLeod in Polk County. Proposed levels include the 10-year flood guidance level (10-YR), high guidance level (HGL), low guidance level (LGL), high minimum lake level (HMLL), and minimum lake level (MLL).

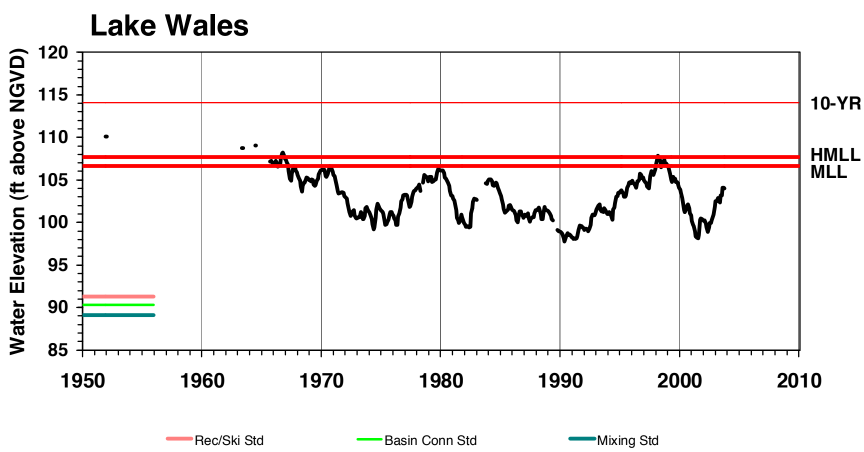


Figure 3-13. Mean monthly surface water elevations through October 31, 2003, and proposed guidance and minimum levels for Lake Wales in Polk County. Proposed levels include the 10-year flood guidance level (10-YR), high minimum lake level (HMLL), and minimum lake level (MLL).

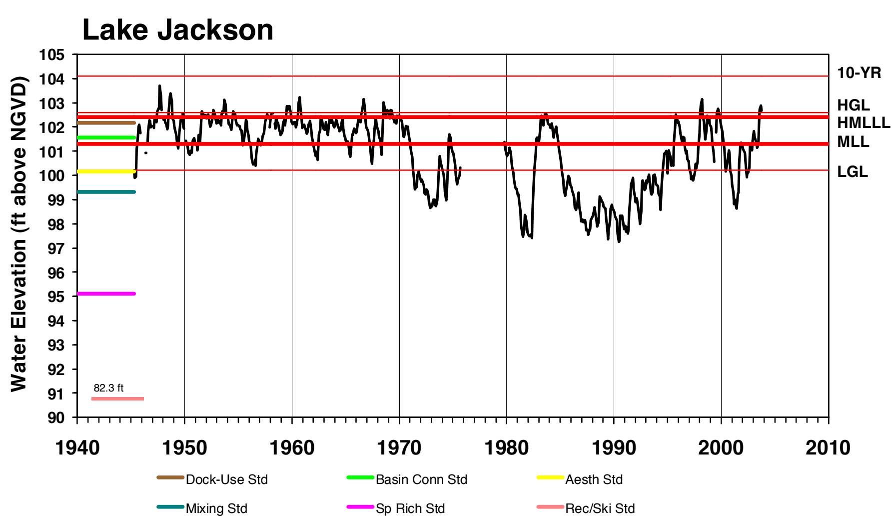


Figure 3-14. Mean monthly surface water elevations through October 31, 2003, and proposed guidance and minimum levels for Lake Jackson in Highlands County. Proposed levels include the 10-year flood guidance level (10-YR), high guidance level (HGL), low guidance level (LGL), high minimum lake level (HMLL), and minimum lake level (MLL).

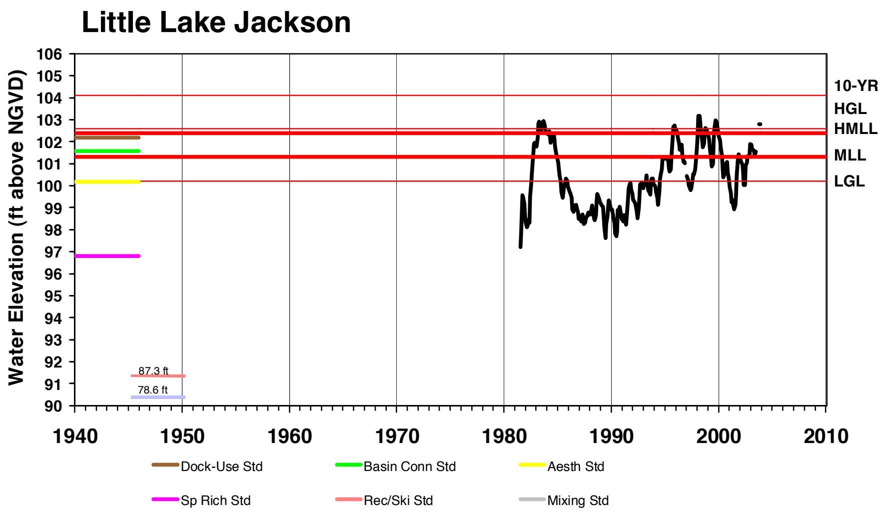


Figure 3-15.
Mean monthly surface water elevations through October 31, 2003 and proposed guidance and minimum levels for Little Lake Jackson in Highlands County. Proposed levels include the 10-year flood guidance level (10-YR), high guidance level (HGL), low guidance level (LGL), high minimum lake level (HMLL), and minimum lake level (MLL).

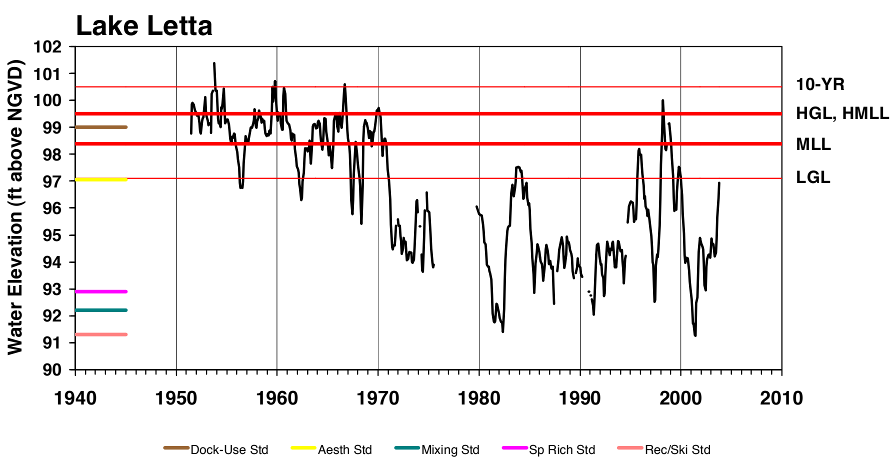


Figure 3-16.
Mean monthly surface water elevations through October 31, 2003, and proposed guidance and minimum levels for Lake Letta in Highlands County. Proposed levels include the 10-year flood guidance level (10-YR), high guidance level (HGL), low guidance level (LGL), high minimum lake level (HMLL), and minimum lake level (MLL).

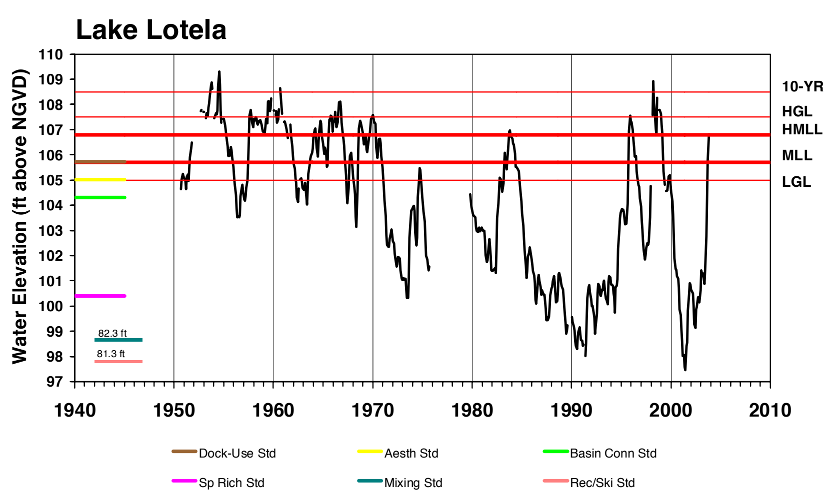


Figure 3-17.
Mean monthly surface water elevations through October 31, 2003, and proposed guidance and minimum levels for Lake Lotela in Highlands County. Proposed levels include the 10-year flood guidance level (10-YR), high guidance level (HGL), low guidance level (LGL), high minimum lake level (HMLL), and minimum lake level (MLL).

Section Four
SWUCA Recovery Strategy

Nearly all minimum flows and levels being proposed for the SWUCA are not currently being met. This circumstance has necessitated the development of a Recovery Strategy, consistent with Section 373.0421, Florida Statutes. The Recovery Strategy is designed to restore minimum flows to the upper Peace River and minimum levels to priority lakes in Highlands and Polk counties, and slow the inland movement of saltwater intrusion such that withdrawal infrastructure will be at minimal risk of water quality deterioration over the next 50 years. The slowing of saltwater intrusion will also make its ultimate stopping more manageable as advances in energy sources and membrane technology enhance the economic and environmental feasibility of desalination. This could provide the necessary quantities of fresh water to create a saltwater barrier or some other appropriate solution to this long-term resource issue. Consistent with statutory direction, the Recovery Strategy ensures that there is sufficient water supply for all existing and projected reasonable and beneficial uses in this eight-county area. This Recovery Strategy furthers the progressive water resource management that has evolved in this area over the last several decades and is consistent with the 1997 amendments to the Florida Water Resources Act of 1972.

There are two major components to the Recovery Strategy: (1) management of groundwater withdrawals throughout the SWUCA such that the Floridan aquifer saltwater intrusion minimum aquifer level can be achieved and sustained; and (2) implementation of a series of water resource development projects that restore minimum flows to the upper Peace River and minimum levels to priority lakes in the Ridge area. Ultimately, these two components are interconnected in that management of groundwater withdrawals to protect against saltwater intrusion will lessen the extent of water resource development projects needed to reestablish perennial flow in the upper Peace River and lake levels in the Ridge area. Conversely, the water resource development projects will not only improve river flows and lake levels, but will enhance recharge to the Floridan aquifer, thereby having a positive impact on management of saltwater intrusion.

There are several principles that drive the development of the Recovery Strategy. Early in the process, the Governing Board approved the following guiding principles:

- Contribute significantly to resource management and recovery
- Protect investments of existing water use permit holders
- Allow for economic expansion and new economic activities

As the Recovery Strategy developed, it became evident that additional principles were guiding the Strategy, including:

- Ensure that the Strategy was based on the best available science, and that the science would be extensively peer-reviewed
- Attempt to minimize the need for rule revisions

- Provide financial and regulatory incentives to maximize the benefits of public and private partnerships
- Ensure the Recovery Strategy is expeditiously implemented in a timeframe that is practical
- Seek consistency with recovery strategies developed elsewhere in the state
- The Recovery Strategy has been designed to meet each of these guiding principles.

There are six major elements that comprise the Recovery Strategy:

1. Development of a regional water supply plan is absolutely essential to achieve effective water management. Regional water supply planning allows communities to strategize on how to best address growing water needs while minimizing impacts to the water resources and associated natural systems. Regional water supply plans also include the costs of water supply development for all users, as prescribed in Section 373.0360, Florida Statutes Such planning can take advantage of long-term land-use changes and allow for strategic development of water supplies. For example, a principal component of the SWUCA Recovery Strategy is to take advantage of land-use changes currently taking place where agricultural land use, which relies almost solely on ground water, is being converted to residential and commercial uses. The Recovery Strategy focuses on supplying the majority of the water needs of the residential and commercial land uses with surface water (mostly captured high flows of rivers), reclaimed water and desalinated seawater. This strategy lessens the competition for ground water and, when coupled with basinwide conservation, land-use changes, regulatory enhancements and other management actions, makes possible the continued issuance of groundwater permits to interests that lack access to economically and environmentally feasible alternatives.

2. Use of existing rules to effectively contribute to the Recovery Strategy. The District's current rules are very robust and provide the regulatory criteria to accomplish the vast majority of what is contemplated in the Recovery Strategy. In order to obtain a water use permit, an applicant must demonstrate that the water use is reasonable and beneficial, is in the public interest and will not interfere with any existing legal use of water. The applicant accomplishes this by providing reasonable assurances, on both an individual and a cumulative basis, as applicable, that the following conditions are met: that the water use (a) is necessary to fulfill a certain reasonable demand; (b) will not cause quantity or quality changes which adversely impact the water resources, including both surface and ground waters; (c) will not cause adverse environmental impacts to wetlands, lakes, streams, estuaries, fish and wildlife, or other natural resources; (d) will comply with the MFL provisions of the Basis of Review; (e) will utilize the lowest water quality the applicant has the ability to use; (f) will not significantly induce saline water intrusion; (g) will not cause pollution of the aquifer; (h) will not adversely impact offsite land uses existing at the time of the application; (i) will not adversely impact an existing legal withdrawal; (j) will incorporate water conservation measures; (k) will incorporate reuse measures to the greatest extent practicable; (l) will not cause water to go to waste; and (m) will not otherwise be harmful to the water resources within the District [40D-2.301(1), Florida Administrative Code (FAC)].

As previously discussed, the Recovery Strategy encourages coastal counties to supply the majority of their public supply needs through the development of surface water (mostly captured high flows of rivers), reclaimed water and desalinated seawater — a strategy that minimizes the adverse effects of competition for ground water. Condition (e) above, *will utilize the lowest water quality the applicant has the ability to use,* can be very effective in encouraging these coastal counties to focus on supplies other than ground water from the Floridan aquifer. This is especially true considering that all four of these coastal counties are included in regional water supply authorities. During the past decade or more, these authorities have coalesced the collective resources of their members, together with financial assistance from the District, Florida Legislature and the federal government, to develop affordable, environmentally sustainable alternative supplies. Additionally, recent analysis has indicated that these alternative supplies are available to these communities, through the regional water supply authorities, to meet projected public supply water needs through at least 2025.

Other permitting conditions described above will be instrumental in ensuring that additional demand management occurs in the SWUCA. Specifically, conditions (j), *will incorporate water conservation measures,* (k), *will incorporate reuse measures to the greatest extent practicable*, and (l), *will not cause water to go to waste*, will allow the District to ensure that each applicant is doing their part in conserving the water resources. Additionally, condition (a), *that the water use is necessary to fulfill a certain reasonable demand*, will be used to ensure that water is not consumed for purposes inconsistent with public interest. There are also special provisions to the District's existing rules that allow the Governing Board to permanently revoke a permit in whole or in part, at any time after notice and hearing, if it finds that a permit holder has not used their water supply for a period of two years or more, unless the user can prove that this nonuse was due to extreme hardship caused by factors beyond their control.

3. Enhancements to existing rules. The most significant enhancement to the District's existing rules is the adoption of the proposed minimum flows and levels as a part of Chapter 40D-8, FAC. Because most of the actual flows and levels are below the proposed minimums for compliance purposes, the rule changes also include an associated Recovery Strategy, to be adopted in Chapter 40D-80, FAC. Finally, additional modifications will be incorporated into Chapter 40D-2, FAC, and its associated Basis of Review for Water Use Permitting. These rule changes primarily address the Net Benefit concept (further described in Section Eight). The purpose of Net Benefit is to provide applicants and the District additional flexibility in situations where existing rules, coupled with water supply planning and water resource development projects, are not adequate to achieve the goals of the Recovery Strategy. Net Benefit is being added to the District's rules specifically so that not only will resource recovery be attained, but the District can also have greater confidence that all reasonable-beneficial needs will concurrently be met. It is anticipated that these situations (where existing rules do not address) can be kept to a minimum; however, Net Benefit can be available as a safety net. An additional strategy is to improve data collection necessary to assess whether a lower per capita standard should be adopted. These enhancements are discussed in detail in Section 8, the regulatory component of the Recovery Strategy.

4. Provide financial incentives to encourage conservation and development of alternative supplies to ensure consistency with the Recovery Strategy. The District has been providing financial incentives to guide recovery of the water resources and sustainable development for well over a decade. These incentives are in excess of $700 million since the late-1980s and are administered through well-established and managed programs such as the Cooperative Funding Initiative, New Water Sources Initiative (NWSI) and Water Supply and Resource Development Initiative. Of the District's fiscal year 2006 budget of about $314.6 million, almost half of these funds ($145.3 million) are set aside to provide financial incentives to cooperators, or for District projects, to further conservation efforts or develop alternative supplies consistent with the District's regional water supply plans and recovery strategies. This includes $25 million of initial funding from the state's Water Protection and Sustainability Trust Fund for alternative water supply development. These incentives help fund a variety of projects and programs, including reclaimed water projects, low-volume plumbing rebate programs, desalination of seawater, storing of high river flows through the use of off-stream reservoirs and/or potable water aquifer storage and recovery systems, water conservation education efforts, BMP implementation, and water resource development projects to return minimum flows and levels to the upper Peace River and priority lakes in the Ridge area. As part of this Recovery Strategy the District reevaluated its long-term "financial engine" and concluded that continuing to "stay the course" will make the necessary funds available to implement the Recovery Strategy.

5. Development and implementation of water resource development projects that will restore historically lost lake and floodplain storage to aid in reestablishing minimum flows to rivers and enhance recharge. The District is focusing on a number of ways to increase wet-weather storage in the upper Peace River watershed. These include raising structures on lakes, restoring old mined lands and wetland systems that have been drained, and storing excess wet season river flow in abandoned waste clay settling ponds. Water stored could be released to augment flow of the river and its tributaries during low-flow periods. The District has estimated that currently identified restoration projects could provide as much as 50 mgd (about 75 cfs) of additional flow to the upper Peace River during a 90-day low-flow period.

6. Resource monitoring, reporting and cumulative impact analysis. As the major elements of the Recovery Strategy described above are implemented, the District will continuously monitor trends in resource conditions and permitted and actual water use. Elements of this monitoring program will include aquifer levels, lake levels and streamflows, permitted quantities and actual water use, changes in use types and relocations, and surface and groundwater quality. Recovery Strategy elements may be modified in the future in response to these resource trends. The monitoring will specifically include the movement of saltwater intrusion in the upper Floridan aquifer. The District will make available its various preventative and remedial programs to permittees potentially at risk of saltwater intrusion, including well backplugging, alternative supplies development and conservation and best management practices implementation, including the FARMS program.

The Recovery Strategy will be reevaluated at a minimum of once every five years as the Regional Water Supply Plan and District Water Management Plan are updated. The District will conduct an annual assessment of water resource criteria and cumulative impacts and review the Recovery Strategy at least every five years prior to 2025. Based on the annual assessment or five-year review, the District may revise the Recovery Strategy as appropriate. If the annual assessments or five-year reviews do not indicate sufficient progress to meet the Recovery Strategy goal of achieving the minimum levels for the Ridge lakes by 2025, the minimum flow for the upper Peace River by 2025, and the saltwater intrusion minimum aquifer level (SWIMAL) by 2025, the Governing Board will revise the Recovery Strategy, as appropriate, to achieve these goals. This adaptive management approach will ensure that the recovery elements are tailored to achieve the principles established by the Governing Board.

Cumulative Impact Analysis

A major component of the resource monitoring and reporting process will involve the cumulative impact analysis. The purpose of the proposed cumulative impact analysis is to integrate the District's comprehensive monitoring program into future Governing Board decision-making regarding recovery in the SWUCA. The cumulative impact analysis will evaluate all changes in permitted and used groundwater quantities and water resource development projects benefiting the upper Floridan aquifer in and around the MIA that have taken place since January 1, 2000. The cumulative impact analysis will take into account the positive effects of reduced groundwater withdrawals and the reduced impacts associated with these withdrawals, the positive effects of water resource development projects that benefit groundwater levels in and around the MIA, as well as the negative effects of new groundwater withdrawals.

As stated in Section 5, in order to achieve the SWIMAL, it is estimated that groundwater pumpage must be reduced by up to 50 mgd. This has been expressed as "up to 50 mgd" because if groundwater withdrawals were optimally distributed throughout the SWUCA, withdrawals could be reduced by less than this amount to achieve the minimum aquifer level. However, for purposes of the cumulative impact analysis, this 50 mgd reduction (e.g., a worst-case scenario) will be used. This 50 mgd reduction is associated with a 0.7-foot decrease in impacts from withdrawals on the aquifer levels in the MIA. The 0.7-foot decrease in impacts also represents the worst-case difference between actual levels and the proposed minimum aquifer level when expressed as the 10-year moving average of levels in the aquifer that existed in the period between 1990 and 1999.

The reduction in impacts from groundwater withdrawals on the minimum aquifer level can also be expressed as an annual amount of recovery. To achieve a reduction in impacts of 0.7-foot by the year 2025, an annual reduction of 0.028-foot (0.7 divided by 25) in impacts must be achieved. Given the volatility of the actual aquifer level, a long-term moving average provides a more practical measure of progress in the field. This can also be expressed as a 2 mgd annual reduction in withdrawals impacting the minimum level (50 mgd divided by 25). Figure 4-1 shows this reduction in withdrawals over the 25-year recovery period.

However, to achieve a net reduction of 50 mgd in groundwater withdrawals by 2025, the challenge is even greater. There are certain water use types in the SWUCA that have permitted groundwater quantities greater than the actual use. Recent trends and projections for these use types indicate that actual use will eventually grow into these permitted amounts. These use types primarily include public supply and power generation. There are other use types, particularly agriculture, where permitted groundwater quantities are also greater than actual use. However, trends indicate that actual use is not growing into the permitted quantities. In fact, just the opposite is true, whereby actual and permitted quantities are decreasing.

In order to achieve a net reduction of 50 mgd in groundwater withdrawals by 2025, this anticipated growth into permitted but unused groundwater quantities must also be offset by reductions in other uses. It is estimated that this growth into permitted but unused quantities represents an additional groundwater amount of 25 mgd. So, the total reduction necessary, in order to achieve a net reduction of 50 mgd in groundwater withdrawals, is 75 mgd, or 3 mgd per year. This required reduction in groundwater withdrawals is depicted in Figure 4-2.

Under the cumulative impact analysis, these reductions in groundwater withdrawals and the associated reductions in impacts on the SWIMAL required to achieve recovery by 2025 will be compared to the actual reductions that have been achieved. The District will monitor reductions in withdrawals associated with such activities as reuse project offsets, savings achieved through reductions in irrigated citrus acreage, savings achieved through the District's FARMS program, and savings attributable to reductions in phosphate mining activities. Actual savings in each of these categories have been estimated through the year 2002 and are depicted in Figure 4-3. The cumulative impact analysis would also take into account improvements in groundwater levels attributable to any water resource development projects that benefit actual groundwater levels, such as aquifer recharge projects. Under cumulative impact analysis, as long as the actual savings achieved are equal to or greater than those necessary for recovery and to offset growth into permitted but unused quantities, it is anticipated the SWIMAL will be achieved and the Governing Board may rely on these existing mechanisms.

Cumulative Impact Analysis – An Example

Figure 4-4 illustrates cumulative impact analysis for a hypothetical situation involving reductions in withdrawals and a water resource development project, both lessening impacts on the minimum aquifer level, and a request for a new groundwater withdrawal increasing impacts on the MIA. In this example, subsequent to January 1, 2000 a 5 mgd reduction in withdrawals in southwestern Polk County is attributable to conservation implemented by the permittee and results in an improvement in the minimum aquifer level of 0.20-foot. In addition, an aquifer recharge project is implemented in western Hardee County, resulting in an improvement in groundwater levels of 0.10-foot. Finally, there is a reduction in groundwater withdrawals in western Manatee County caused by a land-use transition, resulting in an improvement in groundwater levels of 0.10-foot. This results in a total improvement in groundwater levels of 0.40-foot (0.20 + 0.10 + 0.10 = 0.40).

Assuming we are in the fifth year (2004) of the recovery period, we know that the 0.7-foot reduction in impacts by the year 2025 represents an annualized reduction of 0.028-foot in impacts, for a total reduction of 0.14-foot in impacts by 2005 (5 x 0.028). In addition, we know that growth into permitted but unused groundwater quantities also represents an additional withdrawal of 5 mgd, and in this example the evaluation of these increased withdrawals indicates an additional impact on the aquifer of 0.10-foot. The amount of positive benefit associated with reductions in withdrawals (0.40-foot) exceeds that which is required for both recovery and growth into unused quantities (0.14 + 0.10 = 0.24-foot required). In this example, recovery is being achieved consistent with this Recovery Strategy and the staff would recommend to the Board no modifications to the strategy are necessary.

If the cumulative impact analysis indicates that actual reductions in withdrawals (as measured through modeling and in the field) are not sufficient for recovery, growth into permitted groundwater quantities, and to accommodate a request for new groundwater withdrawals, then the District would need to revisit the strategy, resulting in additional rule making, projects or financial incentives, or some combination thereof, designed to achieve recovery.

The above example is a very simplified scenario, but serves to demonstrate how the cumulative impact analysis will be implemented. The example also makes it abundantly clear that a comprehensive monitoring program is essential to the cumulative impact analysis. The District is continuously enhancing its monitoring capabilities. A recent significant improvement is referred to as the Water Use Tracking system, designed specifically to support the SWUCA cumulative impact analysis. The Water Use Tracking system was substantially completed in 2005, but refinements will continue over time, including making much of the information available to interested parties on an as-needed basis for their decision-making.

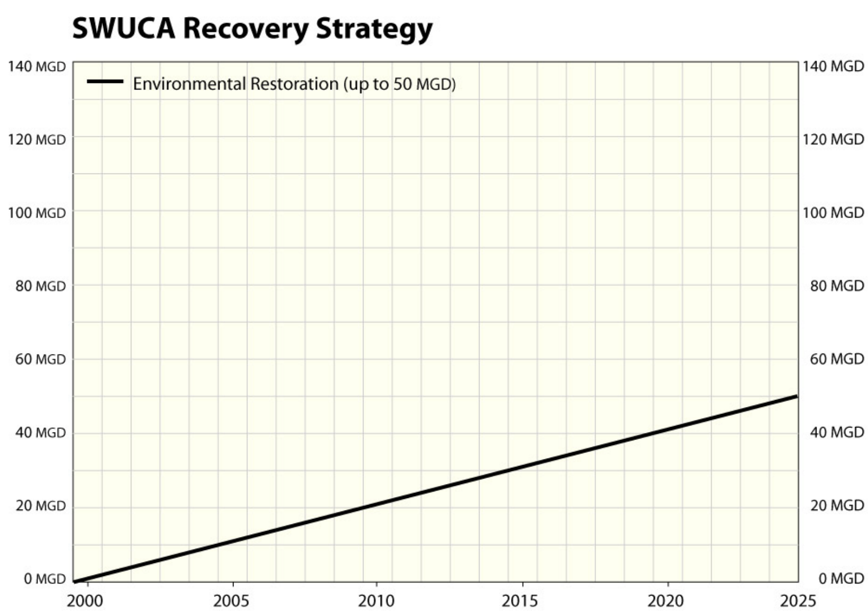


Figure 4-1. Reductions in withdrawals required for recovery.

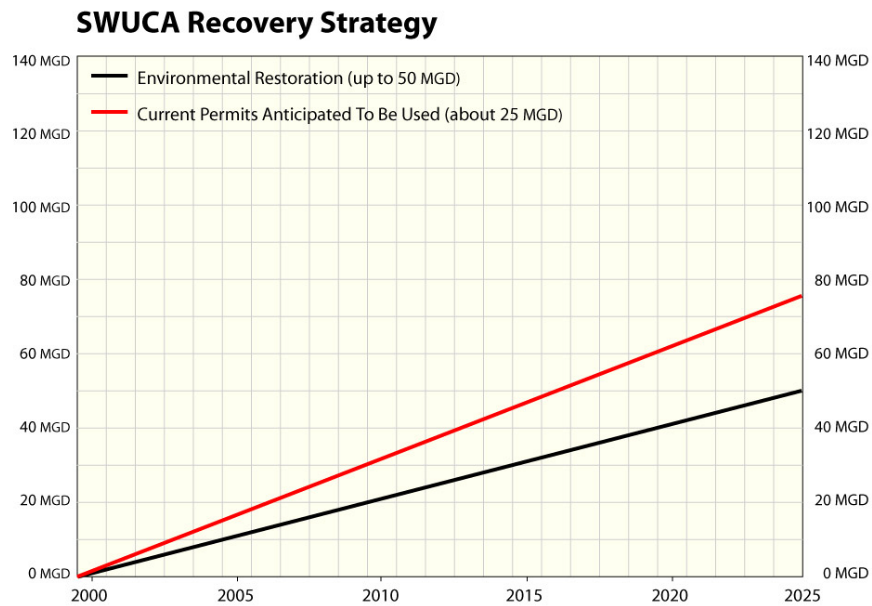


Figure 4-2. Reductions in withdrawals required for recovery and growth into permitted quantities.

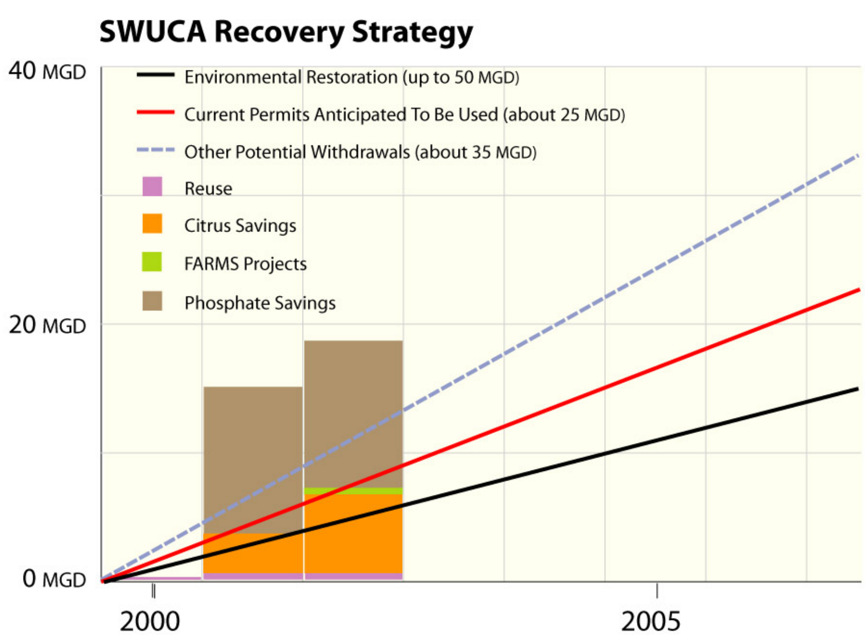


Figure 4-3. Reductions in withdrawals required for recovery and growth into permitted quantities; reduced quantities associated with reuse and conservation.

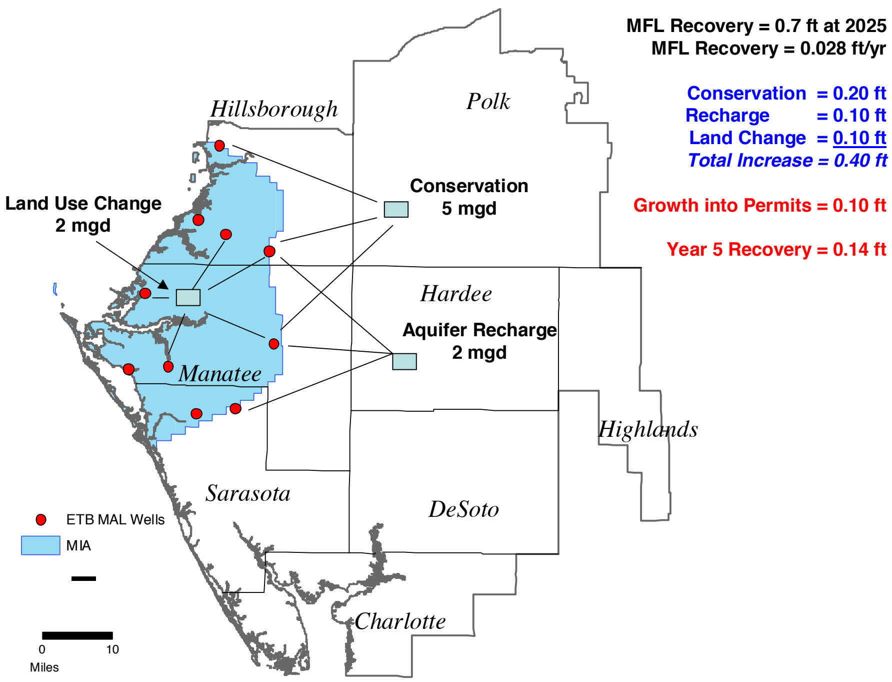


Figure 4-4. Cumulative impact analysis – a hypothetical example.

Section Five
Regional Water Supply Planning Component

Introduction

Regional water supply planning is critical to ensuring effective water management. This is especially true when significant resource and supply concerns exist. In such cases, Florida law (F.S. 373.0421) requires a recovery or prevention strategy to be expeditiously developed as part of the regional water supply planning process *if the existing flow or level in a water body is below, or is projected to fall within 20 years below, the applicable minimum flow or level established.* The recovery or prevention strategy must include *the development of additional water supplies and other actions, consistent with the authority granted by this chapter to: (a) achieve recovery to the established minimum flow or level as soon as practicable; or (b) prevent the existing flow or level from falling below the established minimum flow or level.* The recovery strategy must also *include phasing or a timetable which will allow for the provision of sufficient water supplies for all existing and projected reasonable-beneficial uses, including development of additional water supplies and implementation of conservation and other efficiency measures concurrent with, to the extent practical, and to offset, reductions in permitted withdrawals, consistent with the provisions of this chapter.*

Existing flows and levels are below nearly all the minimum flows and levels currently being proposed in the SWUCA. Appropriately, the Governing Board has directed staff to develop this recovery strategy, the foundation of which is a regional water supply planning effort that demonstrates that minimum flows and levels will be restored as soon as practicable and that adequate water supplies will be available for all existing and projected reasonable and beneficial uses for a planning horizon of at least 20 years. This planning effort is described below and estimates additional water use needs, including reductions in groundwater withdrawals needed for environmental restoration. The recovery strategy also identifies potential water sources and demand management measures needed to ensure sufficient supplies through 2025.

Regional Water Supply Planning Component of the SWUCA Recovery Strategy

There are two major elements of a regional water supply plan. The first is the identification of future water needs and includes any reduction in withdrawals needed for environmental restoration. The second is identifying sufficient traditional and alternative sources, as well as additional savings through conservation efforts, to meet all existing and projected reasonable and beneficial water uses. Other actions such as plugging wells that waste ground water by allowing it to flow away freely at land surface, artificially recharging an aquifer, or retiring water use permits associated with acquired preservation lands can contribute to addressing water needs of a region.

For several decades, the District has conducted long-term water supply planning. Several of the most prominent efforts include the Four River Basins Study published March 1977, the Water Supply Needs and Sources 1990–2020 published January 1992, and the Regional Water Supply Plan published August 2001, which is currently being updated. These reports have been instrumental in advancing the use of alternative supplies and demand management in meeting the region's ever growing population.

Much of the information included in this recovery strategy is derived from the District's unpublished internal review draft of the 2006 Regional Water Supply Plan. The recovery strategy includes projections for both average annual conditions and drought conditions that are expected to occur 1 out of every 10 years.

Reductions Needed to Achieve the Proposed Saltwater Intrusion Minimum Aquifer Levels — Over the past 20 years, the long-term average annual ground-water withdrawals in the SWUCA have been about 650 mgd, of which nearly 90 percent are from the Floridan aquifer. Based on the existing distribution of withdrawals, it is estimated that long-term average annual withdrawals from the Floridan aquifer need to be reduced by 50 mgd to ensure the saltwater intrusion minimum aquifer level is met. If withdrawals were more optimally distributed (i.e., declines in the most impacted areas and increases in the least impacted areas) a reduction of significantly less than 50 mgd would be required. As previously discussed, minimum flows for the upper Peace River and minimum levels for the Ridge area lakes will be primarily achieved through water resource restoration projects. However, a reduction of up to 50 mgd in withdrawals from the Floridan aquifer will enhance restoration efforts for the upper Peace River and the eight minimum level Ridge area priority lakes.

Public Supply – Changes in Water Use 2000 to 2025 — Public supply water use is anticipated to account for the majority of increases in water use through 2025. Table 5-1 summarizes public supply demand projections for each of the counties in the SWUCA. Projections are that an additional 105.2 and 111.8 mgd will be required during average annual and drought conditions, respectively (note, public supply includes domestic self-supply and individual irrigation wells in Table 5-1). The largest increases are expected in Polk, Sarasota, Hillsborough, Manatee and Charlotte counties where increases during drought conditions are anticipated to increase by 22.1, 22.7, 23.1, 20.0 and 10.3 mgd, respectively. As further evidence of the growth trends in public supply demands, Figure 5-1 illustrates the growth in urban land use from 1990 to 2004, a period when over 128,000 acres were converted to urban land uses.

Agriculture – Changes in Water Use 2000 to 2025 — Agricultural water use is expected to decline in many areas of the SWUCA over the next several decades, as shown in Table 5-2. During the past half century, agricultural water use has substantially increased and has become the dominant water use, particularly in the SWUCA. In 2000, a period of record drought, estimated ground water withdrawn in the SWUCA was 836 mgd, of which 581 mgd, or 69 percent, was for agricultural irrigation. In recent years, however, there have been several developments that have adversely impacted or displaced agricultural operations in the area. These include expansion of urban areas; full implementation of the North American Free Trade Agreement (NAFTA) and other global competition issues, more stringent regulations, and destructive insect and disease outbreaks.

Figure 5-2a displays the change in agricultural land use in the SWUCA between 1990 and 1999 and shows that agricultural acreage is declining in areas where urban expansion is occurring. Although there are increases in the more rural areas, examples of land use transitions from agriculture to residential/urban abound, such as in two specific areas in Manatee and Polk counties that were more closely examined. In the 1991–2002 time period, 41,063 acres of agricultural lands were rezoned for residential/commercial development in Manatee County. This is over 9 percent of the county's total land area. The estimated water historically permitted for the rezoned agricultural land is nearly the same as the estimated demand for the projected new development on this land. Another example is in the Polk County Northeast Regional Utilities Service Area. From 1995 to present, 4,616 acres of citrus are in transition to residential/urban. This citrus acreage represents nearly 5 mgd of water use. These reductions are also evident in industry reports. For example, in their 1996–97 Citrus Summary Report, the Florida Agricultural Statistics Service (FASS) reported that at the end of 1995 the total citrus acreage in Charlotte, DeSoto, Hardee, Highlands, Hillsborough, Manatee, Polk and Sarasota counties was 375,263 acres. In 2002, FASS reported total acreage had declined to 371,250 acres, a reduction of 4,013 acres. Additionally, in April 2000, FASS published its most recent Vegetable Summary Report that showed that tomato acreage in the Palmetto-Ruskin growing area, where most of the tomatoes are grown in the SWUCA, decreased from 15,150 acres in the fall of 1994 and spring of 1995 to 13,125 acres in the fall of 1998 and spring of 1999. As further evidence of the declining trends in agricultural activities and associated water use, Figure 5-2b displays the change in agricultural land use in the SWUCA between 1990 and 1999 with proposed land acquisitions and conservation lands.

Phosphate Mining and Processing, Other Industrial and Power Generation Use – Changes in Water Use 2000 to 2025 — Groundwater use for mining and processing of phosphate ore in the SWUCA is expected to remain stable, if not decline over the next several decades, then eventually cease as economically extractable ore deposits are depleted. Groundwater use for phosphate mining and production peaked in the 1970s, but has since dramatically declined as the industry began to recycle water. Average daily use of ground water associated with mining and processing of phosphate ore in the SWUCA has declined from over 300 mgd in the mid-1970s to less than 75 mgd in recent years. Figure 5-3 displays the change in mined areas in the SWUCA between 1990 and 1999 and shows that mining is moving south at a rate of about 5,000 acres per year. Overall water use for other industrial uses and power generation is projected to remain stable or increase in the SWUCA through 2025. Projections indicate that there will be combined effect of a 6.7 mgd increase through the planning period (mostly for power generation), with other components of this use sector experiencing a decrease of 7.0 mgd (mostly in the mining sector).

Recreational and Aesthetic Use – Changes in Water Use 2000 to 2025 — Water use for recreational and aesthetic uses is projected to increase in the SWUCA through 2025. An anticipated increase of 19.6 and 25.3 mgd is projected during average and drought conditions. Much of this increase is for golf course irrigation and should be able to be supplied by reclaimed water, captured stormwater and other alternatives to Floridan aquifer withdrawals.

Table 5-2 is a summary of projected water use changes for all categories in the SWUCA from 2000 through 2025 during average and drought conditions experienced once every 10 years. The table indicates both increases and decreases that are projected to occur in each major use type. Both increases and decreases are shown in this table because these changes in water use may occur at different points in time throughout the planning period and in different locations, such that it would be inappropriate to assume decreases or increases in one area at one point in time will be equally offset by changes in other areas at other times. The total additional need for water is estimated to be 181.7 and 193.7 mgd during average and drought conditions, respectively. Over half of this need is for public supply (average annual of 98.0 mgd and drought of 103.9 mgd). Environmental restoration accounts for over half of the remaining increase (up to 50 mgd). The following is a discussion on how these projected increases can be met.

Potential Sources of Supply for Anticipated Water Needs for the Period 2000 through 2025 — As stated above, most of the projected water use increases in the SWUCA are for public supply. Fortunately, alternative supplies and additional demand management can meet most of these increases. In areas where utilities have limited opportunities to develop alternative supplies, significant quantities needed for growth are anticipated to be met as urban areas expand and use some of the ground water permitted to the land use they have displaced. Potential sources to meet growth in public supply water use are best evaluated by examining individual counties or water supply authority areas. The following is a discussion of the projected public supply water needs and potential supplies for the four counties that comprise the Peace River/Manasota Regional Water Supply Authority. Hardee, Highlands, Hillsborough and Polk counties are presented separately.

Table 5-3 is a summary of additional public supply water needs and potential sources from 2000 to 2025 during both average and drought conditions for Charlotte, DeSoto, Manatee and Sarasota counties (the counties that comprise the Peace River/Manasota Regional Water Supply Authority). As listed, 55.0 and 58.3 mgd of additional demands are anticipated by 2025 under average and drought conditions. Potential supplies to meet additional demands include the use of permitted but unused surface water and non-Floridan aquifer supplies not currently being used in the amount of 32.4 and 1.6 mgd, respectively, during average conditions. Details of how these quantities were derived are included in Appendix 4. These sources total 34 and 35 mgd under average and drought conditions, respectively. This leaves a remaining deficit (projected needs exceeding these sources) of 21 and 23.3 mgd. Reducing water use through conservation efforts could reduce projected demands by an estimated 22.3 mgd. Currently, average per capita rates for the four-county region in an average year are estimated to be about 125 gallons per day. Per capita rates are calculated generally by dividing pumpage by the population served. Per capita rates vary throughout the SWUCA due to variations in the characteristics of utility customer bases and differences in the conservation and reclaimed water programs implemented by utilities.

Other potential supplies include the use of additional reclaimed water. It is estimated reclaimed water could offset additional needs in the amount of 23.7 mgd. The four-county region's increase in public supply demands through 2025 under both average and drought hydrologic conditions are more than offset through the combination of increased surface water, non-Floridan ground water, enhanced conservation and use of reclaimed water.

Table 5-4 is a summary of additional public supply water needs and potential sources from 2000 to 2025 during average and drought conditions for the portion of Hillsborough County in the SWUCA. As listed, 23.1 and 24.5 mgd of additional demands are anticipated by 2025 under average and drought conditions, respectively. Potential supplies to meet these needs include the use of permitted but unused surface water and Floridan aquifer groundwater supplies not currently being used (Appendix 4). This includes approximately 4.3 mgd of the 17 mgd set aside for growth that is part of the 85 mgd of alternative supplies developed as part of the Partnership Agreement. These sources total 5.3 and 5.5 mgd under average and drought conditions, respectively. This leaves a deficit (projected needs exceeding these sources) of 17.8 and 19 mgd. Water demand projections could be reduced by about 5.6 mgd through enhanced conservation efforts. Currently, countywide per capita rates in an average year are estimated to be about 138 gallons per day. Reclaimed water could also offset an additional 4.2 mgd. The additional estimated 8.0 and 9.2 mgd needed under average and drought conditions could be provided by development of additional alternative supplies, more aggressive conservation efforts, the transition of agricultural lands and water uses to public supply or any of the Net Benefit options discussed in Section 8.

Table 5-5 is a summary of additional public supply water needs and potential sources from 2000 to 2025 for the portion of Polk County in the SWUCA. As listed, 22.1 and 23.5 mgd of additional demands are anticipated by 2025 under average and drought conditions, respectively. Potential supplies include the use of Floridan aquifer water that is currently permitted but not being used (Appendix 4). This leaves a deficit (projected needs exceeding sources) of 2.6 mgd under average conditions and a surplus of 0.2 mgd under drought conditions. Water demand projections could be reduced by about 11.8 mgd through enhanced conservation efforts. Currently, countywide per capita rates in an average year are estimated to be about 147 gallons per day. Reclaimed water could offset an additional 5.9 mgd. Cumulatively, the growing public supply needs in Polk County can be more than offset by these various sources of water. In addition, the transition of agricultural land uses to residential and other forms of development will allow for the conversion of ground water historically used for agriculture to help meet needs where the sources in those specific situations where the sources listed above are not adequate.

Table 5-6 is a summary of additional public supply water needs and potential sources from 2000 to 2025 for the portion of Highlands County in the SWUCA. As listed, 4.6 and 4.9 mgd of additional demands are anticipated by 2025 under average and drought conditions, respectively. Potential supplies include the use of Floridan aquifer water that is currently permitted but not being used (Appendix 4). This leaves a deficit (projected needs exceeding sources) of 1.3 and 1.0 mgd. Water demand projections could be reduced by about 2.1 mgd through enhanced conservation efforts. Currently, countywide per capita rates in an average year are estimated to be about 142 gallons per day. Reclaimed water could offset an additional 1.7 mgd. Cumulatively, the growing public supply needs in Highlands County can be more than offset by these various sources of water. In addition, the transition of agricultural land uses to residential and other forms of development will allow for the conversion of ground water historically used for agriculture to help meet needs where the sources in those specific situations where the sources listed above are not adequate.

Table 5-7 is a summary of additional public supply water needs and potential sources from 2000 to 2025 for Hardee County. As listed, approximately 0.6 mgd of additional demand is anticipated by 2025 under both average and drought conditions. Potential supplies include the use of Floridan aquifer water that is currently permitted but not being used (Appendix 4). This leaves a deficit (projected needs exceeding sources) of 0.4 and 0.3 mgd. Water demand projections could be reduced by about 0.2 mgd under both average and drought conditions through enhanced conservation efforts. Reclaimed water could offset an additional 0.7 mgd. Cumulatively, the growing public supply needs in Hardee County can be more than offset by these various sources of water. In addition, the transition of agricultural land uses to residential and other forms of development will allow for the conversion of ground water historically used for agriculture to help meet needs where the sources in those specific situations where the sources listed above are not adequate.

In addition to potential supplies and demand management measures discussed above, there are a broad array of other potential conservation initiatives, alternative supplies, water resource development projects, Net Benefit efforts and resource restoration options available to meet future environmental and growth needs. Table 5-8 summarizes these options, as well as future projected needs and potential options described above.

As shown in Table 5-8, for the time period 2000 to 2025, up to 181.7 mgd under average conditions and 193.7 mgd under drought conditions of additional supply and aquifer reductions are needed to ensure the saltwater intrusion minimum aquifer level is met and sufficient supplies are available for projected increases in water use. As discussed above, potential options to meet these needs include existing permitted but not fully used public supply surface water, Floridan aquifer ground water and other groundwater sources, savings from public supply conservation efforts, and reclaimed water offsets. Other potential supplies include conservation efforts by water users other than public supply, including all future projects to implement best management practices for agriculture, other alternative potable supplies under construction or design, turnover in water use as changes in land use occur, availability of groundwater quantities to meet needs when lands are acquired for conservation purposes, and further use of shallow aquifers. Each of these potential supplies is discussed further below, and together can provide between 325.6 to 353.2 mgd to more than offset the 181.7 to 193.7 mgd of future demands under average and drought conditions, respectively. Additional potential sources, demand management and resource restoration, the impact of which is more difficult to quantify, should provide substantial additional positive benefits. These benefits include an applicant's implementation of Net Benefit projects other than those previously discussed; better distribution of withdrawals in the basin, continued plugging of free-flowing wells; water resource development projects that have an aquifer recharge element; potable water and reclaimed water aquifer storage and recovery projects that use the deep aquifer for storage, thereby aiding recovery of aquifer levels; more aggressive demand management initiatives than the 10 percent contemplated in this recovery strategy; and other similar efforts.

Conservation Efforts Other Than Those in the Public Supply Sector — There are significant conservation efforts in water use sectors other than public supply. One of the largest efforts is in the agricultural sector. The District, in cooperation with the Florida Department of Agriculture and Consumers Services (FDACS), the Natural Resources Conservation Service (NRCS) and the industry, has recently implemented two significant programs to provide financial incentives to agricultural operations to develop alternative supplies and further implement best management practices. The most prominent program is the Facilitating Agricultural Resource Management Systems (FARMS) program that provides up to 75 percent matching funds for an agriculturist to construct tailwater recovery systems, surface water catchment basins and other infrastructure to recycle water and use storm water. Two predecessor projects to this program, Falkner Farms and Pacific Tomato Growers, have constructed infrastructure that will reduce ground water use by nearly 2 mgd. These efforts have been expanded throughout the SWUCA and the District's "Ag Teams" have been reformed to work with farmers to implement these types of projects. An associated effort is the backplugging of wells in primarily the Shell Creek, Joshua Creek and Prairie Creek watersheds to reduce the deleterious impacts of irrigating with poor quality water. These programs, in combination with other agricultural conservation efforts and conservation in industrial and recreational uses, should result in a reduction of at least 61 mgd over the next 20 years.

Changes in Water Use Associated with Land Use Changes — In the SWUCA, there are two approaches that will take advantage of land and water use changes. The first recognizes the displacement of nonresidential land uses by urban/suburban land uses in areas where there are readily available alternative supplies, which is primarily in the four coastal counties of the SWUCA. In these areas, the recovery strategy relies on use of alternative supplies, such as harvesting high river flows, to meet the expanding urban/suburban water needs, and because the land use being displaced relies almost entirely upon ground water, there is a net reduction in groundwater use. The second recognizes the displacement of nonresidential land uses by urban/suburban land uses in areas where alternative supplies are not readily available, which is primarily in the inland counties. In these areas, most of the projected increase in urban/suburban water use should be met with ground water that was previously used by displaced agricultural land uses. It is very difficult to quantify the magnitude of the water savings that will be realized by this land-use transition. Based upon the land-use transitions that are associated with the projected reductions in agricultural and industrial (mining) activities, it is estimated that 74.1 mgd and 95.6 mgd could become available between 2005 and 2025 mgd. This reduction in groundwater withdrawals as land-use conversions take place will contribute to recovery and potentially help meet growing water needs where alternative sources are not feasible (see Section 8). This will be an activity that requires a great deal of monitoring. Much of the benefit from this activity will be associated with a better distribution of groundwater withdrawals. For the past decade nonresidential water use has been declining in the areas of the basin where aquifer level declines have been the greatest (Hillsborough, Manatee and Polk counties) and remaining relatively stable or increasing where aquifer levels are not as stressed (Charlotte, DeSoto and Hardee counties). Such transition will help to recover aquifer levels, which will allow the saltwater intrusion minimum aquifer level to be met.

Retiring Water Use Through Public Land Acquisition Programs — The District historically purchased over 20,000 acres of land per year for a variety of water resource management purposes. Often, acquired lands have associated water use permits for groundwater withdrawals. The District retires these permits when the lands are acquired, which aids in aquifer recovery. The Governing Board has approved 220,000 additional acres for potential acquisition in the SWUCA. There is nearly 40 mgd of permitted groundwater quantities associated with these lands. For purposes of this recovery strategy, it is estimated that an additional 10 mgd of actual groundwater use will be retired through public land acquisition by 2025. As with the reductions in groundwater withdrawals associated with land-use transitions, this 10 mgd will be available to contribute to recovery and, where determined appropriate, potentially to meet growing needs (see Section 8).

Additional Use of the Surficial and Intermediate Aquifers — Additional withdrawals can occur from the surficial and intermediate aquifers in the SWUCA. For example, projections are that additional residential irrigation wells will be drilled, primarily in Sarasota County, representing a 400- to 500-square-mile area. These wells are drilled into the surficial and intermediate aquifers and singularly will account for an increase of over 14 mgd of use from these systems. Additionally, golf courses and industry have increasingly been relying on surficial aquifer water obtained through horizontal wells and other methods. Throughout the remaining 4,500 square miles of the SWUCA, it is possible that up to 21 mgd could be supplied from the surficial and intermediate aquifer systems for similar irrigation purposes using technology such as horizontal wells or private well systems. For purposes of this recovery strategy, it is estimated that an additional 35 mgd of supply can be obtained from these aquifer systems.

Net Benefit — Several of the projects described above will result in a Net Benefit in terms of reducing Floridan aquifer groundwater withdrawals. In addition, there are a number of possible projects and activities that can result in a Net Benefit. This could include an applicant capturing high surface water flows and recharging the aquifer, with potable-quality water during the wet season, and recovering a percentage of that use in the dry season. Net Benefit activities are anticipated to provide a major role in solving resource issues in the SWUCA. However, because of the difficulties involved in predicting when and where they will occur, and how much Net Benefit they will provide, a specific quantity of offset has not been provided.

Water Resource Development Projects — The District is undertaking a series of water resource development projects that are anticipated to enhance Floridan aquifer levels. For example, there are a series of projects to provide perennial flow to the upper Peace River. Because the upper river is well connected to the aquifers, a significant percentage of the flows are anticipated to recharge the aquifers. Additionally, there are several potable water aquifer storage and recovery systems in the basin that store water in the Floridan aquifer. As these systems build up reserves, there will be some benefit to the aquifer systems.

Well Plugging Programs — The District has an extensive well plugging program that saves artesian aquifer water that may be free-flowing at land surface or is being lost to shallow aquifers.

Table 5-1.
Anticipated additional public supply water needs for the period 2000 through 2025 during average annual and drought conditions that occur once every 10 years.

SWUCA Recovery Strategy
Regional Water Supply Planning Component
Additional Public Supply Needed by 2025 (mgd)

County	Average Conditions	Drought Conditions
Charlotte	10.3	11.0
DeSoto	1.8	2.0
Hardee	0.6	0.6
Highlands	4.6	4.9
Hillsborough	23.1	24.5
Manatee	20.0	21.2
Polk	22.1	23.5
Sarasota	22.7	24.1
TOTALS	105.4	111.8

Additional needs shown above are for the period 2000 to 2025. The additional quantities needed during a drought are based on low-rainfall conditions that occur once every 10 years.
Notes: Includes domestic self-supply and irrigation.
May not sum to total due to rounding.

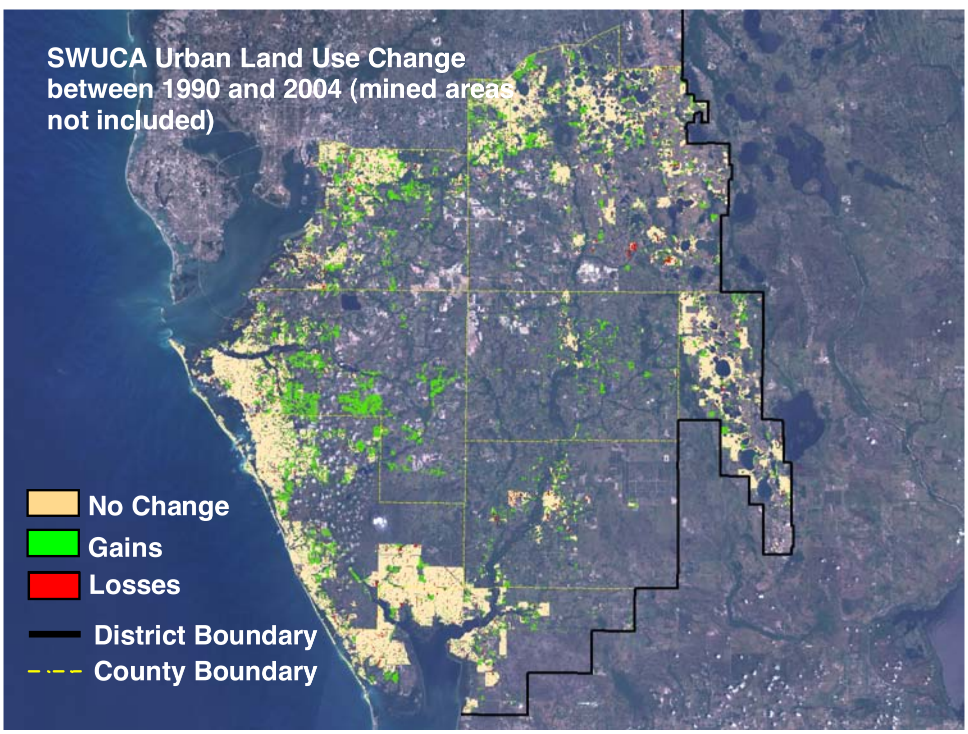


Figure 5-1.
Change in urban land use in the SWUCA between 1990 and 2004 (mined areas not included).

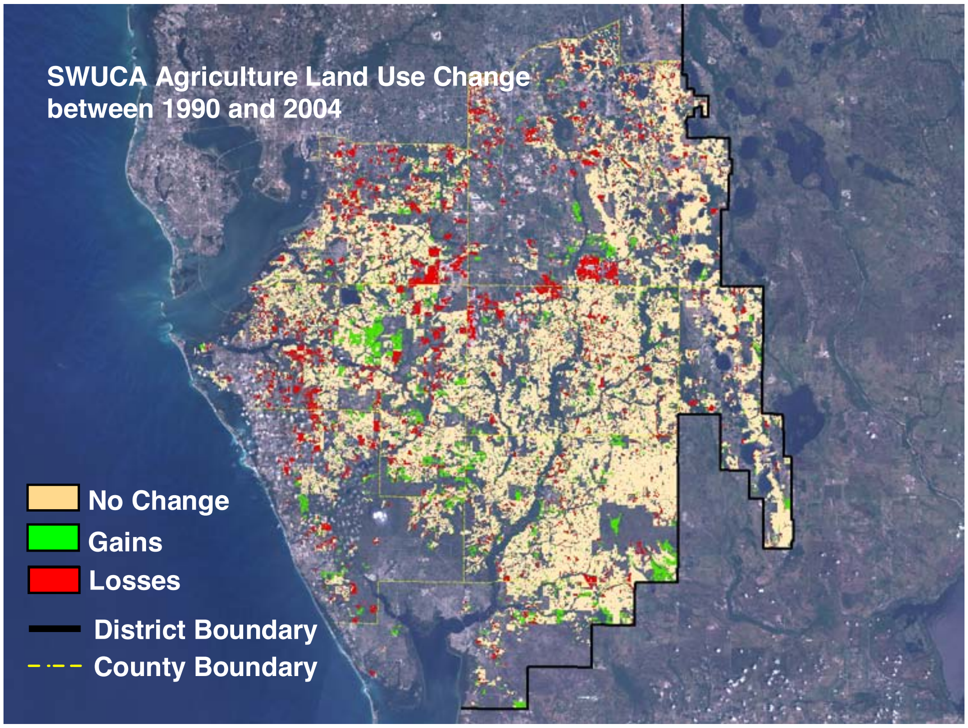


Figure 5-2a. Change in agricultural land use in the SWUCA between 1990 and 2004.

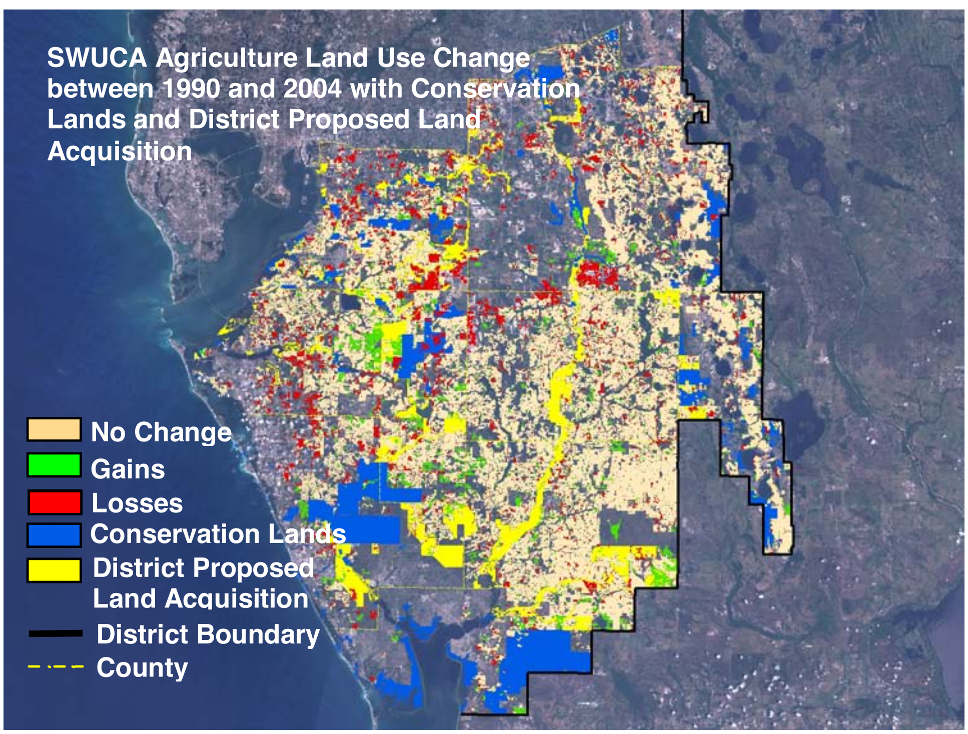


Figure 5-2b. Change in agricultural land use in the SWUCA between 1990 and 2004 with proposed land acquisitions and conservation lands.

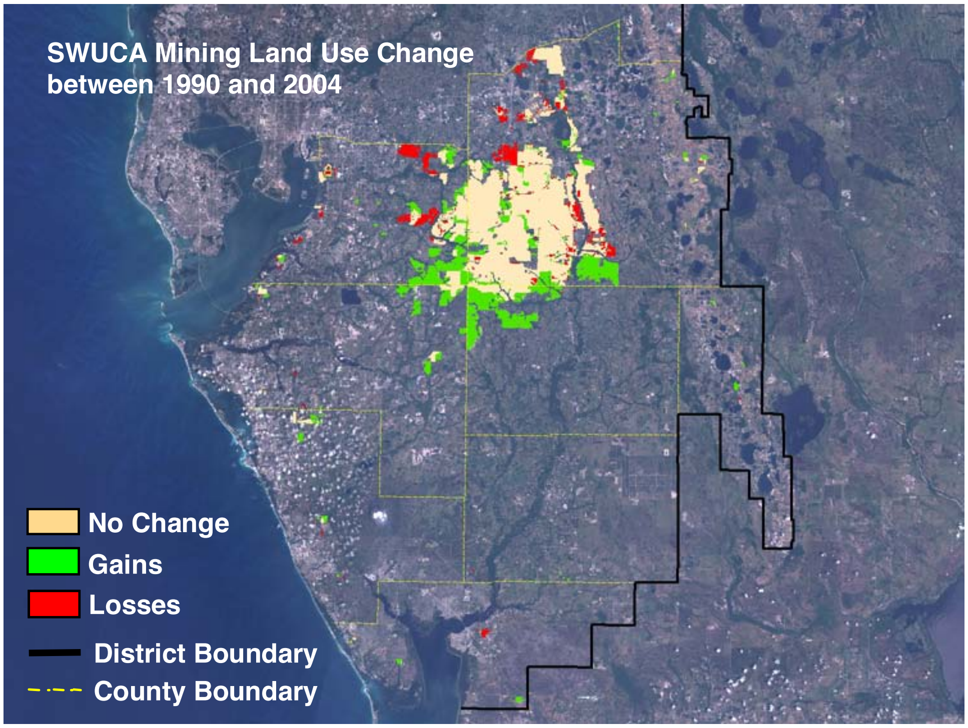


Figure 5-3.
Change in mined areas in the SWUCA between 1990 and 2004.

Table 5-2.
Summary of projected water use changes for all categories in the SWUCA from 2000 through 2025.

SWUCA Recovery Strategy Regional Water Supply Planning Component Projected Additional Water Needed by 2025 (mgd)				
Use Type or Need	Average Conditions		Drought Conditions	
	Increase	Decrease	Increase	Decrease
Quantities Needed to Meet Saltwater Intrusion Minimum Aquifer Levels	Up To 50.0		Up to 50.0	
Public Supply	98.0		103.9	
Residential Irrigation Wells	7.4		7.8	
Agriculture		- 67.1		- 88.6
Industry and Mining	6.7	- 7.0	6.7	- 7.0
Recreational and Aesthetic	19.6		25.3	
TOTALS	181.7	- 74.1	193.7	- 95.6
Additional needs shown above are for the period 2000 to 2025. The additional quantities needed during a drought are based on low-rainfall conditions that occur once every 10 years.				

Table 5-3.
Summary of additional public supply water needs and potential sources from 2000 to 2025 for Charlotte, DeSoto, Manatee and Sarasota counties.

Additional Public Supply Water Needs and Potential Sources, 2000 to 2025 Charlotte, DeSoto, Manatee and Sarasota Counties (mgd)		
	Average Conditions	Drought Conditions
Public Supply Additional Need	55.0	58.3
Potential Sources:		
Existing Permitted Surplus Surface Water	32.4	32.4
Existing Permitted Surplus Floridan Ground Water	0.0	0.0
Existing Permitted Surplus Other Ground Water	1.6	2.6
Total Potential Sources	34.0	35.0
Surplus or Deficit	21.0	23.3
Water Conservation	22.3	22.3
Reclaimed Water	23.7	23.7
Remaining Surplus or Deficit	25.0	22.7
Demand projections include public supply, domestic self-supply and private irrigation wells.		

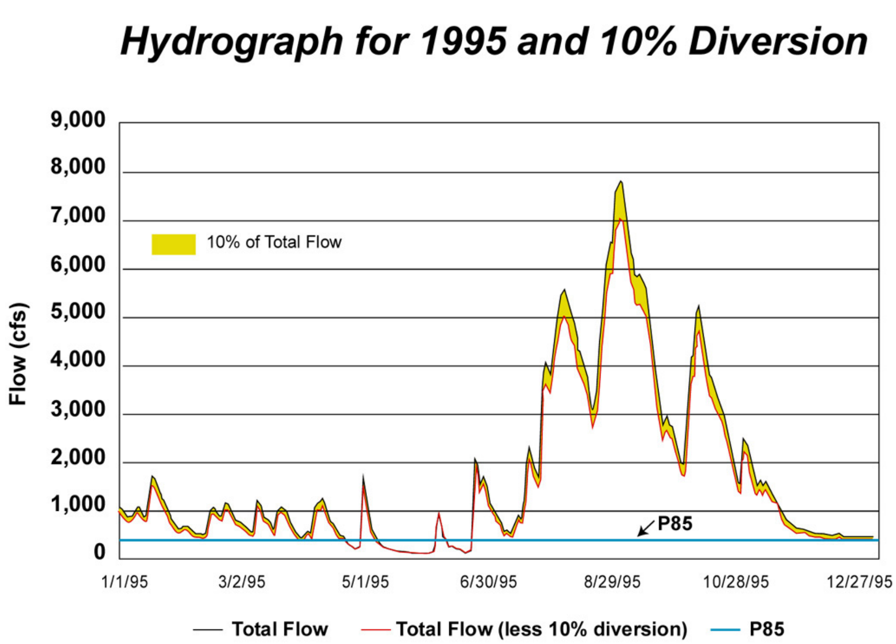


Figure 5-4.
Change in a river hydrograph resulting from the diversion of up to 10 percent of the daily river flows

Table 5-4.
Summary of additional public supply water needs and potential sources from 2000 to 2025 for Hillsborough County.

Additional Public Supply Water Needs and Potential Sources, 2000 to 2025 Hillsborough County in the SWUCA (mgd)		
	Average Conditions	Drought Conditions
Public Supply Additional Need	23.1	24.5
Potential Sources:		
Existing Permitted Surplus Surface Water	4.3	4.3
Existing Permitted Surplus Floridan Ground Water	1.0	1.2
Existing Permitted Surplus Other Ground Water	0.0	0.0
Total Potential Sources	5.3	5.5
Surplus or Deficit	17.8	19.0
Water Conservation	5.6	5.6
Reclaimed Water	4.2	4.2
Remaining Surplus or Deficit	8.0	9.2
Additional Solutions: Alternative Supplies from Tampa Bay Water, Additional Demand Management, Cumulative Impact Analysis and Net Benefit		
Demand projections include public supply, domestic self-supply and private irrigation wells.		

Table 5-5.
Summary of additional public supply water needs and potential sources from 2000 to 2025 for Polk County.

Additional Public Supply Water Needs and Potential Sources, 2000 to 2025 Polk County in the SWUCA (mgd)		
	Average Conditions	Drought Conditions
Public Supply Additional Need	22.1	23.5
Potential Sources:		
Existing Permitted Surplus Surface Water	0	0
Existing Permitted Surplus Floridan Ground Water	19.5	23.7
Existing Permitted Surplus Other Ground Water	0	0
Total Potential Sources	19.5	23.7
Surplus or Deficit	2.6	0.2
Water Conservation	11.8	11.8
Reclaimed Water	5.9	5.9
Remaining Surplus or Deficit	15.1	17.9
Demand projections include public supply, domestic self-supply and private irrigation wells.		

Table 5-6.
Summary of additional public supply water needs and potential sources from 2000 to 2025 for Highlands County.

Additional Public Supply Water Needs and Potential Sources, 2000 to 2025 Highlands County in the SWUCA (mgd)		
	Average Conditions	Drought Conditions
Public Supply Additional Need	4.6	4.9
Potential Sources:		
Existing Permitted Surplus Surface Water	0	0
Existing Permitted Surplus Floridan Ground Water	3.3	3.9
Existing Permitted Surplus Other Ground Water	0	0
Total Potential Sources	3.3	3.9
Surplus or Deficit	1.3	1.0
Water Conservation	2.1	2.1
Reclaimed Water	1.7	1.7
Remaining Surplus or Deficit	2.5	2.8
Demand projections include public supply, domestic self-supply and private irrigation wells.		

Table 5-7.
Summary of additional public supply water needs and potential sources from 2000 to 2025 for Hardee County.

Additional Public Supply Water Needs and Potential Sources, 2000 to 2025 Hardee County in the SWUCA (mgd)		
	Average Conditions	Drought Conditions
Public Supply Additional Need	0.6	0.6
Potential Sources:		
Existing Permitted Surplus Surface Water	0.0	0.0
Existing Permitted Surplus Floridan Ground Water	0.2	0.3
Existing Permitted Surplus Other Ground Water	0.0	0.0
Total Potential Sources	0.2	0.3
Surplus or Deficit	0.4	0.3
Water Conservation	0.2	0.2
Reclaimed Water	0.7	0.7
Remaining Surplus or Deficit	0.5	0.6
Demand projections include public supply, domestic self-supply and private irrigation wells.		

Table 5-8.
Additional needs and potential sources, demand management and resource restoration options.

Additional Total Water Needs and Potential Sources, 2000 to 2025 SWUCA Totals (mgd)		
	Average Conditions	Drought Conditions
Additional Need	181.7*	193.7*
Potential Sources:		
Existing Public Supply Permitted Surplus Surface Water	36.7	36.7
Existing Public Supply Permitted Surplus Floridan Ground Water	24.0	29.1
Existing Public Supply Permitted Surplus Other Ground Water	1.6	2.6
Public Supply Conservation	42.0	42.0
Reclaimed Water Offset	36.2	36.2
Non-Public Supply Conservation (Includes all FARMS Projects)	61.0	61.0
Alternative Potable Supplies Under Construction or Design	5.0	5.0
Groundwater Quantities Available as Land-Use Transitions Occur	74.1	95.6
Groundwater Quantities Available as Lands Acquired for Conservation	10	10
Surficial and Intermediate Aquifers	35	35
Total Potential Sources	325.6	353.2
Surplus or Deficit	143.9	159.5
Additional Solutions: Alternative Supplies, Additional Demand Management, Additional Reclaimed Water, Cumulative Impact Analysis and Net Benefit		

* Note – does not include projected decreases.

Section Six
Water Conservation

Water conservation involves the planning, design and implementation of activities that reduce the amount of water consumed for a given task. A common misconception is that conservation is associated with a sacrifice. However, conservation simply involves managing demands so that water is used more efficiently to produce the same or better quality product or service. Implementing water conservation is appropriate for all types of water users. For purposes of this Recovery Strategy, the use of reclaimed water in lieu of potable quality water for nonpotable purposes in the SWUCA is considered water conservation. In addition, the efficient use, or conservation, of all water resources results in a source of water supply made available to help meet consumptive and ecological needs. As discussed in the previous section, the Recovery Strategy identifies a total potential savings of up to 103 mgd (surface and ground water) through the year 2025 attributable to conservation and reclaimed water projects in the SWUCA.

Reclaimed Water Projects

Simply defined, reclaimed water is wastewater that has been highly treated and is effectively used to meet reasonable and beneficial needs. The objective of the District's reclaimed water (reuse) initiative in the SWUCA is to expand the use of reclaimed water for appropriate purposes such as irrigation for residential landscaping, golf courses, crops, and industrial cooling and processing in order to reduce the use of ground water and surface water for nonpotable purposes. One way to increase utilization is to store excess reclaimed water, currently disposed of in the wet season, in coastal aquifer storage and recovery (ASR) systems for use in the dry season, or to utilize the reclaimed water for environmental restoration. The District is working with public and private sector cooperators to develop the various components of reclaimed water systems including transmission and distribution lines, storage tanks and ponds, and reclaimed water ASR systems. The use of meters and appropriate volume-based rate structures are encouraged as part of the District's reclaimed water partnerships with cooperators.

Since 1991, the District's Basin Boards in the SWUCA and the Governing Board have assisted in the funding of numerous cooperative reclaimed water projects. The District has contributed up to 50 percent of the total project costs for these projects. Table 6-1 lists the reclaimed water projects in the SWUCA that have been completed since 2000, are ongoing, or are planned with secured or pledged funding. The water that will be made available and the offset of traditional supplies achieved by each project are also listed. As shown, these reclaimed water projects will utilize approximately 79.3 mgd of reclaimed water to offset approximately 50 mgd of traditional supplies. This results in a cost of approximately $3.2 million per mgd for the 50 mgd offset. As can be seen from the information in Table 6-1, there is a wide variation in the cost per thousand gallons of reclaimed water projects. This variation is due to the unique characteristics of each project, including the nature of the infrastructure being constructed (e.g., transmission lines, above ground storage, ASR, etc.) and the nature of the end use of the reclaimed water (urban, agricultural or industrial users, etc.). In addition to the types of reclaimed water projects the District has traditionally funded, as reflected in Table 6-1, groundwater recharge and indirect potable reuse projects will also be considered in the future where they prove to be technically, economically and environmentally feasible and where there is a willing local cooperator.

A good example of a cooperator who is successfully developing its reclaimed water resources as a means to offset potable demands in the SWUCA is Sarasota County. The county has been developing its reclaimed water system since the early 1990s and its current system has a capacity of 10.7 mgd and a reuse flow of 5.6 mgd. The county and the District have funded nine reuse projects, eight of which are now complete, at a total cost of over $18 million that will, at build-out, result in an additional 7.4 mgd of reuse flow and 5.9 mgd in offset. The Manasota Basin Board and Governing Board have budgeted more than $7.5 million in support of the county's reuse system through FY2004. The county aggressively acquired franchised wastewater treatment facilities and developed a Northern Regional Reuse System consisting of the four interconnected county wastewater treatment facilities and associated reuse distribution infrastructure, and an interconnection with the reuse system of the city of Sarasota. The county's Southern Regional Reuse System consists of the distribution systems associated with two interconnected county wastewater treatment facilities, plus an interconnection with the city of Venice's reuse system. The connections within its own system, plus the interconnections with other systems, allow Sarasota County to direct reclaimed water flows from areas of low demand to areas of high demand at times when the resource is needed most. Sarasota County is also aggressively pursuing the development of seasonal storage of reclaimed water using ASR technology. Finally, Sarasota County has enhanced the efficiency of reclaimed water use through a volume-based rate structure, subjecting its use for lawn irrigation to watering restrictions and by prioritizing industrial and commercial users who can achieve 100 percent offset of traditional supplies to be supplied with reclaimed water. The county's system maximizes the beneficial use of reclaimed water, and together with using the resource efficiently, illustrates the overall goal of the District and its cooperators.

Demand Management

The District has a comprehensive demand management program in place in the SWUCA that has been effective at reducing water demand for agricultural, public supply, industrial and recreational uses. The District generally employs a combination of three approaches to water conservation: (1) educational efforts involving a variety of media, (2) requirements such as those associated with water use permits and water shortage and conservation rules (i.e., water restrictions), and (3) incentives in the form of technical and financial assistance. The following is a description of the District's demand management efforts in the SWUCA, addressed according to water use sectors.

Public Supply, Industrial, Commercial and Institutional Demand Management

The District routinely offers technical assistance in developing regional and local conservation programs and has developed tools such as model plumbing and landscape codes and a comprehensive water conservation information web site. The District participates in research to address the determination and measurement of water savings and the investigation of various methods for demand management. Since 1991, the District has assisted in the funding of cooperative demand management programs focusing on residential, industrial, commercial and institutional water use. Partnerships with public and private water suppliers are among the common arrangements to provide incentives for conservation. In addition, the District's Industrial Advisory Committee proposed that District staff work with the Florida Institute of Phosphate Research to investigate opportunities for the phosphate industry — specifically, to investigate the potential for reusing and/or recycling cooling tower water. That project and others are listed in Table 6-2, which illustrates the residential, industrial, commercial and institutional demand management cooperative funding projects in the SWUCA that have either been completed since 2000, are ongoing or are planned with secured or pledged funding and summarizes the water savings that will be achieved by each project. The average cost of conserved water for these projects is approximately $1.4 million per mgd.

Agricultural Demand Management
The District has numerous ongoing agricultural demand management initiatives designed to increase the water use efficiency of agricultural operations. Many of these efforts are focused in the upper Myakka, and Shell, Prairie and Joshua Creek (SPJC) watersheds, where agricultural operations are contributing to water quality and quantity problems. In the upper Myakka watershed, the District is working with Pacific Tomato Growers (PTG) and Falkner Farms to make use of excess surface water in the Flatford Swamp to replace ground water used to irrigate row crops. In the SPJC watersheds, the District is working with numerous growers to backplug wells that access poor quality water and to recover and reuse tailwater to prevent it from running off-site into streams used for potable water supply. The backplugging effort, although largely a water quality effort, could potentially result in reduced groundwater withdrawals. Another significant component of the District's efforts to enhance agricultural water use efficiency is the funding of technology and best management practices (BMPs) research for farm irrigation and management. Research projects are often conducted by the Institute of Food and Agricultural Sciences (IFAS) at the University of Florida and are aimed at methods and technologies that can enhance water use efficiency. The results are generally published and may be used by all who could benefit from them, including growers and other water management districts. In addition, the District has an agreement with the U.S. Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS) for an Agricultural Irrigation Efficiency Evaluation Project using a Mobile Irrigation Laboratory (MIL).

Additional details on these important programs are provided in the following text. Table 6-3 lists the agricultural demand management projects that are being funded partially or completely by the District that have either been completed since 2000, are ongoing or are planned with secured or pledged funding, and summarizes the water savings that will be achieved by each project. The costs of the agriculture demand management projects in Table 6-3 (including only those projects with estimated savings) average $1.2 million per mgd conserved.

Shell, Prairie and Joshua Creek (SPJC) Water Conservation
The District has implemented a number of agricultural demand management initiatives in the SPJC watersheds, located in portions of Charlotte and DeSoto counties, where agricultural operations are contributing to water quality and quantity problems. These initiatives are designed to help growers reduce groundwater withdrawals by increasing the water use efficiency of their operations, while at the same time reducing agricultural impacts to surface water features. The extreme drought of 2001 and below-normal winter temperatures increased agricultural irrigation and cold protection requirements in the SPJC watersheds. Water quality degradation in SPJC appears to coincide with irrigation practices during such drought and freeze protection conditions.

Groundwater quality data collected at the District's Regional Observation and Monitoring Program well sites within the SPJC watersheds indicate that groundwater quality degrades with depth. This condition is naturally occurring, inherent to the region and becomes more significant at depths in excess of 1,000 feet below ground surface. A review of well construction characteristics indicates that the total depths of many agricultural irrigation wells in these watersheds exceed this depth. Sustained or intense pumping of these deep wells can cause severe upconing of lower quality water. This condition is made worse by lower potentiometric water levels experienced during prolonged droughts. Effects of upconing are generally related to the extent and duration of pumping. The District has received complaints of crop damage in the region that appear to be attributable to upconing of highly mineralized water and its use for irrigation.

To help address this issue, the District implemented a well backplugging program in the SPJC watersheds. The intent of the program is to assist agricultural operations to reduce their contributions to water quality and quantity problems with the SPJC area. The backplugging program can also potentially result in water savings, depending upon the irrigation practices of the grower subsequent to backplugging. Use of highly mineralized water prior to backplugging requires supplementary irrigation to occur more frequently. The backplugging program may assist growers to reduce groundwater withdrawals by improving water quality, thereby reducing the frequency and amount of supplemental irrigation. The District is monitoring the effects of the backplugging program as to its ultimate effects on groundwater withdrawals.

Backplugging will also help sustain surface water resources for public supplies. The city of Punta Gorda's surface water reservoir receives water from the SPJC watersheds and has been impacted by the contributions of poor-quality water from agricultural irrigation runoff. A notable improvement in water quality has been achieved in wells that have been backplugged to date. Initial results have shown an average of 68 percent improvement in water quality in the wells that have been backplugged.

Upper Myakka-Flatford Swamp Alternative Supply Development

Flatford Swamp is located within the upper Myakka River watershed in portions of Manatee and Sarasota counties. According to a 1998 District study, excess water has resulted in abnormal tree stress and mortality in Flatford Swamp. Most of the damage is within the swamp, although effects are found to the north and south of the swamp's boundaries. The study determined that excess water in the system was the primary cause of the stressed and dying trees. In addition, the study determined the source of this excess water was ground water being used for irrigation purposes by farms in the watershed.

In recent years, flows during the typical dry season have increased. The continuous presence of water, without a springtime drying-out period, is fatal to many trees. Due to the topography of this region, irrigation water gradually seeps through the water table into the swamp.

The District approached the agricultural community for innovative ways to reduce the amount of water entering Flatford Swamp so that normal hydroperiods can be restored to reverse the abnormal tree stress and mortality. As a result of this effort, partnerships with Falkner Farms and Pacific Tomato Growers were established. These projects are designed to capture and reuse subsurface seepage to provide supplemental irrigation. These capture systems will offset groundwater pumping allocations for these project sites. The funding for these projects was matched between each cooperator and the District (Table 6-3).

Facilitating Agricultural Resource Management Systems (FARMS) Program

The Facilitating Agricultural Resource Management Systems (FARMS) program is an agricultural best management practice (BMP) cost-share reimbursement program that involves both water quantity and water quality aspects. It is intended to expedite the implementation of production-scale agricultural BMPs that will provide water resource benefits. The FARMS program is a public/private partnership developed by the District and the Florida Department of Agriculture and Consumer Services (FDACS). The purpose of the FARMS initiative is to implement agricultural BMPs that will provide resource benefits that include water quality improvement; reduced upper Floridan aquifer withdrawals; and/or the conservation, restoration or augmentation of the area's water resources and ecology. FARMS is also intended to assist in implementation of the District's Regional Water Supply Plan. In addition, FARMS is designed to serve as an incentive to the agricultural community within the SWUCA to install and maintain irrigation BMPs that promote alternative sources, while reducing groundwater withdrawals. The program has two resource priority areas: the Shell, Prairie and Joshua Creek watersheds and the upper Myakka River watershed.

Financial contributions from the District and FDACS, in combination with state appropriations received in FY2003 and FY2005, amounts to $4,840,600 of cost-share monies available to growers through FY2005. Existing BMP cost-share mechanisms require that monies supplied by FDACS be used first, prior to using state appropriations. In addition, both of these sources must be used prior to District funds. Currently, there are eight ongoing FARMS projects and eight more projects are proposed for FY05. The annual number of FARMS projects is expected to increase as the program is fully staffed.

Overall, current FARMS projects are expected to achieve an average groundwater savings of 0.4 mgd. If it is conservatively projected that future projects will achieve half of this amount, or about 0.2 mgd, coupled with an objective of undertaking up to 20 projects per year over a 10-year time frame, the total program groundwater savings could approach 40 mgd. Capital costs for future projects are estimated at $400,000 per project, for a total capital cost of $8 million per year, with the District's portion of these costs being $4 million per year. However, future District funding amounts will be contingent on future state, and/or federal, appropriations.

Mobile Irrigation Laboratory

The Mobile Irrigation Laboratory is an ongoing District project that started in 1987. The USDA-NRCS, formerly known as the USDA-SCS, operates the laboratory to evaluate the efficiencies of agricultural irrigation systems and help growers implement practices to better manage their water use. In recent years, the project has been revised to help assist the District's resource regulation efforts. When water users are identified that are pumping in excess of their permitted water use quantities, the staff is available to assist and make recommendations to help reduce their water use. By not continuing to exceed their permitted quantities, enforcement is avoided and resources are saved.

Data collected by the laboratory staff is provided to the District and the grower. This information provides staff with an insight into agricultural irrigation. The USDA-NRCS uses the data to develop an irrigation schedule for the grower. This schedule is a good tool for efficient and effective agricultural water use that results in water conservation. Since the project began, over 1,000 systems have been evaluated. The public and the agricultural community in particular have given a great deal of positive feedback concerning the usefulness of this project.

The current agreement with USDA-NRCS will continue the program through September 2007, with a total funding of $118,000. At the end of FY2005, approximately $36,000 remained available to continue the program.

Table 6-1.
Reclaimed Water Projects: Completed Since 2000, Ongoing or Planned With Secured or Pledged Funding.

Project	To Date [1]			At Build-Out [2]	
	District Funding	Cooperator Funding	Total Project Cost	Additional Water Supply (mgd)	Total Traditional Supplies Offset
Arcadia System Expansion (K889)	$300,000	$300,000	$600,000	0.40	0.30
Auburndale Trans & Pump (K081)	$443,310	$443,310	$886,620	2.00	2.00
Aqua Utilities Reuse (L522)	$209,471	$154,829	$364,300	2.00	1.57
Braden River Utilities Phase 2, 3 & 5 (K594)	$200,000	$200,000	$400,000	0.45	0.27
Braden River Utilities Trans/Pump (K264)	$199,975	$199,975	$399,500	1.30	1.30
Braden River Utilities Trans/Pump/Storage (K488)	$188,115	$188,115	$376,030	0.70	0.70
Bradenton Reuse Exp. (K262)	$2,385,000	$2,385,000	$4,770,000	4.80	3.60
Bradenton Reuse Exp Feas. (L515)	$30,000	$30,000	$60,000	0.00	0.00
Charlotte Co. G.C. (L485)	$655,000	$655,000	$1,310,000	0.89	0.58
Charlotte Co. Regional Exp. (H027)	$1,643,250	$2,699,250	$5,799,000	0.83	0.62
Charlotte Co. Victoria Est's. (K892)	$102,000	$102,000	$204,000	0.31	0.23
Charlotte Co. W. Port Reg.(K891)	$449,000	$449,000	$898,000	0.40	0.30
Charlotte County Rotunda Reclaimed Water ASR (L215)	$435,000	$435,000	$870,000	0.00	0.00
Dundee Reuse System REDI (L553)	$3,013,774	$1,004,000	$4,017,774	0.83	0.42
Desoto Correctional Reuse Feas. (L491)	$37,500	$12,500	$50,000	0.00	0.00
Englewood Lemon Bay Reuse (L028)	$150,000	$150,000	$300,000	0.11	0.08
Englewood Reuse ASR (K257) [3]	$460,000	$460,000	$920,000	0.00	0.00
Englewood Trans. Line (K910)	$450,000	$450,000	$900,000	0.40	0.30
Hills. Co. Trans/Pump (F003)	$2,625,000	$3,964,463	$6,589,263	8.00	6.00
Hills. Co So. Central Reuse ASR (K509) [3]	$500,000	$500,000	$1,000,000	0.00	0.00
Hills. Co. Central Coastal Recl. ASR (H010) [3]	$500,000	$1,000,000	$1,500,000	0.00	0.00
Hillsborough Co. South Hills. Area Reuse Exchange SHARE (H308)	$8,800,000	$8,800,000	$17,600,000	4.20	2.10
Hillsborough Co. South Hills. Area Reuse Project SHARP (H309)	$7,500,000	$7,500,000	$15,000,000	10.00	4.00
Hills. Co. Lithia-Pinecrest (L294)	$1,800,000	$2,700,000	$4,500,000	3.50	1.80
Lake Placid Reuse (L153)	$962,574	$411,626	$1,374,200	0.10	0.06
Lake Wales Reuse Project (P727)	$2,092,000	$3,778,000	$5,870,000	1.00	0.75
Manatee Co Ag Reuse Supply MARS (F014) [4]	$11,980,970	$18,840,970	$37,670,000	20.00	12.00
Manatee Co. Recl. ASR (F007) [3]	$325,000	$325,000	$650,000	0.00	0.00
Manatee County Millbrook Subdivision Reuse (L201)	$89,500	$89,500	$179,000	0.11	0.05
Manatee County Storage Studies (L006)	$200,000	$200,000	$400,000	0.00	0.00
Palmetto ASR Feasibility & Exploratory Well (L229)	$90,000	$90,000	$180,000	0.00	0.00
Polk Co. Storage NERRSE (L475)	$1,940,303	$1,940,303	$3,880,606	0.00	0.00
Polk Co. NE Reuse (K300)	$2,407,867	$2,407,867	$4,815,734	2.08	1.20
Polk Co. Pump/Storage/Tel. (H029)	$850,250	$850,250	$1,700,500	0.00	0.00
Polk Co. Regional Reuse (F035)	$985,750	$985,750	$1,971,500	1.10	0.45
Polk Co. SW Reg. Reuse (H028)	$1,086,750	$1,086,750	$2,173,500	0.00	0.00
Polk Co. Trans/Pump (P563)	$531,566	$531,566	$1,063,132	1.00	0.60
Polk Co. Trans/Pump/Storage (K079)	$1,434,040	$1,434,040	$2,868,080	1.00	0.60
Sarasota Co. N. Recl. ASR (K269) [3]	$1,445,000	$1,515,000	$3,030,000	0.00	0.00
Sarasota Co Trans (K002)	$414,500	$414,500	$829,000	0.36	0.25
Sarasota Co. S. System (FA24)	$1,110,000	$1,110,000	$2,220,000	0.60	0.36
Sarasota Co. Trans (F022)	$1,118,500	$1,118,500	$2,237,000	1.10	0.66

Table 6-1. (Continued)

Project	To Date [1] District Funding	To Date [1] Cooperator Funding	To Date [1] Total Project Cost	At Build-Out [2] Additional Water Supply (mgd)	At Build-Out [2] Total Traditional Supplies Offset
Sarasota Co. Payne Pk (L500)	$375,000	$250,000	$625,000	0.10	0.10
Sarasota Co ASR/UV (L527) [3]	$1,710,030	$1,703,516	$3,413,546	0.00	0.00
Tropicana (K130)	$150,000	$150,000	$300,000	0.79	0.79
Venice Golf and Country Club Stormwater Reuse (L213)	$81,245	$81,245	$162,490	0.45	0.34
Venice Reuse (K006)	$1,181,019	$1,181,020	$2,362,039	1.80	0.90
Venice S. Sarasota System (FB24)	$813,400	$813,400	$1,626,800	2.70	1.60
WateReuse Study of RO, AOP & UV on Reuse (L112)	$275,000	$225,000	$500,000	0.00	0.00
WateReuse Reclaimed Water ASR Study (P175)	$100,000	$293,000	$393,000	0.00	0.00
WateReuse Reclaimed Water Economics Study (P174)	$100,000	$100,000	$200,000	0.00	0.00
WateReuse Reclaimed Water Pathogen Study (P173)	$50,000	$166,000	$216,000	0.00	0.00
WateReuse Study of Reclaimed Water Quality (P872)	$245,000	$225,000	$470,000	0.00	0.00
Wauchula Mine Reuse (K430)	$2,294,000	$3,060,000	$5,354,000	0.95	0.95
Winter Haven Reuse Master Plan (L483)	$50,000	$50,000	$100,000	0.00	0.00
Winter Haven Trans & Pump (P366)	$65,000	$65,000	$130,000	0.14	0.10
Total	**$71,698,879**	**$82,470,465**	**$162,543,054**	**79.30**	**50.03**

[1] "To Date" is the project's funding that is currently budgeted and pledged by the Cooperator and District.

[2] "Build-Out" is the total cost of the project and the total reuse water flow and offset that will result within three years of the project's completion.

[3] Flow and offsets for reclaimed water ASR projects are calculated for 100-day storage, at 75 percent recovery rate, with offset determined by customer type.

[4] Cooperator funding includes $6,860,000 of federal EPA grant money.

Table 6-2.
Public Supply, Industrial, Commercial and Institutional Demand Management Projects: Completed Since 2000, Ongoing or Planned With Secured or Pledged Funding.

Project	To Date [1]			At Build-Out [2]
	District Funding	Cooperator Funding	Total Project Cost	Est. Water Conserved (mgd)
Sarasota Co. Showerhead Exchange	$7,980	$16,020	$24,000	0.33
City of Sarasota Toilet Rebate	$62,973	$237,027	$300,000	0.0385
Polk County Toilet Rebate	$50,000	$50,000	$100,000	0.00943
FIPR Feasibility Study: ICI Water Conserving Technology	$23,000	$23,000	$46,000	Research
Landscape Education Coordination Initiative	$40,000	$0	$40,000	TBD
Longboat Key Water Wise Irrigation Program	$10,000	$10,000	$20,000	TBD
Total	**$193,953**	**$336,047**	**$530,000**	**0.37**

[1] "To Date" is the project's funding that is currently budgeted and pledged by the Cooperator and District.
[2] "Build-Out" is the total cost of the project that will result upon the project's completion.

Table 6-3.
Agricultural Demand Management Projects: Completed Since 2000, Ongoing or Planned With Secured or Pledged Funding.

Project	To Date [1]			At Build-Out [2]
	District Funding	Cooperator Funding	Total Project Cost	Est. Water Conserved (mgd)
Alt. Treatment of Bare-Rooted Strawberry Transplants	$90,000	N/A	$90,000	Research
Characterizing Nitrogen Fertilizer Usage and Leaching in Fresh Market Tomato Fields of the Palmetto-Ruskin Agricultural Area	$120,000	N/A	$120,000	Research
Citrus Water Mgmt. Training	$24,000	N/A	$24,000	Research
Cold/Chill Protection of Tropical Plants in the Nursery	$160,020	N/A	$160,020	Research
Crop Coef. / Water Use for Watermelons	$130,000	N/A	$130,000	Research
Determination of Citrus Leaf Freezing Temperatures	$16,000	N/A	$16,000	Research
Determining Water Requirements for Landscape Plant Establishment	$250,000	$750,000	$1,000,000	Research
Determining Reasonableness of District Amounts for Micro Irrigated Ridge Citrus in Highlands County	$30,000	N/A	$30,000	Research
Determine Total Water Budget and Irrigation Requirements For Mature Southern Highbush Blueberries Grown on Pine bark	$153,000	N/A	$153,000	Research
Determining Water Use During Production of Select Tropical Foliage Plants	$60,000	N/A	$60,000	Research
Development of Irrigation Schedules/Crop Coef. for Trees	$70,000	$70,000	$140,000	Research
Development of Irr Schedule & Crop Coef. For Trees (Seedlings to 5" Calipers) Phase II	$98,750	N/A	$98,750	
Effective Rainfall of Ridge Citrus	$105,000	N/A	$105,000	Research
Effects of Micro-Sprinkler Irrigation on Citrus Irrigation	$99,500	N/A	$99,500	Research
Enhancing Irrigation & Nutrient BMPs for Seepage Irrigation	$90,000	N/A	$90,000	Research
Evaluation & Demonstration of Soil Moisture Based On-demand Irrigation Controllers For Vegetable Production	$142,900	N/A	$142,900	Research/Education
Evaluating Low Cost Irrigation Mgmt. Devices	$85,000	N/A	$85,000	Research
Evaluation & Development of an ET Reference	$99,900	N/A	$99,900	Research
Falkner Farms Surface Water Withdrawal Project [3]	$1,569,300	$2,767,747	$4,337,047	2.1
FARMS Projects [4, 5, 6]	$224,000	$3,819,400	$4,043,400	4
FAWN Data Dissemination/Education	$45,000	N/A	$45,000	Education
FAWN Data Dissemination/Education	$125,000	N/A	$125,000	Education
Field Evaluation of Bahiadwaft, For Water Use Efficiency, Turf Quality, Mowing Requirements and Persistence	$157,500	N/A	$157,500	Research
Impact of Organic Amendments on Soil Water Retention & Cons.	$175,000	N/A	$175,000	Research
Investigation & Developing Methods to Determine Urban Landscape Irrigation for Planning and Permitting in Central Florida	$20,000	N/A	$20,000	Research
Mobile Irrigation Laboratory	$93,000	$25,000	$118,000	NA
Protecting Water Quality through the Use of Effective Water & Nutrient Management Practices for Strawberry Production	$75,000	$487,000	$562,000	Research

Table 6-3. (Continued)

Project	To Date [1] District Funding	Cooperator Funding	Total Project Cost	At Build-Out [2] Est. Water Conserved (mgd)
Reclaimed Water for Irrigation of Container-Grown Plants	$89,000	N/A	$89,000	Research
Reduce Winter/Fall Citrus Irrigation	$125,000	N/A	$125,000	Research
Sod Irrigation On-Farm Demo	$36,000	N/A	$36,000	Research
Strawberry Irrig / Nutrient Mgmt	$75,000	N/A	$75,000	Research
Tailwater Recovery	$135,000	N/A	$135,000	Research
Water Requirements for Estab Plastic Mulched Crops	$60,000	N/A	$60,000	Research
Workshops on Frost/Freeze Protection for Ornamentals & Vegetables	$16,500	N/A	$16,500	Research
Total	**$5,409,370**	**$8,915,871**	**$14,325,241**	**8.6**

[1] "To Date" is the project's funding that is currently budgeted and pledged by the Cooperator and District.

[2] "Build-Out" is the total cost of the project that will result upon the project's completion.

[3] Reflects actual costs incurred to-date and projected costs of phase 2.

[4] Includes FY05 funding for projects anticipated to be approved by Basin and Governing Boards.

[5] Cooperator Funding reflects funds obtained from state agencies and contributions from individual farmers. Contributions from individual farmers are expected to range from 25–50 percent of total project costs.

[6] Savings indicated are only a portion of total project savings; the total will be determined as projects are developed.

Section Seven
Storage, Flows and Ecosystem Protection/Restoration Projects

Section Four, "SWUCA Recovery Strategy," identified the development and implementation of water resource development projects as one of the five elements to achieve recovery of minimum flows in the upper Peace River and recovery of lake levels within the Ridge area. Projects targeting the upper Peace River focus on restoring historically lost lake and floodplain storage to aid in reestablishing minimum flows to rivers and enhanced recharge. The concept is to store wet-weather flows for release during low-flow periods. Storage will be achieved in a number of ways, including the raising of structures on lakes, restoring old mined lands and wetland systems that have been drained, and the utilization of abandoned clay settling areas. These are all realistic opportunities currently being explored. It is only through the combination of many of these type projects that significant flows can be generated to meet minimum flows.

Projects providing recovery of lake levels along the Ridge area will be more localized to the specific targeted lake. Structure modification (inflow and outflow), contributing drainage system restoration, backplugging of canals and augmentation are all project possibilities.

As projects are implemented and begin to restore the aquifer, river and lake levels, the associated water resources will see significant recovery. Safeguards must be put in place to ensure that water restored as a result of these projects is not allocated through the water use permitting process. Reservation of water generated through restoration projects is contemplated under Chapter 373, Florida Statutes, and must be part of project implementation.

Reservations
Chapter 373, Florida Statutes, contains provisions for the "reservation" of water resources. Section 373.223, Conditions for a permit, paragraph (4) states: "*The governing board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety. Such reservations shall be subject to periodic review and revision in the light of changed conditions. However, all presently existing legal uses of water shall be protected so long as such use is not contrary to the public interest.*" The District intends to utilize these statutory reservation provisions in conjunction with certain water resource development projects that are components of the Recovery Strategy. For instance, water associated with upper Peace River recovery projects that store high flows for release during low-flow conditions will be reserved from permitting by rule.

Peace River Watershed:
Over the past 150 years, there have been substantial changes to the Peace River watershed. These changes have included clearing, draining, recontouring and mining of lands for purposes of residential and commercial development, transportation, agriculture, recreation, timbering, power generation, ore and mineral extraction, and other land uses. These uses have required extensive drainage and alteration of surficial land features accompanied by hydrologic impacts. At the same time, significant withdrawals of ground and surface waters within and adjacent to the watershed have occurred. All these activities have cumulatively

resulted in significant changes to the hydrology and ecosystems of the watershed. The projects described in this section will restore significant basin storage, resulting in enhanced aquifer recharge and longer duration river flows. Currently under consideration are projects that could provide nearly 50 mgd of additional outflow from increased storage. The present estimated cost of these projects is over $100 million.

One of the projects assesses the hydrologic connection between the Peace River and the underlying aquifer and determines the flow loss to karst openings within or adjacent to the riverbed. The project will evaluate the potential installation of flow restriction barriers to reduce gravity drainage to the underlying aquifers during low-flow conditions. The return of historical storage will also make possible significant lakeshore ecosystem restoration. These projects are a critical component of the District's SWUCA Recovery Strategy in that they provide a cost-effective approach to aid in the restoration of minimum flows to the upper Peace River and allow ground water to continue to meet the significant urban, agricultural and industrial water needs of the area.

These projects will also contribute to the restoration and preservation of flows to Charlotte Harbor, an estuary included in the National Estuary Program. One project also provides for the construction of a regional water quality treatment system to remove much of the nutrient and other pollutant load that Lake Hancock and its watershed are contributing to the main stem of the Peace River and to Charlotte Harbor.

Lakes in the Ridge area:

Approximately 130 lakes lie along the 90-mile Ridge area, which extends from the cities of Davenport and Haines City in the northern Ridge to Sebring and Lake Placid to the south. A high number of deep sinkhole basin lakes make this region uniquely different from other lake regions in the District, as well as throughout the state. As focal points of outdoor recreation, many of these lakes have become closely linked to the economies and quality of life of the local towns and communities. Over the past 35 years, surface water elevations at many of these lakes have declined substantially. The changes in lake stage may be attributed to climatic patterns, dynamic geological processes, modification of surface water drainage features, shifts in land use, and water withdrawals. The minimum levels proposed, as described in Section 3, are intended to provide protection for cultural and natural system values of lakes.

The lakes along the Ridge area are threatened by a variety of water quality and quantity impacts. Common impacts include stormwater runoff, wastewater effluent, residential and agricultural fertilizer applications, agricultural runoff, groundwater pollution, shoreline habitat degradation and hydraulic alterations that can affect lake stages. Contained in this section are projects designed to determine the feasibility of achieving minimum levels, as well as a screening procedure that has been developed in order to set priorities for financing future lake management projects.

Lake Hancock Lake Level Modification and Ecosystem Restoration Project

Purpose:
The objective of this project is to restore historical storage, outflow and lakeshore ecosystem of Lake Hancock, a 4,500-acre lake in the headwaters of the Peace River watershed. This restoration will aid in reestablishing perennial flow to the upper Peace River, the primary objective of the proposed minimum flow requirement. This project is also a critical link to a major greenway that extends from Charlotte Harbor, a designated estuary of national significance, through the Peace River watershed and Green Swamp, and further north to the Ocala National Forest.

Need:
This project is one of a series of projects being pursued to meet the proposed minimum flows and levels for the upper Peace River, which are 17 cubic feet per second (cfs) at Bartow, 27 cfs at Fort Meade and 45 cfs at Zolfo Springs. During the 30-year period from 1975 through 2004, flows in the upper Peace River were below the proposed minimum flows at Fort Meade approximately 28 percent of the time. This project, along with other similar projects, will restore significant basin storage, resulting in enhanced aquifer recharge and longer duration of upper Peace River flows. Groundwater withdrawals in the SWUCA have resulted in declines in aquifer levels throughout the SWUCA and contribute to reduced flows in the upper Peace River. This project is a critical component of the District's SWUCA Recovery Strategy in that it provides a cost-effective approach to aid in the restoration of minimum flows to the upper Peace River and allows ground water to continue to meet the significant urban, agricultural and industrial water needs of the area. The return of historical storage in Lake Hancock will make possible significant lakeshore ecosystem restoration. This project will also contribute to the restoration and preservation of flows to Charlotte Harbor, an estuary included in the National Estuary Program.

Description:
The goal of the project is to store water in Lake Hancock by raising the control elevation of the existing outflow structure on the lake from 98.7 feet NGVD up to a target elevation of 100.0 feet NGVD, then slowly release the stored water during the dry season to help meet the low-flow requirements in the upper Peace River. Preliminary results indicate that storing water in Lake Hancock may recover up to 50 percent of the minimum flows for the upper Peace River, which includes accounting for approximately 25 cfs of sink losses within the river, reestablishing perennial flow to the upper Peace River. Once water levels are restored, other projects will be undertaken to reestablish historical lakeshore ecosystems, although some restoration projects are already under way where hydrologic conditions are favorable (e.g., confluence of inflow streams and the lake). Biological indicators and early twentieth century photography indicate that Lake Hancock's mean annual flood elevation was approximately 102 feet above sea level. The lake was lowered via an outfall canal dug in the natural overflow channel. A structure in this outfall canal significantly controls the elevation of the lake, which now fluctuates two or three feet below where it once did. A detailed watershed analytical model to predict the extent of water levels under proposed normal and flooding conditions has been developed to identify lands that would have to be acquired or otherwise compensated. The District purchased the Old Florida Plantation and this property will be used, at least in part, for the Lake Hancock Lake Level Modification project.

The Old Florida Plantation property is a Development of Regional Impact containing approximately 3,346 acres located along the southern and eastern shoreline of Lake Hancock. The property includes approximately 251 acres of lakes, 545 acres of wetlands and approximately 2,700 acres of pasture used to graze cattle. The Development Order of Approval for the Old Florida Plantation authorizes 4,797 residential development units as well as a mixture of retail commercial, office space, a marina, a barn and stable area, a golf course and a public school.

Schedule:

Design and Permitting	2004–2007
Land Acquisition	2002–2007
Construction and Restoration	2008–2010

Potential Funding Sources	Prior Years	FY2006	Future Funding	Totals
SWFWMD	$53,222,000	$300,000	$35,500,000	$89,022,000
Polk County	3,710,000			3,710,000
State Grants	750,000			750,000
Florida DOT Funds	1,000,000			1,000,000
State Surface Water Restoration		300,000		300,000
Totals	$58,682,000	$600,000	$35,500,000	$94,607,000

Note: Portions of SWFWMD funding have and will come from the Preservation 2000 and Florida Forever programs and will be used for land acquisition or easements.

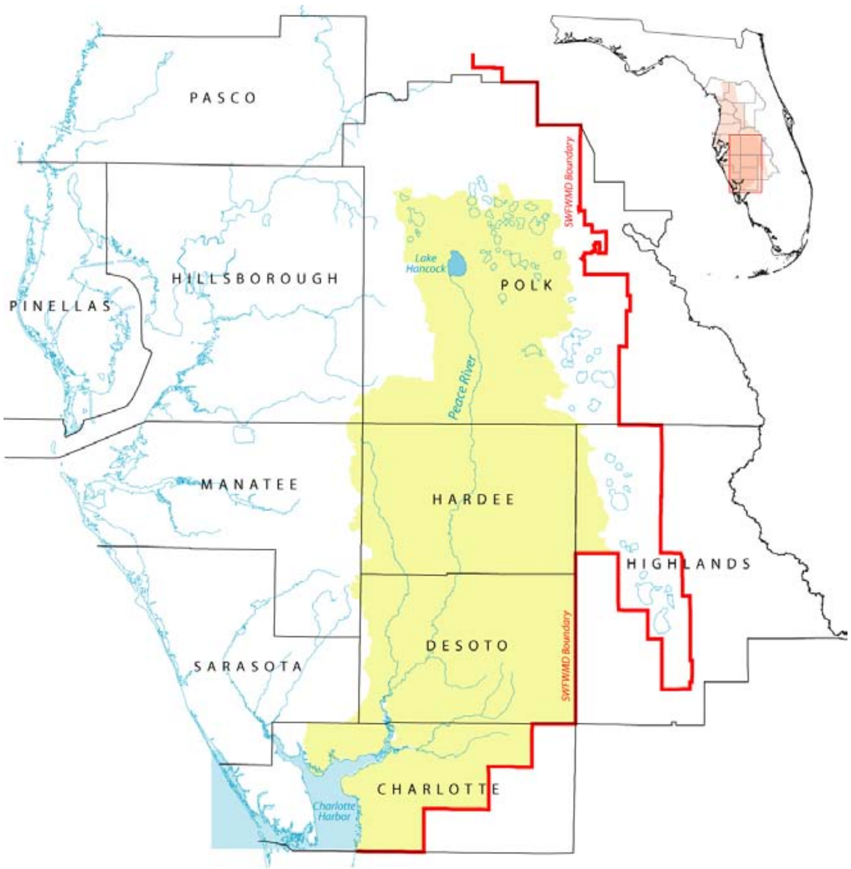


Figure 7-1.
Peace River watershed, including Charlotte Harbor, showing location of Lake Hancock. Lake Hancock is a 4,500-acre lake in the headwaters of the Peace River watershed.

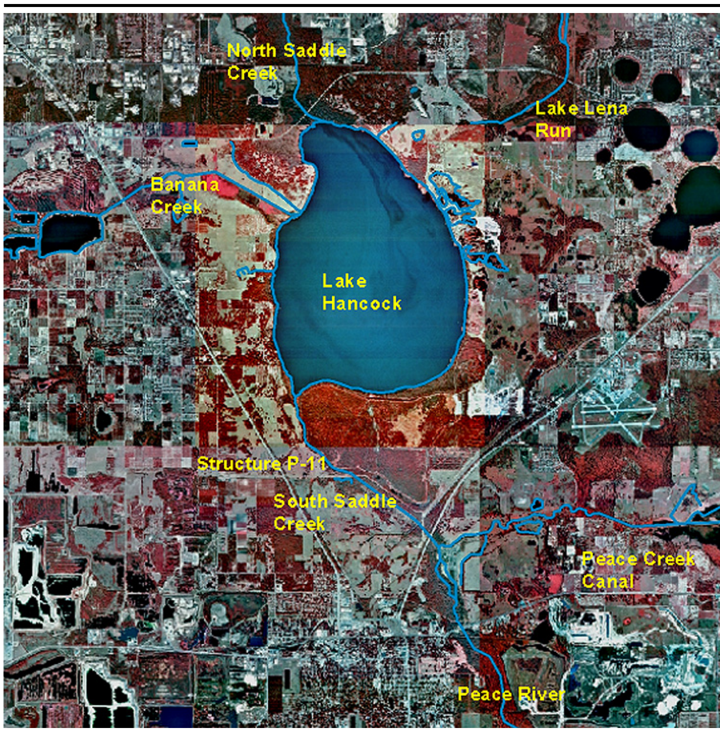


Figure 7-2.
Lake Hancock System. Emphasis of the project is to restore storage, flow and lakeshore ecosystems that were lost in the early twentieth century.

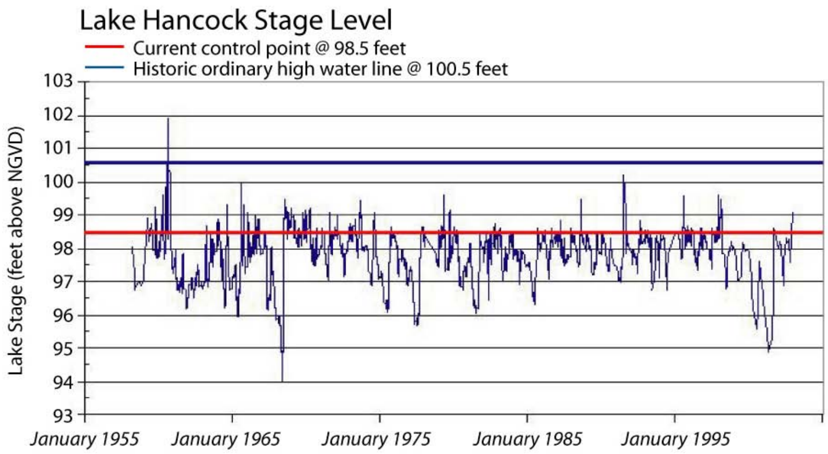


Figure 7-3.
Hydrograph of Lake Hancock illustrating that lake levels have been reduced by about two feet.

Figure 7-4.
Historically, the upper Peace River flowed year-round in all but the driest years.

Figure 7-5.
Excessive groundwater withdrawals and hydrologic alteration from urban, agricultural and industrial development in the upper Peace River watershed have resulted in the river often completely disappearing into sinkholes or not flowing at all.

Peace Creek Restoration via the USDA-NRCS Wetlands Reserve Program

Purpose:
The purpose of this project is to restore hydrology, storage, conveyance, recharge and wetland functions in the Peace Creek Canal and associated floodplain, while enhancing water quality and natural systems. This work will be accomplished through the District's Watershed Management Program in cooperation with other entities. Hydrologic restoration is one of the primary objectives of the minimum flow recovery plan to restore the perennial flow to the upper Peace River. This project is also a critical link to a major greenway that extends from Charlotte Harbor, an estuary included in the National Estuary Program, through the Peace River watershed and Green Swamp, and further north to the Ocala National Forest.

Need:
Over the past 150 years, there have been substantial land alterations in the upper Peace River watershed including clearing, drainage, recontouring and mining. These activities cumulatively resulted in significant changes to the watershed's hydrology and ecosystems. This project is a critical component of the District's SWUCA Recovery Strategy in that it provides a cost-effective approach to restore minimum flows to the upper Peace River and allows ground water to continue to meet the significant urban, agricultural and industrial water needs of the area.

Description:
The project includes the purchase of conservation easements and/or fee interest, evaluation, design, permitting, development of construction documents, construction and initial post-construction monitoring and maintenance necessary for hydrologic restoration in the Peace Creek watershed. Peace Creek is one of nine major tributary watersheds that comprise the Peace River watershed. Agricultural practices, mining and land development, especially during the early twentieth century, significantly contributed to the change of flow patterns, and loss of wetlands, storage and recharge. One major agricultural operation has requested assistance from the USDA-NRCS Wetlands Reserve Program to restore lost hydrologic and ecologic functions in wetlands on their property. The project includes $3.1 million for the purchase of conservation easements and/or fee interests on this property. Once an interest in these lands is acquired, restoration efforts will be undertaken in a manner compatible with continued agricultural operations on parts of their property and maintenance of the restored areas. Restoration will provide valuable habitat for both listed and common wildlife that inhabit or use wetlands for cover, breeding and/or foraging and bring about a return of historic flows and surface water storage capacity within the floodplain. Benefits in both headwaters and downstream areas will be realized in the watershed and in its ultimate outfall — Charlotte Harbor. Enhanced aquifer recharge should occur as extended natural storage is restored. The probable cost of these efforts is in the $10 to $15 million range, with funding leveraged from local, regional, state and federal sources. The project includes $29 million for purchase of conservation easements and/or fee interest, and $10 million for design, permitting and restoration. Several other agricultural operations have expressed an interest in the Wetlands Reserve Program and may request assistance from the USDA-NRCS in future years.

Schedule:

Conservation Easement and/or Fee Interest Acquisition	2002–2008
Restoration Design and Permitting	2005–2008
Restoration Construction	2008–2010

Potential Funding Sources	Prior Years	FY2006	Future Funding	Totals
SWFWMD	$1,387,500	$750,000	TBD	$2,137,500
State Appropriation	250,000	250,000	TBD	500,000
USDA/NRCS WRP Funds	3,100,000	0	TBD	3,100,000
State Surface Water Restoration		125,000		125,000
Totals	**$4,737,000**	**$1,125,000**	**TBD**	**$5,862,500**

Note: Future construction and any operation and maintenance costs are presently unknown.

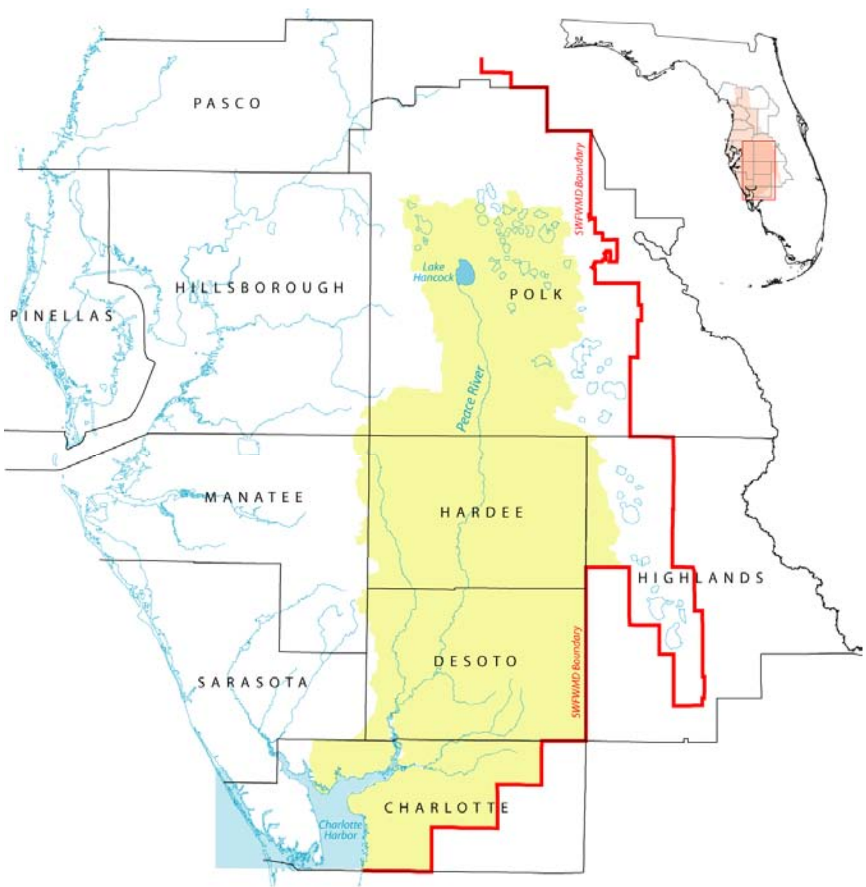


Figure 7-6.
Location map of the Peace River watershed.

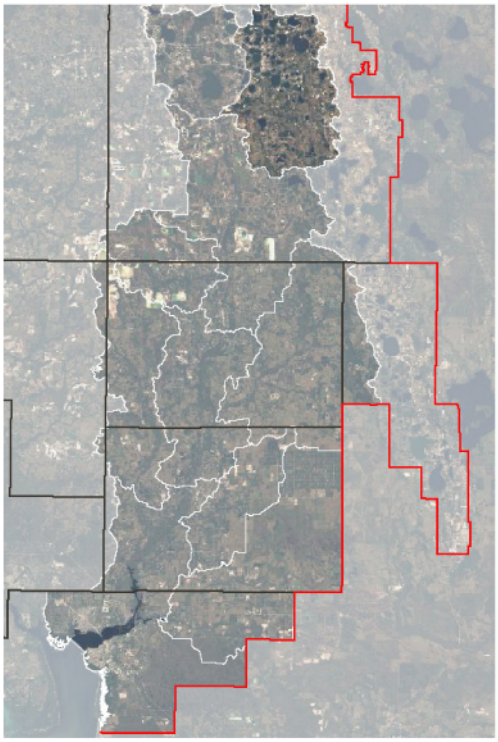


Figure 7-7.
Location of the Peace Creek sub-basin in the Peace River watershed.

Figure 7-8.
Peace Creek Drainage Canal has effectively drained agricultural lands during the past century.

Upper Peace River Resource Development Project

Purpose:
The purpose of the project is to restore storage, flows, water quality and ecosystems in the upper Peace River watershed that have been lost, degraded or significantly altered. The project will also aid in the restoration of flows and water quality within the entire Peace River and Charlotte Harbor, an estuary included in the National Estuary Program, and will enhance a major greenway that extends from Florida's lower west coast through the Peace River watershed and Green Swamp to the Ocala National Forest.

Need:
Over the past 150 years, there have been substantial land alterations in the upper Peace River watershed including clearing, drainage, recontouring and mining. These activities cumulatively resulted in significant changes to the watershed's hydrology and ecosystems. This project is a critical component of the District's SWUCA Recovery Strategy in that it provides a cost-effective approach to restore minimum flows to the upper Peace River and allows ground water to continue to meet the significant urban, agricultural and industrial water needs of the area.

Description:
This project involves the investigation of resource restoration and development opportunities in the upper Peace River watershed that could contribute to restoration of minimum flows. An evaluation of existing and anticipated future watershed conditions will be performed. BMPs will be developed and implemented to meet the minimum desirable flow rates identified by the "Upper Peace River: An Analysis of Minimum Flows and Levels (August 25, 2002)." One option involves evaluating the feasibility of an above-grade surface water impoundment and associated intake and discharge facilities to divert water from the Peace River during periods of high flow, for release back to the river when flows are below the minimum desirable flow rates. Other BMPs that will be evaluated include reconnection of closed basins and areas that have been hydraulically severed through anthropogenic changes in the watershed and the use of mined lands to provide attenuation, improve water quality and enhance infiltration. An alternative analysis including a cost/benefit evaluation of potential BMPs will be performed. Preferred BMPs will be further developed through the implementation process and will require additional funding.

Two previous projects, the Upper Peace River Minimum Flow Enhancement project, and the Old Lands Phosphate project, were initiated in FY2003 to accomplish similar goals. The Upper Peace River Minimum Flow Enhancement project included funding for a feasibility analysis and design and permitting of a surface water reservoir on reclaimed mine land. The District evaluated a reservoir site, located on the east side of the Peace River just south of CR 640 and began the land acquisition process. The property owner rejected the District's offer for purchase, which terminated the efforts for this site. As part of the Old Lands Phosphate project, District staff identified other potential reservoir locations and areas that no longer contribute runoff to the river as a result of mining activities, but potentially could be hydraulically reconnected. Both of these previous projects have been incorporated into the Upper Peace River Resource Development project.

Lidar topographic data has been obtained for the entire upper Peace River watershed. A watershed evaluation has been initiated, which includes the review of permits and approved mine plans to develop data that will be used in the development of a surface water model. Alternative sites for the above-grade impoundment are being evaluated, and preliminary geotechnical testing is being conducted. A Request for Proposals for engineering services for testing, surveying, design and permitting will be developed and advertised once a contract to purchase is executed. Design, permitting and construction of the above-grade impoundment will require additional funding.

Schedule:

Watershed Evaluation	2003–2007
Land Acquisition	2007–2010
Design and Permitting	2007–2010
Construction	2010–2012
Operation and Maintenance	perpetual after 2012

Potential Funding Sources	Prior Years	FY2006	Future Funding	Totals
SWFWMD	$1,057,500	$500,000	$500,000	$2,057,500

Note: Future construction and any operation and maintenance costs are presently unknown.

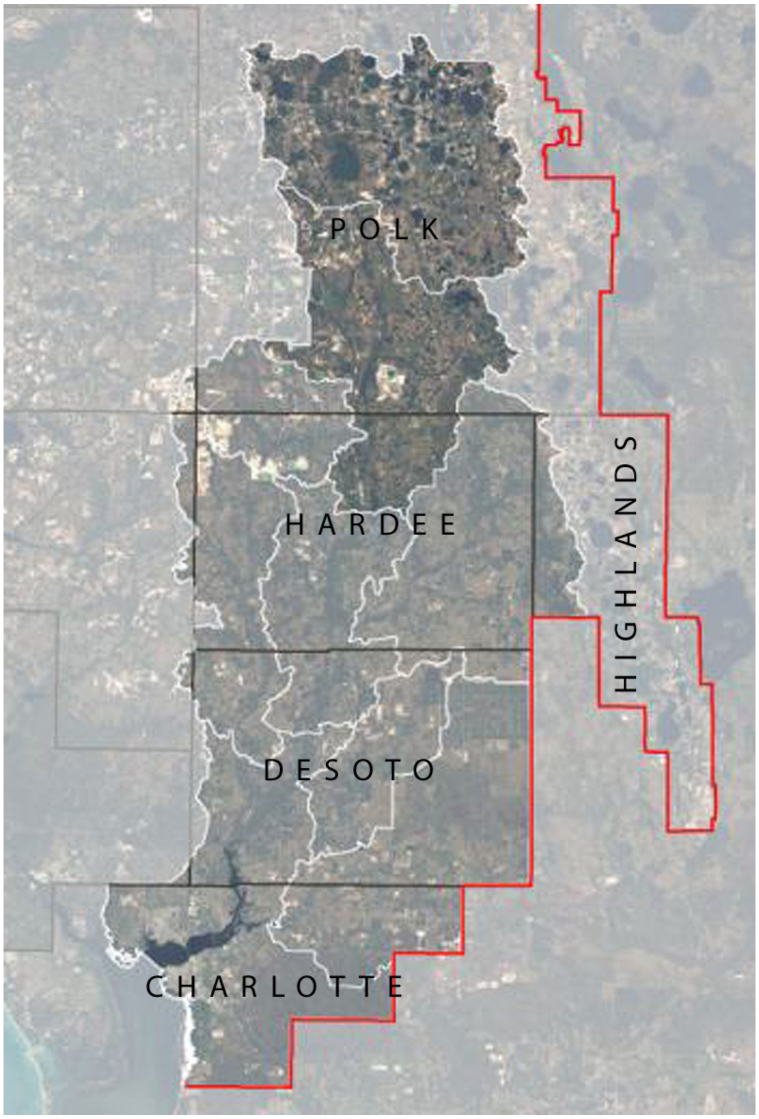


Figure 7-9.
Map of the Peace River watershed with the upper watershed highlighted.

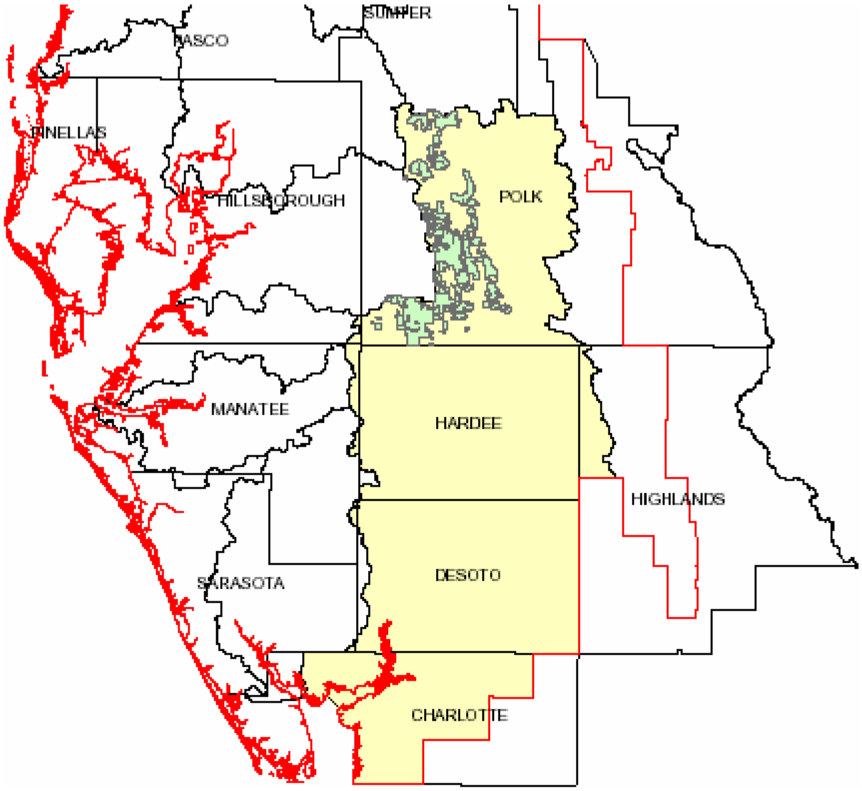


Figure 7-10. Location of phosphate mining Old Lands within the Peace River watershed.

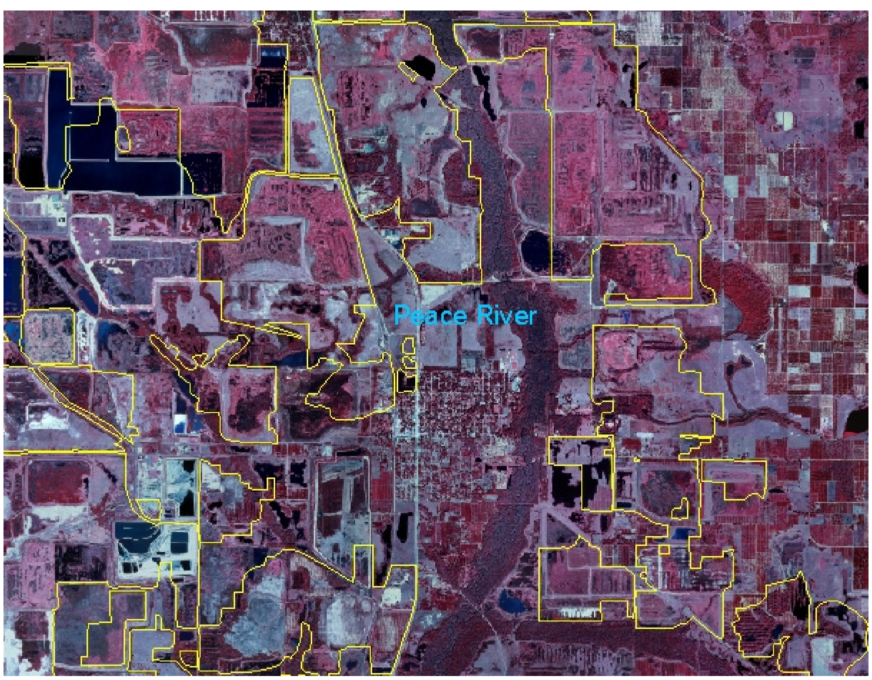


Figure 7-11. Satellite image of phosphate mining Old Lands areas adjacent to the Peace River.

Lake Hancock Water Quality Treatment Project

Purpose:
The purpose of this project is to improve the quality of water discharging from Lake Hancock into South Saddle Creek by constructing a regional water quality treatment system. This treatment system will remove much of the nutrient and other pollution that Lake Hancock and its watershed are contributing to the main stem of the Peace River and Charlotte Harbor, an estuary included in the National Estuary Program.

Need:
Historical data has shown that the Saddle Creek drainage basin, one of nine sub-basins in the Peace River watershed, contributes approximately 6 percent of the total flow of the Peace River, yet contributes approximately 13 percent of the watershed's total annual nitrogen load. Nitrogen has been identified as the primary target nutrient in restoring water quality in the Peace River and preventing degradation of Charlotte Harbor, a Surface Water Improvement and Management priority water body. The Peace River ecosystem routinely suffers from algae blooms during periods of low flows and warm weather. These events not only affect the fish and wildlife associated directly with the river and estuary, but also affect the region's largest potable surface water supply system, operated by the Peace River/Manasota Regional Water Supply Authority. Many of the basins along the Peace River, including Lake Hancock, have been identified by the Florida Department of Environmental Protection as impaired under the Clean Water Act, requiring that Total Maximum Daily Loads be established. Furthermore, nitrogen loads have been predicted to increase significantly over the next 20 years as a result of growth. Water quality treatment of discharges from Lake Hancock has been identified as the most cost-effective means of reducing nitrogen loads into the Peace River and Charlotte Harbor. Additionally, the restoration of the South Saddle Creek ecosystem will enhance a major greenway that extends from Charlotte Harbor through the Peace River watershed and Green Swamp and further north to the Ocala National Forest.

Description:
Discharges from Lake Hancock will be diverted to a water quality treatment system located near the southern end of the lake and in the vicinity of South Saddle Creek, the tributary between the lake and the Peace River. Several treatment technologies are being evaluated including settling ponds, treatment wetlands, chemical coagulation and aquatic plant-based technologies. The District acquired the 3,346-acre Old Florida Plantation property and the 197-acre south Saddle Creek property that may be utilized for the outfall treatment project. Other sites may also be considered. Construction would take place following design and permitting. The selected treatment system will require ongoing operation and maintenance. The total project budget is comprised of $16,185,446 for design, permitting, construction and construction management for the water quality treatment system, and approximately $4.9 million for property acquisition and other compensation to impacted properties or infrastructure.

Schedule:

Monitoring/Feasibility Study	2004–2008
Design and Permitting	2008–2009
Land Acquisition	2003–2006
Construction	2009–2011

Funding Source	Prior Years	FY2006	Future Funding	Totals
SWFWMD	18,335,446		TBD	$18,335,446
State Appropriation	1,100,000	350,000	TBD	1,450,000
Federal Funds	800,000	500,000	TBD	1,300,000
Totals	$20,235,446	$850,000	—	$21,085,446

Note: SWFWMD funding is anticipated to be from the Florida Forever program.

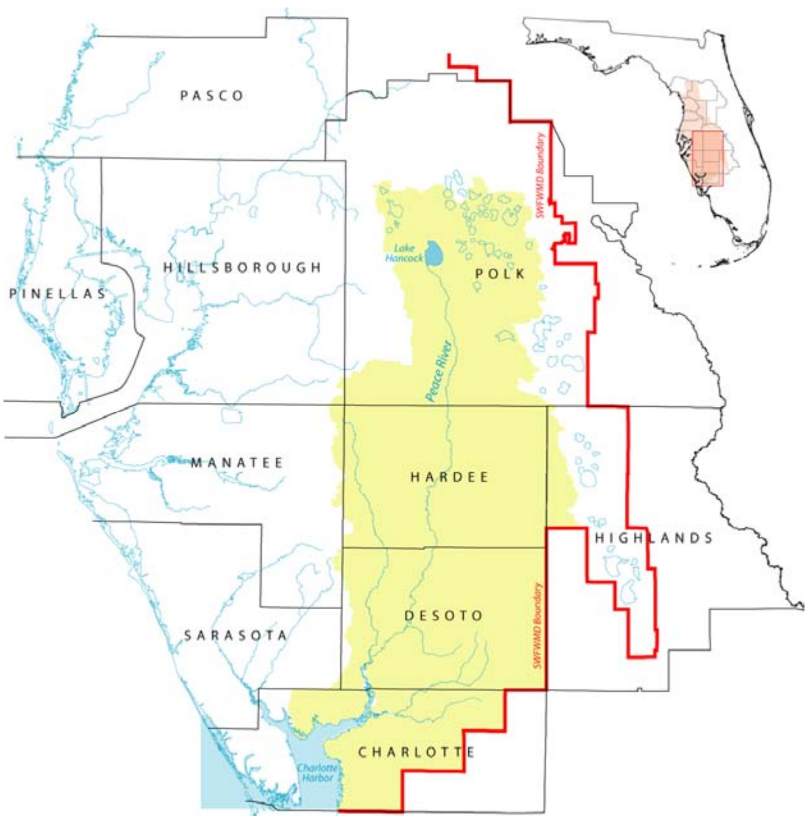


Figure 7-12.
Peace River watershed, including Charlotte Harbor, showing location of Lake Hancock. Lake Hancock is a 4,500-acre lake in the headwaters of the Peace River watershed.

Figure 7-13.
Satellite image of Lake Hancock, 1999. South Saddle Creek is the outfall for Lake Hancock

Figure 7-14.
View of South Saddle Creek. Control structure is in center of picture. Note cypress trees on left-hand side of figure, which are remnants of the original South Saddle Creek system. This project is to restore this system and build an enhanced water quality treatment system.

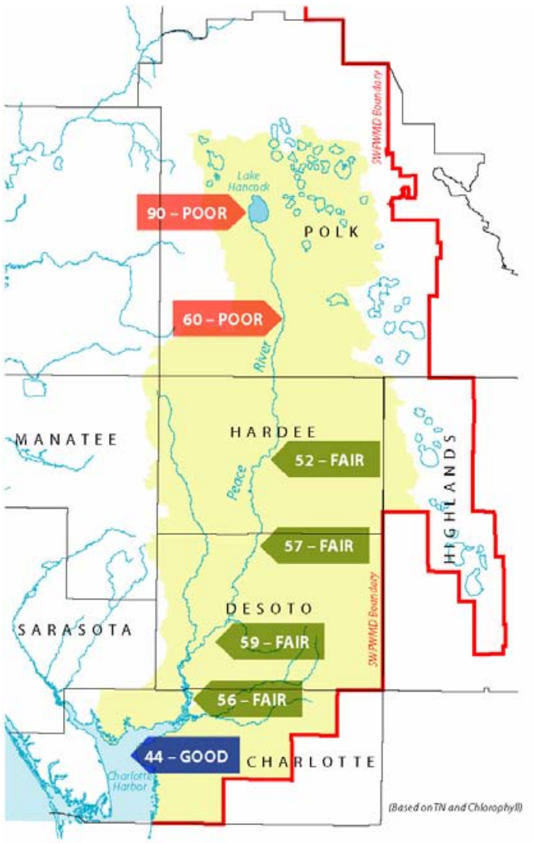


Figure 7-15.
Water quality rating of the Peace River watershed based on total nitrogen and chlorophyll concentrations. The poorest water quality is from the Saddle Creek drainage basin, which includes Lake Hancock.

Streamflow Losses Through Karst Features in the Upper Peace River

Purpose:
The objective of this project is to assess the hydraulic connection between the river and underlying aquifers, characterize and map karst features within or adjacent to the riverbed, and determine the amount of flow loss to the karst openings along the upper part of the Peace River from Bartow to Homeland (Figure 7-16). Understanding the extent, timing and magnitude of flow loss to the underlying aquifers is the first step in the process of developing water resource development projects that could eventually help reestablish perennial flow to the upper Peace River, the primary objective of the proposed minimum flow requirement to be enacted in 2004. In addition, once the study is completed, flow restriction barriers (berms) can be installed around the major karst features to eliminate or reduce gravity drainage to the underlying aquifers, thereby allowing more flow down the river channel during the dry season.

Need:
This project will identify flow losses to the underlying aquifers and increase the duration of river flows. This project is a critical component of the District's SWUCA Recovery Strategy in that it provides a cost-effective approach to aid in the restoration of minimum flows to the upper Peace River, and allows ground water to continue to meet the significant urban, agricultural and industrial water needs of the area.

Description:
From Bartow to Homeland, a series of solution features, conduits and sinkholes are prevalent within the riverbed and adjacent floodplain (Figure 7-17). Long-term decline in Upper Floridan aquifer water levels has reversed the hydraulic gradient between the river and the underlying aquifers, resulting in gravity drainage from the surface to the underlying aquifers. The first phase of the project will identify major karst features and determine flow losses along the river between Bartow and Homeland. The second phase of the project will evaluate and implement options for keeping low river flows in the river channel. Major elements of Phase I include: (1) conducting an analysis of hydrogeologic and historical land-use information in the basin, (2) identifying, locating and characterizing karst features in the riverbed and floodplain, (3) quantifying flow losses to the karst openings and gains from mining outfalls, and (4) assessing the hydraulic connection of the river to the underlying aquifers. Two new stream gaging stations will be installed on the river by the USGS between Bartow and Fort Meade. The District will provide and supervise drilling operations at four sites near the upper part of the Peace River (Figure 7-18). Drilling operations will involve collection of data on geology, hydraulic characteristics and degree of connection between the riverbed and underlying aquifers. Monitor wells will also be installed in the surficial aquifer, intermediate aquifer system and the Upper Floridan aquifer at each site to compare river stage with groundwater system elevations. Phase II of the project will consist of engineering design, permitting and construction of low-flow berms around karst features to maintain low river flows in the river channel. These berms will be designed to keep low flows in the river channel during extreme low-flow periods so that minimum flow requirements can be achieved, while also enabling recharge to the Floridan aquifer to occur via these karst features during higher flows.

The first phase of the project was initiated in FY2002 and will be completed by October 2007. An interim project report was provided by the USGS in October 2003 that includes the location of karst features and preliminary estimates of flow loss to the underlying aquifers. A final report will present the findings of the study at the end of FY2007. The project budget for the study is comprised of $1,182,800, divided equally between the USGS and the District. Drilling costs for coring, installation of monitor wells and hydraulic testing is estimated at $600,000. The estimated cost of the second phase, to reduce flow loss through the construction of berms, was based on 20 karst features at $50,000 each for a total of $1 million. In addition, it is expected that engineering design and permitting costs will be about $500,000.

Schedule:

Interim Feasibility Report	2003
Drilling and Testing (4 sites)	2004–2005
Final Report	2005
Construction of Berm Features	2006–2008

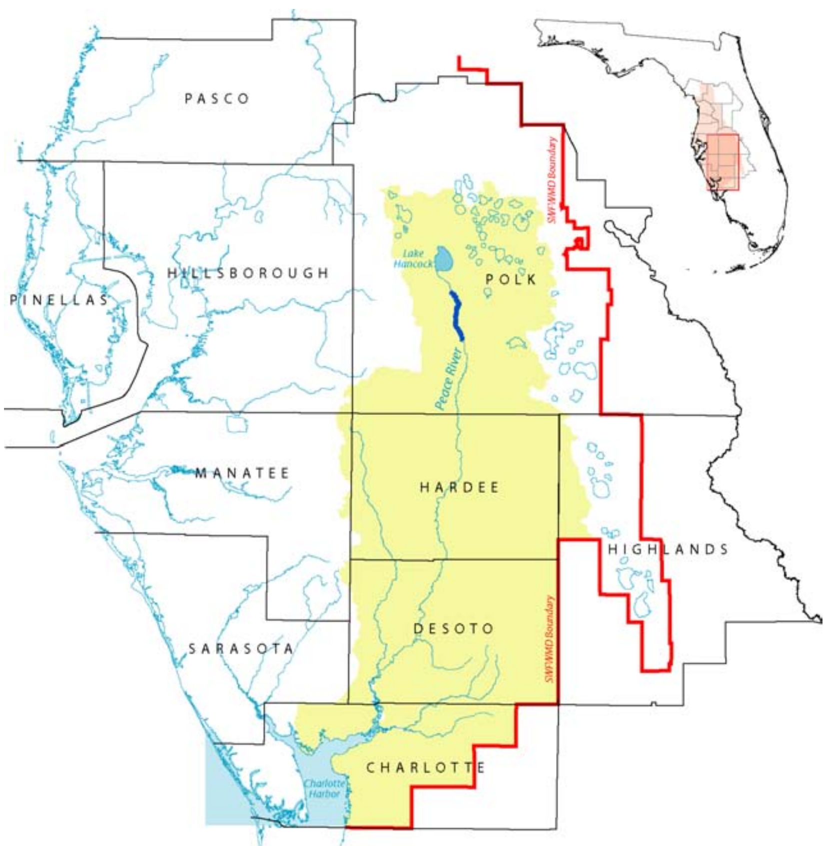


Figure 7-16.
Peace River watershed, including Charlotte Harbor, showing location of sinkhole area along the river from Bartow to Homeland.

Figure 7-17.
Peace River flowing into sinkhole near Bartow Wastewater Treatment Plant, May 2001.

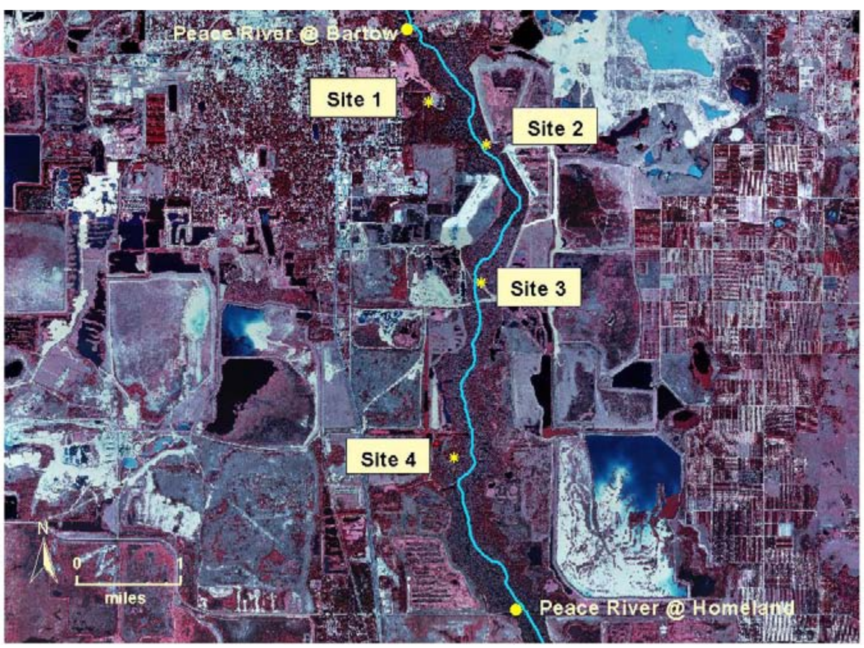


Figure 7-18.
Satellite image of upper Peace River from Bartow to Homeland showing the location of four groundwater monitor well sites.

Upper Carter Creek Watershed
Pilot Augmentation Project for Lake Lotela

Purpose:
The Lake Lotela project is presented as an example of one of the options that may be implemented to achieve adopted minimum levels on lakes in the region. The goal of this project is to construct a pilot augmentation well and monitoring system to study the feasibility of groundwater augmentation to increase surface water levels in Lake Lotela, an 800-acre lake in the Upper Carter Creek watershed in Highlands County (Figure 7-19). The project will be accomplished through augmentation of the lake with ground water from the surficial aquifer or the Floridan aquifer. The project will help ensure compliance with the minimum levels that are to be established for Lake Lotela, as described in Section 3. This lake has a history of augmentation and is extremely leaky. One of the principal goals of the Recovery Strategy is to protect the investments of existing legal users. For that reason, options have been developed that can contribute toward achieving recovery to adopted MFLs without having to rely upon extensive cutbacks in existing groundwater withdrawals as the primary means of recovery. The pilot augmentation project for Lake Lotela will first look at the feasibility of using the surficial aquifer to augment the lake and is just one of the tools that may be applied to lakes in the area to achieve MFLs. Prior to the initiation of an augmentation project, the District will investigate other alternatives for stabilizing lake levels, such as modifying surface water control structures and drainage features in the lake basin.

Need:
Over the past 35 years, surface water elevations at Lake Lotela have declined substantially (Figure 7-20 and Figure 7-21). The changes in lake stage may be attributed to climatic patterns, dynamic geological processes, modification of surface water drainage features, shifts in land use and water withdrawals. In response to a mandate from the Florida Legislature, the District has developed minimum levels to protect Lake Lotela and other regional lakes from significant harm that may be attributed to water withdrawals. The minimum levels proposed for Lake Lotela are intended to provide protection for cultural and natural system values associated with the lake. Developing the ability to augment Lake Lotela with ground water pumped from either the surficial aquifer or the Floridan aquifer will ensure that these values are protected. The proposed project is an important component of the District's SWUCA Recovery Strategy, to provide a cost-effective approach for compliance with the minimum levels proposed for Lake Lotela (Figure 7-21).

Description:
The first phase of the Lake Lotela pilot augmentation project will be to investigate the feasibility of augmenting the lake using ground water pumped from the surficial aquifer. The project will involve the purchase of approximately one to two acres of land within one-half mile of Lake Lotela; a feasibility analyses to determine surface water leakage to the aquifer and water quantities needed for augmentation; design and permitting; installation of a pilot well/pump system (one 16-inch diameter surficial well 150 feet deep); installation of three monitoring wells; installation of an evapotranspiration (ET) and a rain gauge site; and installation of a pipeline (2,000 feet) from the well to the lake. Land acquisition will be pursued for the purpose of installing a surficial aquifer well for augmentation of the lake. A feasibility analysis to determine the quantity of water needed to maintain the lake stage at the minimum level will include development of appropriate water budget parameters and an

operations schedule. A preliminary water budget analysis indicates that approximately two to four mgd during dry weather conditions may be required for augmentation to overcome the vertical leakage to the Floridan aquifer and maintain the lake stage within the desired range of lake fluctuation in order to achieve the proposed minimum lake level. During wet periods the rate will be low, probably less than two mgd. The augmentation rate is not intended to overcome ET, since this is a natural component of the lakes water budget and is necessary to produce the natural lake fluctuation. It is anticipated that virtually all the augmentation water will return to the aquifer, since augmentation will not result in an appreciable increase in ET. If land is available, the location of the augmentation well will be laterally down gradient of the lake to recapture and recirculate lateral seepage from the lake to the extent possible. Since there is a strong vertical flow component to the underlying aquifer, augmentation water that isn't captured by the well will reach the Floridan aquifer relatively quickly.

Results from testing of the first well and the response of the lake stage to the augmentation will be evaluated to determine how many additional wells will be necessary in the final system to produce up to four mgd. Installation of additional augmentation wells will be phased in over time following this feasibility study. The two to four mgd quantity is consistent with previous permitted augmentation rate of 3.6 mgd from the Floridan aquifer by Florida Power's old power plant that was located adjacent to the lake. Permitting and installation of a well/pump system will be followed by a monitoring program for evaluation of potential adverse impacts associated with the augmentation and refinement of the operations schedule. The potential impacts from the augmentation will be closely monitored and will include lake water chemistry, sediment analysis and biota monitoring. Implementation of the project will aid the restoration of water surface levels at Lake Lotela and provide the necessary information to design the final augmentation system that will ensure compliance with proposed minimum levels.

The total project budget is $710,000. This includes $60,000 for the feasibility analyses and design; $100,000 for permitting; $150,000 for installation of one surficial aquifer augmentation well and pump; $180,000 for 2,000 feet of 16-inch diameter pipeline; $10,000 for purchase of one acre of land for the augmentation well; $90,000 for installation of three surficial monitoring wells and one Floridan monitoring well; $40,000 for installation of an ET and rainfall station; and $80,000 for lake monitoring during augmentation. Costs associated with use of a Floridan aquifer augmentation well system in lieu of a surficial aquifer system will be approximately the same.

Schedule:

Feasibility Analyses and Design	2004–2005

Funding Source	FY2006	Future Years	Totals
SWFWMD	$100,000	TBD	$100,000

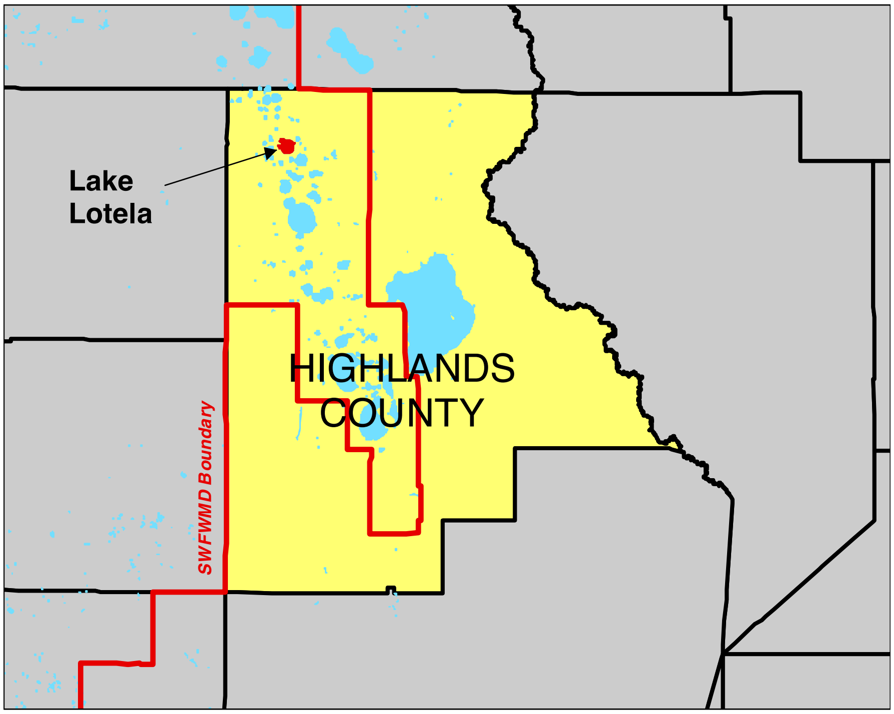


Figure 7-19.
Location map for Lake Lotela in Highlands County.

Figure 7-20.
During periods when lake surface levels are low, natural system and cultural values associated with Lake Lotela are diminished.

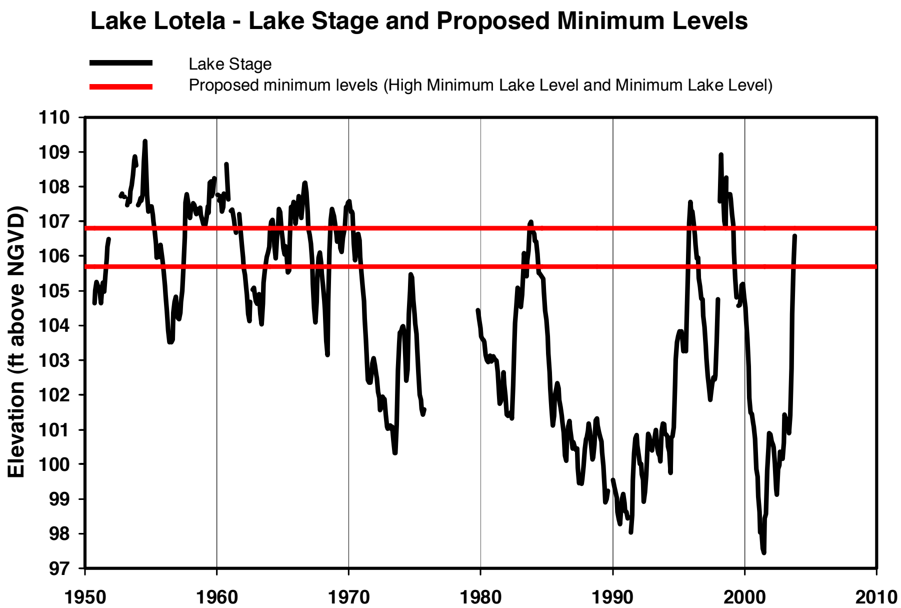


Figure 7-21.
Lake stage from 1950 through the present, and proposed minimum levels for Lake Lotela.

Ridge Area Lakes Screening/Restoration Project

Purpose:
Based on the current rate of urbanization and the continual impacts from historical development, there are more lakes in need of protection or restoration than the Peace River Basin Board and local governments can possibly address. Because of the limited funds available for lake management projects and the likelihood that more projects will be submitted for funding as urbanization continues to expand, a screening procedure was developed for the Basin Board in order to set priorities for financing future lake management projects. This comprehensive water resource management approach to the area's lakes is consistent with the Basin Board's Comprehensive Watershed Management priorities for this region. This project will describe the screening procedure methodology, screening results and, finally, the management priorities and strategies derived from the screening results.

Need:
The lakes along the Ridge are threatened by declining water quality and declining lake stage. Common water quality impacts include stormwater runoff, wastewater effluent, residential and agricultural fertilizer applications, agricultural runoff, groundwater pollution, and shoreline habitat degradation. This project will not only address water quality impacts to the lakes but will also identify and implement projects to help achieve the proposed minimum levels of the eight Ridge area lakes within the MFL program.

Description:
The screening process was developed on the basis of three major components: (1) a water quality summary index, (2) the watershed importance as determined by the lake size and its hydraulic connectivity with other lakes and/or streams, and (3) an evaluation of lake habitat quality. During the screening procedure, a score of 1 to 4 was assigned to each of these three screening components with a score of 4 representing best conditions. The sum of these three assigned scores resulted in the final lake screening value for the 106 lakes evaluated, ranging from 3 to 12. The water quality index was performed by compiling all available water quality from the District and Polk County and calculating the Florida Trophic State Index (FTSI). The watershed importance was determined by reviewing District aerial maps and lake level survey files to identify hydraulic connections to other lakes and streams. The evaluation of lake-habitat quality was the most field intensive part of the process and involved collecting new data through a field assessment of shoreline habitat and surrounding impacts, as well as a GIS land-use assessment of each lake watershed.

Lake screening results were separated into three major groupings. The first grouping includes lakes receiving high screening values ranging between 10 and 12. Since these lakes have overall good water quality and habitat, they should be categorized as preservation lakes. Lakes in this grouping would benefit from proactive measures to prevent future water quality and habitat degradation. The second screening grouping is for lakes receiving low screening numbers ranging between 0 and 7. These lakes should be considered under an improvement or restoration category. Since some of these lakes have an overall poor condition, significant restoration measures should be anticipated to improve water quality.

The third grouping is for lakes receiving medium screening values ranging between 7.1 and 9.9. Lakes in this category may benefit from a combination of both preservation and restoration actions. Lakes with these screening values are show in Figures 7-22 and 7-23.

The management priority proposed as part of the completion of this screening procedure is somewhat unique (Kolasa and Dooris 2003). Instead of placing priority on restoration of lakes of poor condition, the District proposes to place emphasis on protective lake management strategies first, to attempt to prevent further degradation of lakes with an overall fair to good condition that have regional significance. The highest priority for future lake management projects is placed on intermediate grouping lakes (green designation), while high grouping lakes receive second priority and low grouping lakes receive lower priority. The three major deciding factors for setting this priority were the greater potential for loss of biological diversity and decline in water quality, preventative timing, and cost benefit.

During the course of the lake screening, restoration projects were identified for the Ridge area and proposed as Basin Initiatives for the FY2003 Peace River Board Basin Budget. The first of these projects is a GIS mapping project that will provide a 100-year history of the alterations in the Ridge that have potentially impacted the region's water resources. The project will provide maps of the predeveloped land cover, natural streams and floodplains, and historic lake levels, thus allowing a better understanding of the extent of the land alterations. The resulting maps will be used as a tool to develop restoration projects for surface water features connected to lakes. The second of these projects is the restoration of existing conservation lands connected to lakes. Under this project, all public conservation lands within the Ridge area will be evaluated for prospective restoration activities that will improve the hydrologic and water quality functions of the downstream connected lakes. Higher priority will be given to projects that will help achieve minimum levels for the eight Ridge area lakes with proposed minimum levels. In addition, as part of this project, opportunities for restoration will continue to be evaluated for newly proposed lakes within the ongoing MFL program. This will include an analysis of all opportunities to operate or modify existing structures to help achieve minimum lake levels. Additionally, the Jackson-Josephine Creek system will be evaluated to determine the potential for hydrologic restoration to help meet the minimum level for Little Lake Jackson and Lake Jackson. The project involves utilizing a watershed model to evaluate options for enhancing the Jackson-Josephine Creek system to restore natural systems, help to meet the minimum lake levels, and still provide the flood protection benefits. The cost and benefits will be evaluated to determine if there are feasible restoration opportunities to help meet the minimum lake levels. As a result of the high number and high cumulative cost of the potential future projects, it is critical for the District to continue to develop partnerships with state and local agencies to help resolve funding issues with future lake management in this region.

Schedule:

Lake Screening Assessments Complete	2003
Soils Map and Vegetation Model Complete	2004
Predevelopment Land Cover Map Complete	2005
Surface Water Features Map	2005
Identification of Hydrologic Restoration Projects on Public Lands	2005–2006
Watershed Evaluation and Cost Benefit of Specific Projects	2005–2007
Implementation of Restoration Activities	2007–2012

Funding Source	Prior Years	FY2006	Future	Totals
SWFWMD	$869,697	$66,721	TBD	$936,418
State Surface Waters Restoration		58,824	TBD	58,224
Highlands County		30,000	TBD	30,000
Totals	$869,697	$155,545		$1,024,642

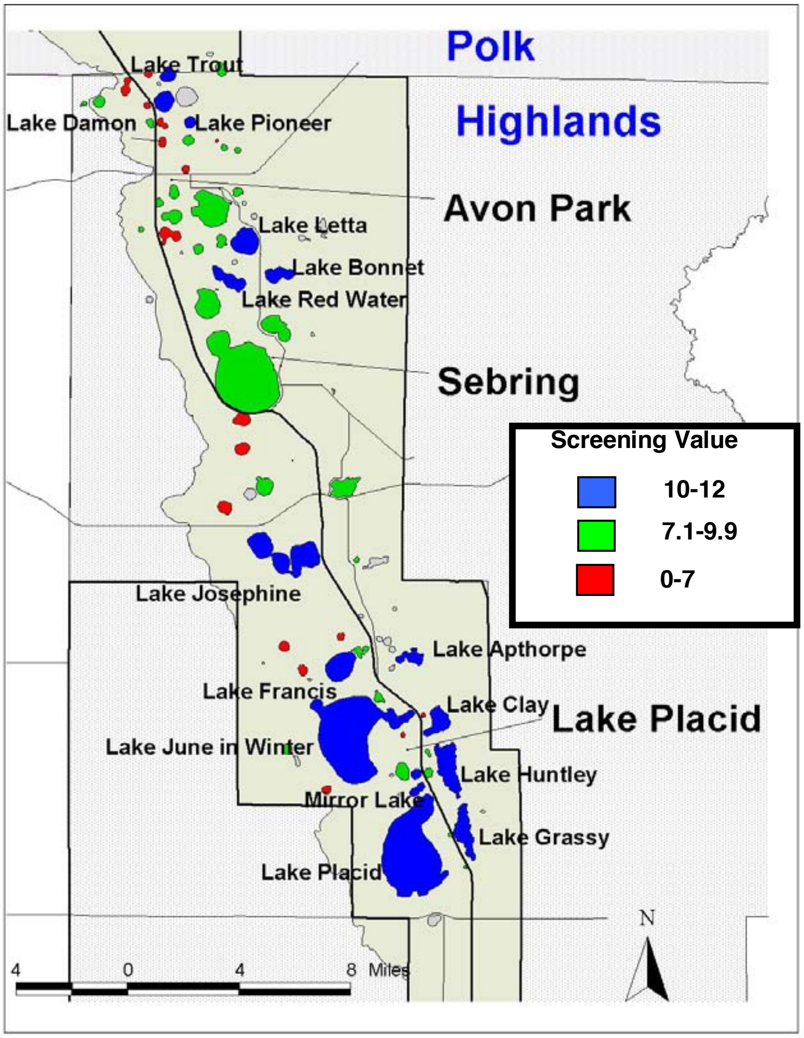


Figure 7-22. Screening results for lakes located along the Ridge area in Highlands County. Lakes colored in gray were those that were not accessible.

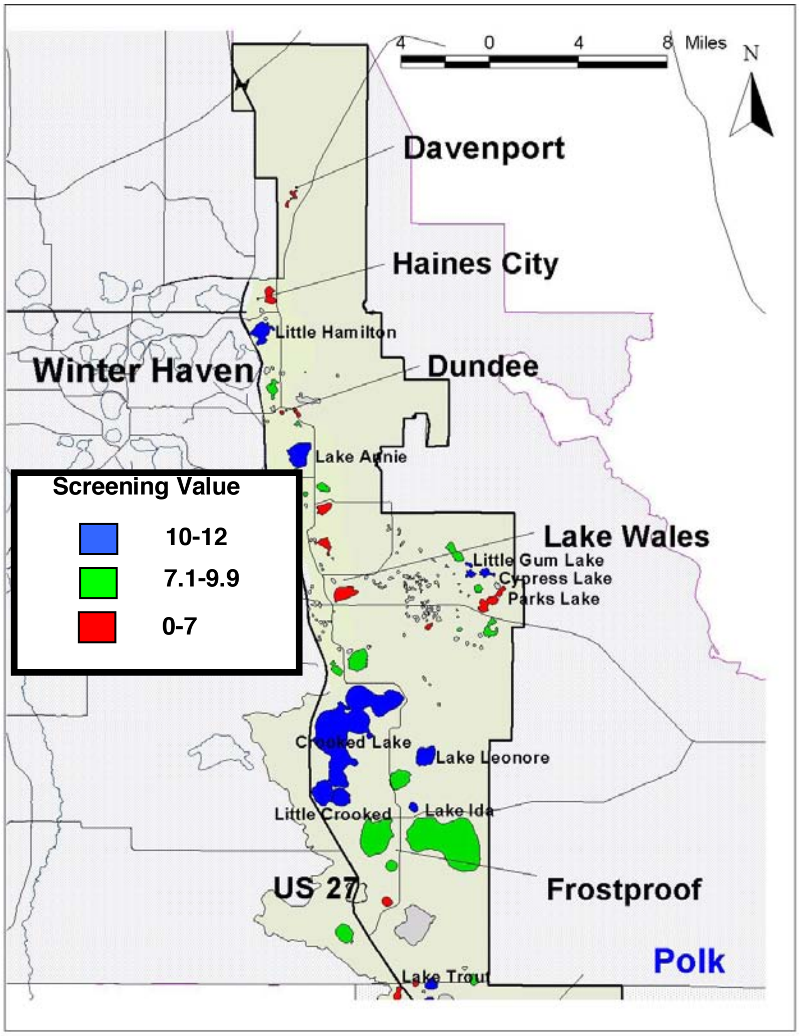


Figure 7-23. Screening results for lakes located along the Ridge area in Polk County. Lakes colored in gray were those that were not accessible

Section Eight
Regulatory Component

As discussed in the preceding sections, one of the two major components of the Recovery Strategy is a net reduction of Floridan aquifer groundwater withdrawals of up to 50 mgd. This reduction is primarily aimed at reducing the rate of saltwater intrusion, but may also have positive effects on river flows and lakes levels. This reduction is anticipated to occur primarily through additional conservation, further reliance on alternative supplies and turnover in water use as land-use changes take place. The District's existing rules contain many of the necessary regulations to support this strategy. Most of the necessary provisions have been in place for over a decade and additional provisions have recently become effective. Few additional rules are necessary to implement the Recovery Strategy, and only those new rules clearly identified as being necessary to meet statutory directives or the goals and objectives set by the Governing Board are included as components of this Recovery Strategy. A goal of the proposed new rules is to provide applicants additional flexibility. New rules include adoption of the minimum flows and levels (MFLs), enhancements to the public supply conservation (per capita) requirements, implementation of restrictions on new groundwater withdrawals that would impact MFL water bodies, implementation of a comparative analysis process of actual groundwater levels compared to the median levels experienced during the 1990s in the areas surrounding the upper Peace River and MFL lakes, and a series of Net Benefit options intended to assist in achieving the Governing Board's stated objectives of contributing significantly to resource recovery while protecting the investments of existing legal users and allowing for economic expansion.

The District recognizes that there are varying degrees of stress on the water resources in the SWUCA. The regulatory components of the Recovery Strategy have been designed in recognition of these variations. The extent to which water use permits are affected by the regulatory components is directly proportional to the resource conditions in the area affected by a permit's withdrawals and the extent to which the withdrawals contribute to these resource conditions. For instance, the regulatory component includes establishment of the SWIMAL within the existing "Most Impacted Area" designation in coastal portions of southern Hillsborough, Manatee and northern Sarasota counties. Groundwater withdrawals in and surrounding the MIA area that impact on saltwater intrusion will be much more affected by the minimum aquifer level than groundwater withdrawals in the eastern portions of the SWUCA. Conversely, groundwater withdrawals in the coastal areas will likely not be affected by the minimum lake levels proposed for priority lakes in Polk and Highlands counties, because these coastal withdrawals have little potential to impact groundwater levels in proximity to the Ridge lakes.

Finally, the District will continuously monitor trends in resource conditions and permitted and actual water use in the SWUCA (see Section 4). The Recovery Strategy may be modified in the future in response to these resource trends. The Recovery Strategy, including these regulatory components, will be reevaluated at a minimum of once every five years as the Regional Water Supply Plan and District Water Management Plan are updated.

Reasonable-Beneficial Requirements
The reasonable-beneficial use requirement of the District's existing and proposed rules will be a key component of achieving the Recovery Strategy objectives. Permits are granted

based upon meeting numerous rule criteria, including that the quantities requested are fully needed for the proposed use, or the existing use in the case of a renewal. Section 4.1 of the Basis of Review for Water Use Permits contains explicit language on this subject that indicates quantities can only be allocated for a "*certain, reasonable need or demand.*" Additionally, the Basis states, "*only the portion of demand that is supported by adequate documentation will be permitted.*" In the SWUCA, there is currently a total of approximately 1.2 billion gallons per day permitted quantity (963 mgd Floridan, 84 mgd intermediate and 156 surface water), while the highest estimated use was 927 mgd (2000), a difference of approximately 277 mgd of unused, permitted quantity. The 927 mgd is the combined surface and groundwater use with 835 mgd of this amount being ground water. Although some of this unused quantity can be explained (e.g., population growth or business investments for conditions that have yet to occur), some of this unused quantity may be due to speculation. The District will continue to scrutinize unused quantities in an effort to decrease the difference between permitted and used quantities within the SWUCA. This requirement is contained in existing District rules, however, as more and better data regarding actual use becomes available, the positive effect of this requirement is improved over time and enhancements to the existing rules are proposed to make it clear that this improved data will be considered in future permitting decisions.

The applicant for a new permit or for the modification or renewal of an existing permit is required to provide detailed information to demonstrate the demand for the quantities intended to be used during the term of the proposed permit. This requirement is intended to assist the District in seeking to reduce the difference between permitted quantities and used quantities. For those cases in which an applicant is seeking a modification or renewal of an existing permit, the District shall consider historical use, metered pumpage data, trends and patterns of usage, actual type of usage and other relevant factors submitted or proposed by the applicant to determine whether the quantities requested are reasonable-beneficial quantities.

Conservation — Existing Provisions

Conservation has long been a major element of water management in the District and especially along Florida's west coast. Best management practices have been implemented by the majority of users in all sectors of water use through research and development, water supply planning, financial incentives and regulatory requirements. Often these methods are commingled as research and development identifies a better practice, the District and other agencies provide financial incentives to accelerate implementation; updates are made to planning documents; and regulatory criteria are modified to reflect the advances.

The District's existing water use permit rules contain 13 conditions for issuance that are considered when evaluating a water use permit application throughout the District. These provisions address conservation requirements, including that the proposed use is necessary to fulfill a certain reasonable demand, will incorporate water conservation measures, will incorporate reuse measures to the greatest extent practicable and will not cause water to go to waste. Additional conditions are required in water use caution areas such as the SWUCA to further conservation efforts. In the SWUCA, many of these conditions were recently added with their anticipated savings now beginning to be realized.

The Recovery Strategy anticipates a reduction of about 80 mgd in water use due to conservation efforts (including public supply reclaimed water offsets) in the SWUCA over the next 20 years. Limited changes to existing rules, coupled with the cooperatively funded conservation projects and financial initiatives described in Section 6, should be adequate to achieve these savings. Some of the more recent conservation requirements will be instrumental and are worthy of review. These include per capita and utility reporting requirements, the requirement for wholesale permits, site-specific conservation plans for industrial, mining and recreational uses, and an irrigation drought credit system. As an aside, the District has recently undertaken an initiative in conjunction with the other water management districts and Department of Environmental Protection to achieve greater consistency and effectiveness of water use permitting rules, as well as other rules. This effort may lead to additional rule making to modify or enhance District rules.

Over the past two decades planning initiatives have contemplated lowering per capita water use requirements. The earlier Highlands Ridge area, Eastern and Northern Tampa Bay WUCA plans all included a tiered approach to reduce per capita water use over time. This approach, which is contained in the District's existing rules, relied upon per capita reporting requirements to demonstrate that minimum per capita water use requirements should be lowered over time. Although the original minimum per capita requirement of 150 gpd is still in effect, these provisions have aided a lowering of per capita water use throughout the area.

During the 1990s, the SWUCA planning efforts continued to focus on improving public supply water use efficiency, as well as efficiencies for other water use sectors. In early 2003, the District's water use permit rules were amended to include the following key provisions: (1) require all utilities within the SWUCA to adopt a water-conserving rate structure by January 1, 2004; (2) require rate structure information describing fixed and variable charge rates, minimum quantity charges, block size and pricing, seasonal rates and applicable months — to be provided to each customer at least once a year; (3) require all utilities with permits that exceed 100,000 gallons per day to collect residential water use information beginning January 1, 2003; and (4) require all utilities to submit an annual report on their utility water use no later than April 1 of each year covering the preceding year.

The reports associated with this final requirement, together with proposed enhancements regarding population estimation methodology described below, will be paramount to achieving the Board's desire to continue reductions in per capita water use. Thereafter, these reports will contain the information necessary for the District to properly assess a utility's efforts in achieving conservation goals. Currently, in many cases, deficiencies in the data submitted limit the District's ability to provide a thorough assessment and handicap the achievement of effective water use management. Further, a variety of factors cause variations in per capita rates, including population-served calculations, differences in the cost of water and the types of water rate structures, conservation programs of the permittee, characteristics of the permittees' customer bases (e.g., urban versus suburban residences with differing lawn and landscape characteristics), and the availability, appropriateness and cost associated with alternative sources of water. Some of these factors (rates and rate structures, conservation programs) are within the control of the permittee and can be modified to encourage conservation and lower per capita rates. The permittee has a lesser ability to influence other factors, such as the existing customer base and the availability of cost-effective and appropriate alternative sources.

For instance, in some areas within the SWUCA, such as portions of Sarasota County, shallow groundwater wells can be used for irrigation purposes. Such use is actually encouraged due to the fact that withdrawals from these shallow aquifers result in source-substitution, which reduces withdrawals from the Floridan aquifer. This will significantly lower per capita rates as measured by a utility in this area, since these irrigation demands are being met by this alternative source. However, in other areas, shallow ground water may be less available, such that irrigation wells must be drilled deeper and are therefore more costly, and the withdrawals may impact lake levels or streamflow and would therefore be discouraged. Due to the variability in these factors, it may be difficult to establish one per capita standard that is appropriate and equitable for all public supply permittees in the SWUCA.

In addition to the expanded conservation requirements for public supply mentioned above, the SWUCA I rules also imposed significant new requirements regarding water conservation plans for other uses. These new requirements are more stringent with respect to the degree of water conservation required and the amount of documentation of positive progress. Other new requirements, such as requiring more permittees to record and report their actual use in conjunction with their actual activity, limiting inch application rates for irrigation use, water audits and more comprehensive annual reports for public supply permittees, allow the District to better track progress toward water conservation.

The SWUCA I water-conserving conditions applied to water use permits are specific to water use types. All existing users not previously in a water use caution area who have permits for groundwater withdrawals for industrial, commercial, mining, dewatering, recreation and aesthetic (excluding golf courses) were required to submit water conservation plans by January 1, 2003. These plans describe where and when water savings could be reasonably achieved. Industrial, commercial, dewatering and mining uses also had to specifically address all components of water use and water loss in a water balance. The water balance includes recycling, using reclaimed water and landscape design. An implementation schedule had to be specified for each water-saving element listed. All holders of a water use permit for golf course irrigation, who had not already submitted a plan (previously required in the Highlands Ridge area and Eastern Tampa Bay WUCAs), had to submit a water conservation plan to the District by January 1, 2003. A "Golf Course Conservation Guidelines" document was developed to assist a permit holder to create an acceptable water conservation plan.

In terms of agricultural and recreational uses, the SWUCA rules implemented January 1, 2003, include a significant conservation element in the drought credit system. This system, which applies to all crops and landscape materials except those that use plastic mulch, provides a permitted quantity suitable for average rainfall conditions, with an allowance of additional quantities during drought conditions and freezes. The drought credit system is constructed so that for any year where a permit holder uses less water than the average permitted quantity, the amount not used is set aside in an account for later use. This system provides an incentive to conserve water quantities during average to wet periods for use during dry periods. It also had a beneficial effect of reducing the permitted quantities in the SWUCA by approximately 243 mgd.

Conservation — New Public Supply Provisions

It is proposed that the per capita standard of 150 gpd currently in effect in the Ridge area and Eastern Tampa Bay WUCAs be extended to the remainder of the SWUCA for consistency. It is further proposed that the District establish, by rule, a consistent methodology for calculating per capita rates, including methodologies for estimating the permanent residents, temporal residents and tourist components of population served. Public supply permittees will then be required to submit calculations of per capita rates utilizing this standardized methodology, in a phased approach, as follows:

- Permitted quantities of 500,000 gpd or greater must implement and report within two years of the effective date of the rule

- Permitted quantities between 100,000 and 500,000 gpd must implement and report within three years of the effective date of the rule

- Permitted quantities less than 100,000 gpd must implement and report within four years of the effective date of the rule

This information will be provided in the annual reports permittees are required to submit. This will allow for the "apples to apples" comparisons between utilities needed to refine per capita requirements and will determine if different standards should be applied for different geographic regions due to hydrogeologic and other conditions.

It is important to note that most utilities' per capita rates appear to already be below the 150 gpd rate, with many substantially below. Simply being below this minimum standard, however, does not relieve utilities from further conservation efforts. The reports described above will also allow the utilities and District to evaluate if further savings could be achieved through more aggressive rate structures, use of reclaimed water, education and other creative demand management initiatives. Ultimately, it is in a utility's best interest to be as efficient as practicable, since conservation remains the most cost-effective and environmentally friendly means of meeting existing and projected water use requirements of their customers.

It is also noted that the District is currently participating in a statewide initiative, lead by the Florida Department of Environmental Protection, to address public supply water conservation. The outcome of this initiative may have future implications on the District's approach to public supply conservation, including these new provisions addressing per capita rates. In addition, consistent with new legislative provisions adopted in 2005, a public water supply utility may propose a goal-based water conservation plan that is tailored to its individual circumstances. Progress toward goals must be measurable. If the utility provides reasonable assurance that the plan will achieve effective water conservation at least as well as the water conservation requirements adopted by the District, including per capita requirements, and is otherwise consistent with Section 373.223, Florida Statutes, the District will approve the plan which shall satisfy water conservation requirements imposed as a condition of obtaining a consumptive use permit.

Further Reliance on Alternative Supplies — Existing Provisions

Further reliance on alternative supplies will be critical to ensuring there are adequate supplies for all existing and projected reasonable and beneficial water use through at least the 2025-planning horizon. In addition to meeting much of the projected increases in use, alternative supplies will play a vital role in reducing Floridan aquifer withdrawals. This will primarily be accomplished through utilities developing alternative sources to supply the growing urban population. Concurrently, the previous land use for these new urban areas was typically agriculture. That agricultural land use was supplied nearly entirely with Floridan aquifer water. Consequently, overall withdrawals from this principal aquifer are anticipated to decline. Most of this decline should occur in the communities where cost-effective and environmentally sustainable alternative supplies are readily available. These supplies include use of river flows, with emphasis on capturing an appropriate percentage of high flows, sustainable use of the surficial and intermediate aquifers, reclaimed water and desalted seawater.

As discussed in Section 5, this component (changes in water use associated with changes in land use) of the Recovery Strategy should reduce withdrawals from the Floridan aquifer by at least 50 mgd. Most of this reduction will be in the area where wells are at the greatest risk of the deleterious effects of saltwater intrusion. Additionally, the District's existing rules contain provisions that can be used to address this element of the Recovery Strategy. Specifically, one of the District's 13 conditions of issuance to receive a water use permit requires that applicants demonstrate that they are using the lowest quality water that they have the ability to use. This requirement has existed for over a decade and has been effective in encouraging applicants to develop alternative supplies, thereby reducing competition for Floridan aquifer withdrawals. The District will continue to emphasize this requirement in evaluating applications for permits, including applications for new and renewal permits. Amendments to the existing rules are being proposed to further enhance and clarify these provisions.

In addition to the above requirement, in January 2003, new requirements focused on alternative source development were added to the District's rules that apply specifically to the SWUCA. They include investigation of the feasibility of reuse and desalination to satisfy all or a part of an applicant's demand. More specifically, the reuse provisions require applicants for a water use permit in the SWUCA to investigate the feasibility of the use of reclaimed water and that reuse shall be required where economically, environmentally and technically feasible.

The desalination provision requires that within the SWUCA where salt water exists, all industrial and public supply applicants for new or replacement quantities of ground water of 500,000 gpd annual average quantities or greater investigate the feasibility of desalination to provide all or a portion of requested quantities and to implement desalination if feasible.

As recognized by the existing rules, financial and technical feasibility play a major role in implementing the lowest quality water condition and can lead to significantly different results when two applicants in the same area request a permit.

Adoption of Minimum Flows and Levels

As discussed in Section 3, a minimum level is proposed for the Upper Floridan aquifer in the most impacted area, minimum flows for the upper Peace River and minimum levels for eight priority lakes in the Ridge area. The District must adopt each of these MFLs, as well as the methodologies utilized to establish the minimums, in rule by amending 40D-8, Water Levels and Rates of Flow. Once MFLs are established, requests for new quantities in the SWUCA (new quantities are defined to include requests for new permits, requests for increased quantities or a change in use type associated with renewals, and requests for increased quantities or a change in use type associated with modifications) will be issued only where it is demonstrated that there will be no increased impacts to the SWIMAL, that groundwater resources in proximity to other MFL water bodies are stable or improving (both of which are further described below) and the application meets all other applicable rule criteria.

Adoption of Recovery Strategy Rules

Because existing flows and levels are below the proposed minimums for most MFL water bodies, the District must develop a Recovery Strategy. A portion of the Recovery Strategy is comprised of the existing rules described above, as well as limited proposed new rules. These new rules include amendments to 40D-80, Recovery and Prevention Strategies for Minimum Flows and Levels, where the overall Recovery Strategy is described, and amendments to 40D-2, Consumptive Use Permitting and the associated Basis of Review. The primary purpose of these new rules is to allow for new reasonable-beneficial uses which impact upon a minimum flow or level water body that is below its minimum to occur while still achieving the Recovery objectives and, in the case where a Net Benefit is required, contributing to recovery.

It is proposed that new permitting criteria be adopted to ensure all new withdrawals (as described above) in the SWUCA are consistent with the Recovery Strategy. Specifically, new withdrawals will not be allowed to have negative impacts on the SWIMAL while actual groundwater levels are below the minimum. Once recovery has been achieved, new withdrawals would not be allowed to cause actual levels to fall below the minimum. While actual groundwater levels are below the minimum, applications for new groundwater uses that impact upon the SWIMAL will only be issued where it is demonstrated that the new use contributes to recovery of the SWIMAL through the application of a Net Benefit option, as further described below.

However, for the upper Peace River and the eight priority lakes, recovery is being achieved primarily through water resource development projects that will restore historically lost surficial storage in the respective watersheds, not through reducing groundwater withdrawal impacts on these water bodies. Therefore, the regulatory approach to managing groundwater withdrawals is somewhat different for these water bodies whereby the Recovery Strategy calls for not allowing groundwater withdrawals to worsen impacts to these water bodies. For the upper Peace River and eight MFL priority lakes, a process to monitor actual groundwater levels (expressed as a 10-year moving average) in the areas surrounding these water bodies is proposed. New quantities will not be permitted if the levels are lower than the median levels experienced during the 1990s, as further described below. Regulation of requests for new direct withdrawals from the upper Peace River or the MFL lakes will be further accomplished through application of existing rules and the Net Benefit provisions described below.

In those cases where proposed rule criteria to prevent impacts to the SWIMAL, the groundwater level comparative analysis for the upper Peace River and MFL lakes, or the application of existing rules indicate an applicant's proposed new use impacts a minimum flow or level water body that is below its minimum flow or level, the applicant may obtain a permit by selecting one of the Net Benefit options below, or through the competing applications process. The Net Benefit options described below only apply to permit applications for new quantities (as described above) that impact an MFL water body that is below its minimum. For those applications that do not impact an MFL water body that is below its minimum and for those applications that involve a renewal with no new quantities requested, the existing permitting rules will apply. It is anticipated these new Net Benefit provisions will be required only in a minority of all permitting activities in the SWUCA, because the majority of permitting activity is for renewals without new quantities and because sizeable quantities of "new" water are expected to be obtained through alternative source development.

Analysis of New Groundwater Withdrawal Impacts on the Saltwater Intrusion Minimum Aquifer Level

All applications for new quantities will be evaluated, utilizing a cumulative assessment based upon best available information, to determine whether the proposed withdrawal will impact on the SWIMAL. Where such an impact is anticipated to occur, the withdrawal will be permitted only if the application includes a Net Benefit, as described below, and meets all other applicable rule criteria. Impacts from proposed new withdrawals outside the MIA will be evaluated based upon impacts at the MIA boundary (see Figure 8-1). Impacts from proposed new withdrawals inside the MIA will be evaluated based upon impacts on the minimum aquifer level.

Analysis of New Groundwater Withdrawal Impacts on the Upper Peace River and Priority MFL Lakes

All applications for new quantities will be evaluated to determine whether the proposed withdrawal will impact groundwater levels below the upper Peace River. Where such an impact is anticipated to occur, the withdrawal will be permitted only if the application meets all other applicable rule criteria and the current 10-year moving average monthly water level in the area is above 53.3 feet, National Geodetic Vertical Datum (NGVD), which is the median for the 10-year moving average monthly water levels during the period 1990–1999. If it is determined the application cannot be issued pursuant to these evaluation criteria, the applicant can propose to implement a Net Benefit as described below. This groundwater level comparative analysis will be conducted utilizing an average calculated from District groundwater monitoring stations in the groundwater basin that best represent long-term trends in groundwater levels affecting the upper Peace River, including Regional Observation Monitoring Well Program (ROMP) wells 60, 59, 45, 30 and 31 (see Figure 8-2).

All applications for new quantities will also be evaluated to determine whether the proposed withdrawal will impact groundwater levels below Ridge lakes with established minimum lake levels. Where such an impact is anticipated to occur, the withdrawal will be permitted only if the application meets all other applicable rule criteria and the current 10-year moving average monthly water level in the area is above 91.5 feet, NGVD, which is the median for the 10-year moving average monthly water levels for the period 1990–1999. If it is determined the application cannot be issued pursuant to these evaluation criteria, the applicant can propose to implement a Net Benefit as described below. This groundwater level comparative analysis will be conducted utilizing an average calculated from District groundwater monitoring stations that best represent long-term trends in groundwater levels affecting the MFL lake levels, including Lake Alfred Deep, ROMP wells 28X, 57, 43XX and Coley Deep (see Figure 8-3).

Net Benefit Described

A Net Benefit is only required when a proposed new withdrawal impacts a minimum flow or level water body and the actual flow or level is below the minimum or is expected to fall below the minimum as a result of the new impact, as described above. A Net Benefit is obtained when the proposed new withdrawal, coupled with other activities or measures, will result in an improvement to the minimum flow or level water body that more than offsets the impact of the withdrawal. In order to provide a Net Benefit, the measures proposed by the applicant must offset the predicted impact of the proposed withdrawal and also provide an additional positive effect on the water body equal to or exceeding 10 percent of the predicted impact. As previously stated, the use of Net Benefit is expected to be limited, but under Florida administrative law, the existing rules in Chapter 40D-2, FAC, will have to be amended to add the Net Benefit option. This includes the procedures to be followed and the conditions and terms upon which Net Benefit will be accepted. Net Benefit options are described below.

Net Benefit Options

Groundwater Replacement Credit – The Groundwater Replacement Credit is proposed as an incentive for an applicant to provide other groundwater use permit holders with alternative supplies, such as reclaimed water. The holder of groundwater replacement credits can use the credits to provide a Net Benefit in order to obtain ground water or additional water from, or otherwise impacting upon, a minimum flow or level water body, because the overall result will be an improvement, or lessening of impacts, from withdrawals on that water body. The Groundwater Replacement Credit is created when an applicant (Supplier) provides an alternative supply to offset actual groundwater withdrawals by an existing permit holder (Receiver) that impact a minimum flow or level water body. The Groundwater Replacement Credit is 50 percent of the amount that is offset that was reasonable-beneficial used amount and will be available to the Supplier, the Receiver, a designated third party, or some combination thereof. The Supplier and Receiver will make the determination of which entity obtains the credit quantity, whether it is divided between them or whether they wish to assign it to a third party. The groundwater quantities discontinued may be placed in a standby permit that will be issued to the Receiver for activation in the event that the alternative supply is discontinued, interrupted or decreased. The Groundwater Replacement Credit will exist for only as long as the Receiver maintains use of the alternative water supplies. The credit will remain available if the Receiver transfers the standby permit to a new owner at the same site who continues the same water use with the alternative supplies.

Reclaimed water suppliers are not eligible for a Groundwater Replacement Credit when they redirect reclaimed water from existing reclaimed water users to other reclaimed water users and such redirection causes an existing reclaimed water user to reinstate permitted standby groundwater withdrawals, unless the reclaimed water provider can demonstrate that the cumulative effect of such redirection will be a greater reduction in groundwater withdrawals and will contribute more to recovery of MFL water bodies in the SWUCA than would otherwise occur absent of the redirection.

Mitigation Plus Recovery – Where an applicant for new water demonstrates compliance with all conditions for issuance, except that it impacts the SWIMAL, or fails the analysis for the upper Peace River or MFL lakes, the applicant can apply for a permit provided that he provides a Net Benefit to the impacted MFL water body. For example, if an applicant's proposed withdrawal from the Floridan aquifer is determined to fail the comparative analysis of groundwater levels for the upper Peace River, the applicant can propose a water resource development project that more than negates the proposed impact and receive a permit. In this case, an applicant could build a reservoir to store excess wet season flows and make releases in the dry season to provide flows that exceed the flows that occurred prior to the proposed activities.

Another mitigation mechanism could be the retirement of a permit where the existing used quantities impact the MFL, such that the reduction in impact that results from retirement more than offsets the impact of the proposed withdrawal. This mitigation mechanism may be particularly useful in areas where land use is changing from agriculture to residential and commercial development and alternative supplies are limited. Local governments can utilize retirement of existing permitted and reasonable-beneficial used quantities that result from land-use transitions in order to provide a Net Benefit. To do so, an agricultural operation would amend or retire its permitted quantities to reflect the reduction in production acreage and associated withdrawals, and the local government would concurrently apply for a permit or permit modification to serve the new use. The permit could also provide for a phased schedule over time. In the local government's application for a water use permit that includes service to the land involved, the local government would offer retirement of the previous permitted and used quantities as mitigation plus recovery. In those areas where the local government has concern that others may try to avail themselves of a Net Benefit associated with these permitted and historically-used quantities, the local government could work with the existing agricultural permittee to apply to become co-permittee to have greater control on those permits.

It is anticipated that this option — providing a Net Benefit through the retirement of existing withdrawals — will be most commonly used in interior portions of the SWUCA where public supply demands are increasing as agricultural lands are developed, and yet alternative supplies are most limited and may be insufficient to meet growing demands. The following example is provided to demonstrate how this Net Benefit approach might be applied within these areas. Figure 8-4 shows a hypothetical application to modify a public supply permit to increase quantities from the upper Floridan aquifer in an amount of 300,000 gpd. In this example, it is assumed the actual groundwater levels are at or above 91.5 feet, NGVD, as described above; hence the MFL criteria are not constraining this application. However, it is determined the increased quantities would have an unacceptable individual impact on an MFL lake that is below its minimum, causing denial of the application. Several options are available to the applicant, including enhanced conservation, beyond that required by the District's rules, to reduce the proposed increase. This might include improved rate structures to target high-end users and additional education efforts. In this example, it is assumed these increased conservation efforts result in a reduction of 50,000 gpd in the requested amount. In addition, the point of withdrawal could be moved further away from the impacted water body, reducing impacts. Finally, the applicant could propose a Net Benefit to offset any remaining impacts to the lake by providing reclaimed water to an existing user (a citrus grove) whose previous withdrawals were impacting the same water body. This proposed offset is at least 110 percent of the proposed withdrawal's remaining impacts, absent the Net Benefit. These various measures (conservation, moving the point of withdrawal and the mitigation) more than offset the proposed withdrawal's impact on the lake, as shown in Figure 8-5, and the permit can be issued.

An elaboration of how these various forms of mitigation will work is presented sequentially below.

I. The local government identifies its future reasonable-beneficial demands beyond what current sources can supply.

II. The local government evaluates all practical water conservation opportunities (water-conserving rate structure, reclaimed water conservation rate structure, Florida-friendly landscaping ordinances, water audits, etc.) and implements or plans implementation of those that are feasible.

III. The local government evaluates potential alternative water supplies (reclaimed water, surface water, captured storm water, etc.) and implements those that are feasible.

(Note: District assistance is available regarding items II and III above.)

IV. For the remaining demand for which new ground water is needed, the local government undertakes an evaluation of potential well sites using groundwater flow models. This evaluation identifies all potentially impacted features, such as wetlands, lakes, or existing legal users' wells, that are likely to be impacted by the new withdrawal. This evaluation is based on a cumulative assessment that includes existing permitted withdrawals. It is important to note that the District has developed a user-friendly groundwater flow model for its 16-county area that allows an applicant to "telescope" to a specific region to address local impacts. The District encourages use of this calibrated model in the permitting process. Use of this model should significantly reduce development costs.

V. If there are no adverse impacts, standard permitting would apply and there would be no need for pursuing permit transfers/conversions.

VI. If there are potential impacts, the type(s) of impacts must be addressed individually. For example, if the impact is to existing legal users' wells, changing the proposed well location(s), changing pumping schedules or deepening the pumps of the affected well may resolve the problem. If wetlands or lakes are impacted, changing well locations and pumping scenarios should also be evaluated.

VII. Under the proposed SWUCA rules, if the approaches listed above do not remedy the problem and an impact to a lake, wetland or other standard rule criteria are limiting withdrawals, or if there is an impact to an MFL water body requiring a Net Benefit, current options include:

   A. Retiring Actively Used Permitted Quantities – This option involves mitigation in the form of retiring actively used permitted quantities (e.g., agricultural wells) that have an impact on the same well, wetland or lake that the proposed withdrawals impact. The process would be:

      1. The local government identifies potential existing and actively used permits in the surrounding area that might be retired to offset the needed increase in withdrawals.

      2. The local government utilizes groundwater flow models to calculate the positive effect on the impacted feature of ceasing the withdrawals authorized

by the permit to be retired, and to determine whether this effect offsets the impact of the proposed withdrawals.

3. The pumpage that occurred within the permit term of the permit to be retired would be used for this analysis (i.e., pumpage that actually affected the impacted feature).

4. If the impact of the proposed withdrawals is offset (mitigated) by the cessation of withdrawals due to the permit retirement, the impact issue is resolved. However, if a significant adverse impact still occurs, further mitigation would be required. Additionally, if a significant adverse impact continued to be predicted for an MFL water body that was below its established minimum under the proposed SWUCA rules, the impact must be reduced an additional 10% beyond the offset to obtain a Net Benefit.

   One of two approaches may be used to retire permitted quantities. The first approach is that the entity that is mitigating in the form of retiring permitted quantities transfers the permit into its name, and demonstrates ownership or control of the related property. Then, as part of the application for new quantities, the entity submits a request to retire the permit, along with model results showing the offset.

   Another possible way to retire the permit is for the local government to have an agreement with the current permit holder to notify the District to cancel its permit simultaneously with the application for the new permit (that would include model results showing the offset). In either case, the permit will be retired coincident with the issuance of a permit that contains an increase in quantities that is based on the retirement.

B. Converting Actively Used Permitted Quantities – This option involves transferring an existing actively used permit (e.g., a citrus grove) to either the land developer or the local government, then modifying the permit to change the use from agriculture to public supply. In this option, the withdrawals would remain at their originally permitted location. The steps in the process would be as follows:

   1. The existing permit is transferred into the new owner's name (the developer).

   2. The local government would condition the development order for the parcel to include a caveat that the permit will either be used by the developer to supply the needs of the parcel to be developed, or be transferred to the local government if it has committed to supplying the community.

   3. If the developer or some other entity with ownership or control will operate the withdrawals, they provide an application to modify the water use permit to change the use type.

   4. If the local government will operate the withdrawals, ownership or legal control of the withdrawal facilities must be transferred to the local government and the permit must be transferred from the developer/owner to the local government.

5. Upon transfer of the permit to the local government, an application to change the use type would be submitted to the water management district.

   Since the withdrawal is not changing location and assuming the withdrawals are operated in a similar manner to the historical withdrawals at the site, there would not likely be an impediment to issuance of the changed-use permit. However, (1) if the withdrawal impacts an MFL water body that is below the MFL, a Net Benefit is required, and (2) if the withdrawal will be operated differently than the historical use (e.g., a different pumping pattern), this change would have to be addressed in the permit evaluation.

C. Cumulative Assessment – The District will be performing an annual assessment of water resource criteria and cumulative impacts. This assessment will provide information regarding permitted and used quantities that have either decreased or increased since January 1, 2000. The net change, impact on an MFL water body and the recovery progress of that water body can be considered when evaluating new withdrawals. The District will also continue to evaluate cumulative impacts based on best available information for the vicinity of the proposed withdrawal.

Use of Quantities Created by District Water Resource Development Projects – The District anticipates that its water resource development projects will result in the development of new quantities above and beyond the quantities needed to achieve recovery to MFLs. All or a portion of these new quantities that are not reserved or otherwise designated for recovery may be made available to permit applicants and used as a Net Benefit to offset other proposed withdrawals which would impact MFL water bodies.

If an applicant demonstrates compliance with all applicable conditions and has contributed to a District water resource development project, the applicant may propose consideration of quantities made available through the District water resource development project as a Net Benefit, provided the applicant demonstrates that:

- The proposed withdrawal affects the same MFL water body affected by the water resource development project

- The quantity developed in excess of the quantity reserved or otherwise designated for the MFL has been determined

- The proposed Net Benefit quantities will not interfere with quantities reserved or otherwise designated by the District for water resource development

Self-Relocation

In order to further attain the Governing Board's stated principle of protecting the investments of existing water use permit holders, new provisions are being proposed allowing permittees to move their point of use. This is referred to as "self-relocation." Applications by existing permittees to relocate all or part of their existing permitted quantities to a new site, as long as there is no increase in quantities, no change in use type or ownership, and no increased impacts to MFL water bodies, will be treated as self-relocations and not a new use. None of the provisions specific to new uses will apply. Total reasonable-beneficial permitted quantities are available for self-relocation, including unused quantities determined to be reasonable-beneficial. Under an application for self-relocation, both the existing permit (if not all permitted quantities are being self-relocated) and the new permit are scrutinized for reasonable-beneficial use and demand, and must meet all other applicable Chapter 40D-2, FAC, rule criteria, including a finding that impacts to MFL water bodies will not worsen.

A number of local governments have expressed an interest in knowing when applications are made for self-relocations for permits within their respective jurisdictions, particularly to make existing landowners aware of the implications of relocating quantities from properties intended for future development. The District will enhance its existing notification process for water use permit applications to local governments to clearly identify applications for self-relocation.

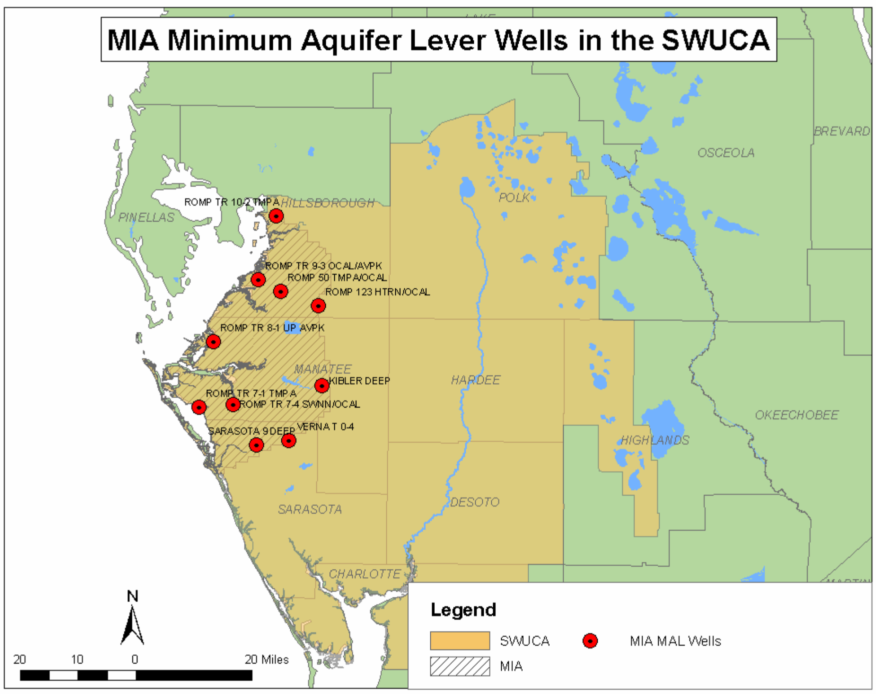


Figure 8-1. Saltwater intrusion minimum aquifer level monitor wells and the most impacted area.

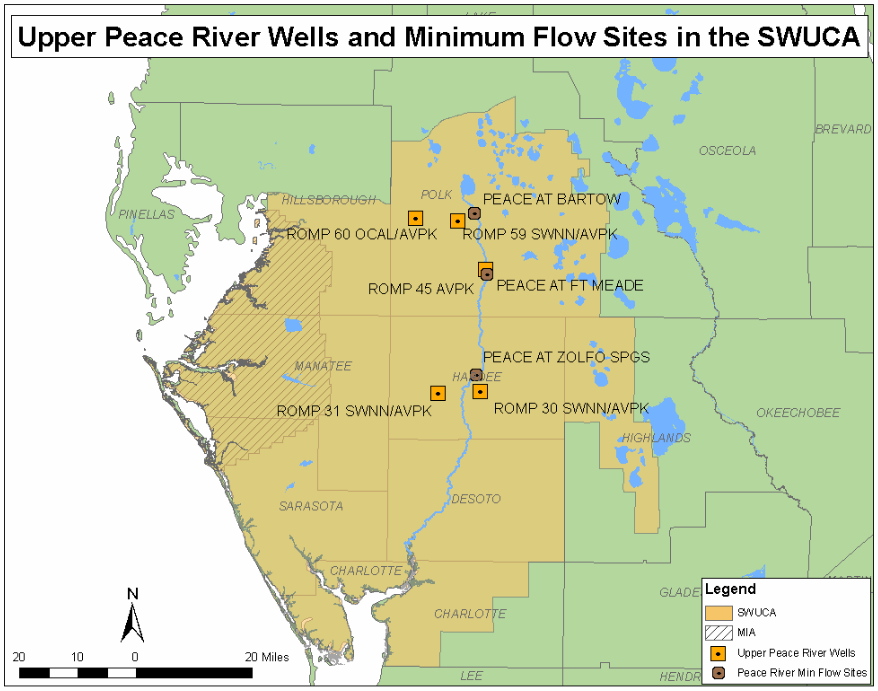


Figure 8-2.
Upper Peace River groundwater monitoring wells.

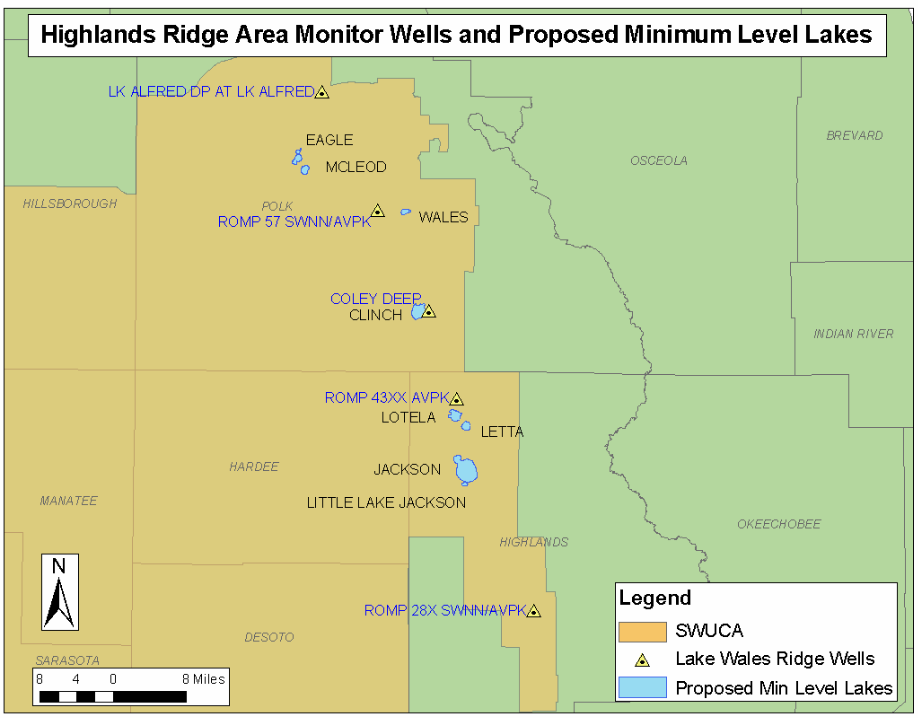


Figure 8-3.
Minimum lake level monitor wells.

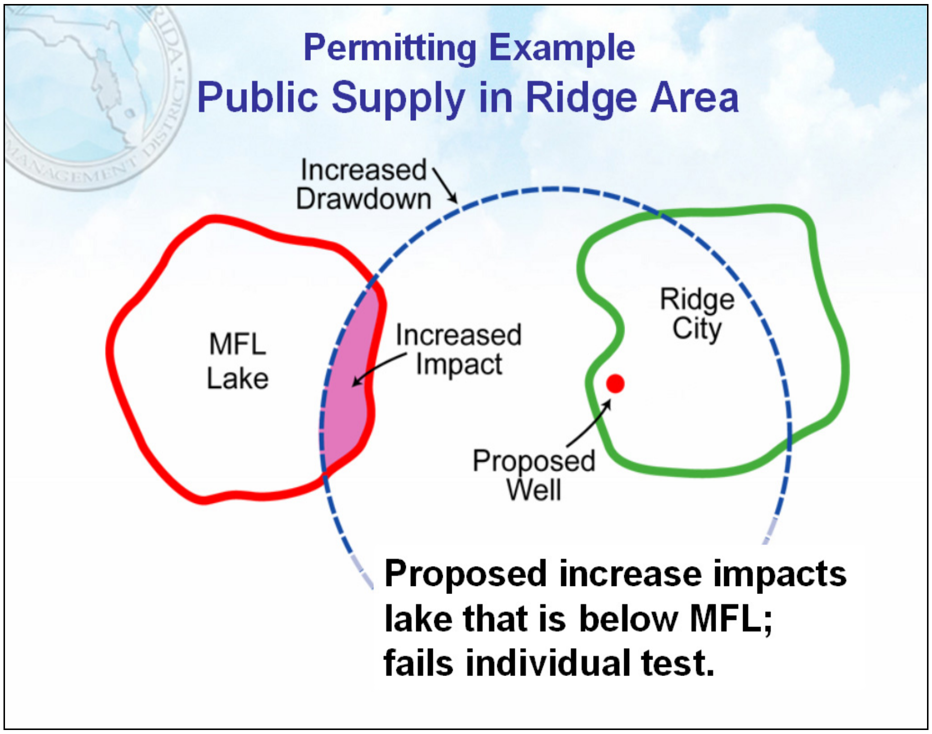


Figure 8-4. Permitting example — public supply in Ridge area — prior to Net Benefit.

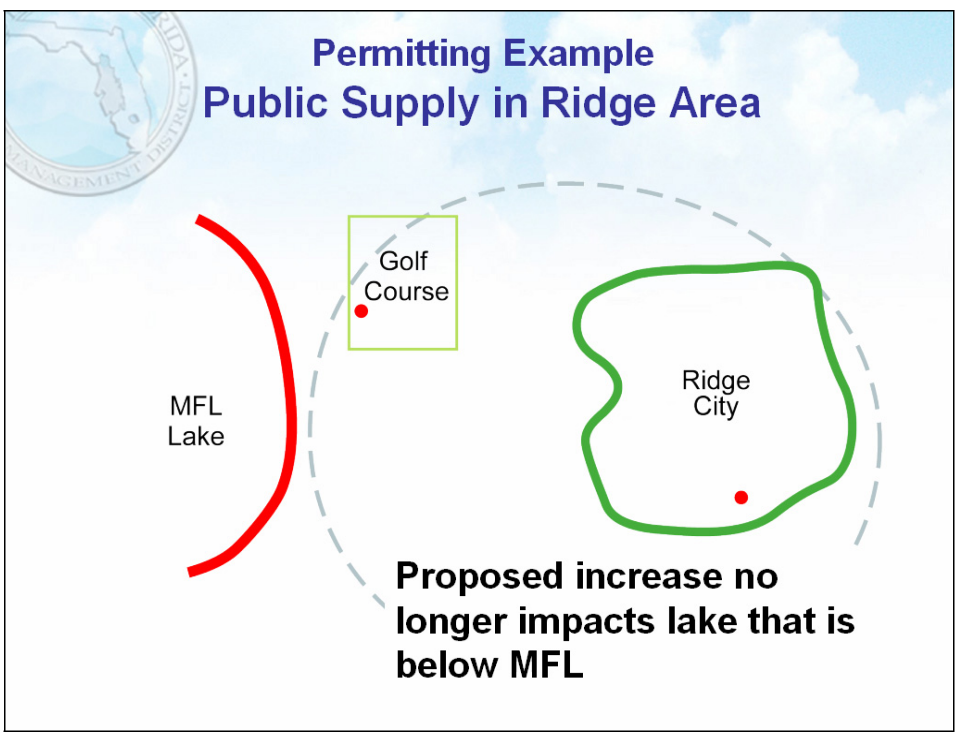


Figure 8-5. Permitting example — public supply in Ridge area with Net Benefit.

Section Nine
Financial Component

Section 373.0831, Florida Statutes, contains legislative findings and intentions that are relevant to the financial component of the SWUCA Recovery Strategy.

(1) The Legislature finds that:

(a) The proper role of the water management districts in water supply is primarily planning and water resource development, but this does not preclude them from providing assistance with water supply development.

(b) The proper role of local government, regional water supply authorities, and government-owned and privately owned water utilities in water supply is primarily water supply development, but this does not preclude them from providing assistance with water resource development.

(c) Water resource development and water supply development must receive priority attention, where needed, to increase the availability of sufficient water for all existing and future reasonable-beneficial uses and natural systems.

(2) It is the intent of the Legislature that:

(a) Sufficient water be available for all existing and future reasonable-beneficial uses and the natural systems, and that the adverse effects of competition for water supplies be avoided.

(b) Water management districts take the lead in identifying and implementing water resource development projects, and be responsible for securing necessary funding for regionally significant water resource development projects.

(c) Local governments, regional water supply authorities, and government-owned and privately owned water utilities take the lead in securing funds for and implementing water supply development projects. Generally, direct beneficiaries of water supply development projects should pay the costs of the projects from which they benefit, and water supply development projects should continue to be paid for through local funding sources.

(d) Water supply development be conducted in coordination with water management district regional water supply planning and water resource development.

(3) The water management districts shall fund and implement water resource development as defined in s. 373.019. The water management districts are encouraged to implement water resource development as expeditiously as possible in areas subject to regional water supply plans. Each governing board shall include in its annual budget the amount needed for the fiscal year to implement water resource development projects, as prioritized in its regional water supply plans.

(4)(a) Water supply development projects which are consistent with the relevant regional water supply plans and which meet one or more of the following criteria shall receive priority consideration for state or water management district funding assistance:

1. The project supports establishment of a dependable, sustainable supply of water which is not otherwise financially feasible;

2. The project provides substantial environmental benefits by preventing or limiting adverse water resource impacts, but requires funding assistance to be economically competitive with other options; or

3. The project significantly implements reuse, storage, recharge, or conservation of water in a manner that contributes to the sustainability of regional water sources.

(b) Water supply development projects which meet the criteria in paragraph (a) and also bring about replacement of existing sources in order to help implement a minimum flow or level shall be given first consideration for state or water management district funding assistance.

Definitions of Water Resource Development and Water Supply Development are as follows:

Water resource development means the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation, and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and groundwater recharge augmentation; and related technical assistance to local governments and to government-owned and privately owned water utilities.

Water supply development means the planning, design, construction, operation, and maintenance of public or private facilities for water collection, production, treatment, transmission, or distribution for sale, resale, or end use.

As provided by the above legislation, the District has prioritized projects and programs that provide regional water resource benefits. This prioritization is taken into account when considering whether or not any District funds are available and the level of any matching funds.

Potential Funding Sources
The following funding sources are potentially available to assist in funding development of alternative supplies, implementation of water resource development projects and demand management initiatives needed to fully implement the SWUCA Recovery Strategy. The funding sources include only those that could potentially be generated from fiscal year 2007 through fiscal year 2020. This allows the funding to be in place five years before water supply demand to provide sufficient time to construct the necessary infrastructure.

New Water Sources Initiative (NWSI)
In 1994, the Governing Board initiated a financial incentive program known as the New Water Sources Initiative (NWSI). This program was created to assist in a “pay as you go,” leveraged cooperative program in the development of sustainable, nontraditional alternatives

to groundwater use. Since its inception, the Governing Board has budgeted $10 million annually, an amount matched by the affected Basin Boards, for specific projects for a total of approximately $20 million per year. A local cooperator then matches the total District contribution. NWSI funding is fully committed to projects through 2007. If the Governing Board and the four SWUCA Basin Boards (90 percent of Alafia River, 6 percent of Hillsborough River and 100 percent of the Manasota and Peace River Basins' budgets are allocated to the SWUCA for planning purposes) elect to maintain their annual funding commitment of $20 million per year through 2020, it is estimated that $8.8 million per year (44 percent) of the total NWSI funds could be allocated to the SWUCA from 2008 through 2020. At this rate of funding, $122.2 million could be available from 2007 through 2020 for NWSI projects in the SWUCA.

Historically, both the NWSI and Basin Board Cooperative Funding programs have required a cost share on an equal basis (50/50 cost share for eligible costs) with cooperators. However, many of the future projects may require a higher percentage of District funding. For example, certain components of the upper Peace River recovery projects may not have local cooperators and may be funded entirely by the District. In recognition of this potential, this analysis has assumed that 50 percent of the future NWSI budgets would be set aside for projects to be funded completely by the District. The remaining 50 percent would be matched on an equal cost basis, which would yield an additional $61.1 million through 2020.

Water Supply and Resource Development (WSRD) Program

The District established a Water Supply and Resource Development (WSRD) Program in FY2000 to provide funding for projects of a regional significance on a matching, flexible basis to complement the District's NWSI and Cooperative Funding programs. It is anticipated that the Governing Board and eight Basin Boards will collectively contribute at least $15 million annually to this fund (Governing Board $7.5 million and Basin Boards $7.5 million). If the Governing Board and the four Basin Boards that encompass the SWUCA maintain a minimum funding commitment of $15 million per year through 2020, it is estimated, for planning purposes, that $6.6 million dollars per year (44 percent) could be allocated for the SWUCA from FY2013 through 2020. For the years 2007 through 2012, the amount potentially available for the SWUCA is based on existing Governing Board and Basin Board project commitments totaling $40 million, existing Governing Board and Basin Board WSRD reserves of $18.8 million, and an additional $20 million in Governing Board reserves with matching Basin Board funding of $20 million. The allocation of additional Governing Board reserves is based on original financial plans to equalize water supply and resource development funding for the SWUCA based on Governing Board taxing effort. At this rate of funding, $151.6 million could be available through 2020. As with the District's NWSI and Cooperative Funding programs, if local cooperators match half of these funds, an additional $75.8 million can be leveraged.

Cooperative Funding Program

The four Basin Boards that encompass the SWUCA provide significant financial assistance for conservation and alternative source programs through the NWSI, WSRD and Cooperative Funding programs, primarily to governmental entities. However, the Governing Board and Basin Boards have also partnered with private entities. Under current policy, cooperative projects funded by the Basin Boards usually require a 50/50 cost share by a local cooperator. In FY2004, the Basin Boards began to consider reduced funding matches for rural communities pursuant to the state's Rural Economic Development Initiative (REDI).

- Whether and in what percentage a local government or local government utility is transferring water supply system revenues to the local government general fund in excess of reimbursements for services received from the general fund, including direct and indirect costs and legitimate payments in lieu of taxes.

After one or more meetings to solicit public input on eligible projects, the Governing Boards shall select projects based upon the criteria set forth above.

The state funds will be applied toward the maximum 20 percent of the eligible projects' construction costs. In addition, the Legislature has established a goal for each water management district to annually contribute funding equal to 100 percent of the State funding for alternative water supply development assistance. The State's Water Protection and Sustainability Program, if continued by the Legislature, will serve as a significant source of matching funds to assist in the development of alternative water supplies by 2025.

State of Florida, Florida Forever Program
The Florida Forever Act (FFA), passed in 1999, is a $10 billion, 10-year, statewide program that will provide the District approximately $26.25 million per year for land acquisition, environmental restoration and water resource development. At least 50 percent of these funds must be spent on land acquisition over the life of the program. Of the Florida Forever funds currently allocated to water resource development ($130 million), the District has expended or committed $57.8 million ($44.8 million for land acquisition and $13 million for water body restoration.) The District intends to spend the remaining $72.2 million on land acquisition in support of water resource development. A "water resource development project" is defined as a project eligible for funding pursuant to Section 259.105 (Florida Forever) that increases the amount of water available to meet the needs of natural systems and the citizens of the state by enhancing or restoring aquifer recharge, facilitating the capture and storage of excess flows in surface waters, or promoting reuse. Implementation of eligible projects under Florida Forever includes land acquisition, land and water body restoration, ASR facilities, surface water reservoirs and other capital improvements. An example of how the funds were used for water resource development was the purchase of lands around Lake Hancock within the Peace River watershed in support of the Lake Hancock Lake Level Modification and Ecosystem Restoration Project.

Federal Revenues
In 1994, the District began an initiative to seek federal matching funds for water projects. Since that time, the Office of the Governor, the Department of Environmental Protection, other water management districts and local government and regional water supply authority sponsors have joined with the District. Through a cooperative effort with members of Florida's Congressional Delegation, the Federal Initiative has grown substantially. In 1999, the effort was expanded to seek funding for the development of alternative source projects and in 2001, the state of Florida and the water management districts expanded a list of projects in order to seek all available resources to develop a water supply strategy that would meet the demands of growth throughout the state while being environmentally sustainable. The projects include the use of alternative water supply technologies, as well as stormwater retention and filtering and wastewater treatment. Each district certifies that the projects submitted for funding are regional in scope and that matching funds are available either from the District budget or from a local government sponsor.

To date, a total of $95 million has been received by local cooperators. Federal matching funds for the construction of the Bill Young Regional Reservoir were obtained through this initiative that also includes funding for the Tampa Bay Regional Reclaimed and Downstream Augmentation Project and the Peace River and Myakka River Watersheds Restoration Initiative.

District staff considers funding for water supply projects to be a top priority and continues to work with the Office of the Governor, the FDEP and the members of the Florida Congressional Delegation to secure federal funding.

Local Government, Regional Authorities and Water Utilities Funding
Local governments, regional water supply authorities, and government-owned and privately owned water utilities take the lead in securing funds for and implementing water supply development projects. Generally, direct beneficiaries of water supply development projects should pay the costs of the projects from which they benefit, and water supply development projects should continue to be paid for through local funding sources. Projecting these local funding sources into the future has not been done because of the unknowns associated with projects where the District is not a partner. However, District funds are assumed to be used on a matching basis where the District becomes a partner through the NWSI, WSRD or Cooperative Funding programs. As provided for by the water resource development legislation, the District has prioritized projects and programs that provide regional water resource benefits. This prioritization is taken into account when considering whether or not any District funds are available and determining the level of any matching funds.

Summary of the SWUCA Financial Engine
Table 9-1 shows the various potential funding sources to address project needs in the SWUCA. As illustrated in this table, the potential funding sources could provide $559 million through 2020. It is important to note that the planned funding identifies only known sources of funding and does not include anticipated federal funds. Further, the Basin Board Cooperative Funding Program projection is based on current funding allocations made by the four SWUCA basins to water supply and resource development and conservation projects.

For REDI-eligible projects, the Basin Boards have generally funded 75 percent of project cost, with the local governments funding the remaining 25 percent. The Basin Boards have an additional funding mechanism known as a Basin Initiative that allows the Boards to increase their percentage match or in some cases provide total funding for the project. If the four SWUCA Basin Boards elect to maintain their current levels of funding for water supply and resource development projects under the Cooperative Funding Program from 2007 through 2020, this could yield $46.6 million. If cooperators match half of these funds, an additional $23.3 million can be leveraged.

State Revenues
State revenues have the potential to play a significant role in funding water resource development projects in the SWUCA. During the 2002 legislative session, the District began pursuing state funds for the FARMS Program. This effort resulted in the District receiving $1.5 million dollars in FY2003 to address the resource goals associated with the Upper Myakka watershed and Shell Creek initiatives. The District has since received additional state appropriations of $1 million in FY2005 and $1 million in FY2006 to assist with expansion of the FARMS program throughout the SWUCA. In addition, the Florida Department of Agriculture and Consumer Services (FDACS) has provided funding of $273,621 in FY2003, $500,000 in FY2004, and $50,380 in FY2005 for the FARMS program. In FY2003 the District executed the FARMS Operating Agreement with the FDACS. Under this Operating Agreement the District and FDACS have agreed to seek funding annually for a minimum of 10 years. The District will continue to seek funding for the program. This approach, coupled with the District's efforts to maintain other existing sources of state revenues, could add to the funds available for projects in the SWUCA.

The District has also been allocated a total of $1.7 million from state appropriations through 2006 for restoration activities in the upper Peace River, including important funding for the Lake Hancock Lake Level Modification and Ecosystem Restoration project.

Water Protection and Sustainability Program
The new State of Florida Water Protection and Sustainability Program was created in the 2005 legislative session through passage of Senate Bill 444. The program provides matching funds for the District Governing and Basin Boards' NWSI, WRSD and Cooperative Funding programs for alternative water supply development assistance. For 2006, the first year of funding, the Legislature allocated $100 million for alternative water supply development assistance, with $25 million allocated for this District. It is anticipated that the District may receive future annual allocations of $15 million for the program, subject to annual appropriation by the Legislature. Although the new state program has been referenced as a 10-year program, the legislation does not stipulate the program term. For planning purposes, it is estimated that the District will be allocated $15 million in 2007. Of this amount, $6.6 million per year (44 percent) could be allocated for the SWUCA. If annual funding for the Water Protection and Sustainability Program continues through 2015, it is possible that an additional $52.8 million could be generated for alternative water supply development in the SWUCA.

Program guidelines are incorporated into Chapter 373, Florida Statutes, and include conditions on match requirements, project selection, project benefits and project implementation. The following is a summary of some of the more pertinent criteria:

Alternative water supplies projects eligible for funding are defined as projects that utilize salt water; brackish surface water and ground water; surface water captured predominately during wet-weather flows; sources made available through the addition of new storage capacity for surface or groundwater; water that has been reclaimed after one or more public supply, municipal, industrial, commercial, or agricultural uses; the downstream augmentation of water bodies with reclaimed water; stormwater; and any other water supply source that is designated as nontraditional for a water supply planning region in the applicable regional water supply plan.

Funding from the program can only be used for the construction element of an eligible project.

Funding Match
Applicants for projects that may receive funding assistance pursuant to the program shall, at a minimum, be required to pay 60 percent of the project's construction costs. The state will provide up to 20 percent of construction costs with the water management districts to provide an equal match. Water management districts and Basin Boards may, at their discretion, use ad valorem or federal revenues to assist a project applicant in meeting the statutory funding match requirements.

Governing Boards shall determine those projects that will be selected for financial assistance. The Governing Board may establish factors to determine project funding; however, significant weight will be given to the following factors:

- Provides environmental benefits by preventing or limiting water resource impacts.
- Reduces competition for water supplies.
- Replaces traditional sources in order to help implement a MFL or reservation.
- Implemented by a permittee that has achieved targets contained in a goal-based water conservation program.
- Quantity of water supplied as compared to its cost.
- Construction and delivery of reuse water is a major component.
- Implemented by a multi-jurisdictional water supply entity.
- Part of a plan to implement two or more alternative supply projects, which will produce water at a uniform rate for a multi-jurisdictional water supply entity.
- The percent of project costs to be funded by the water supplier or water user.
- Includes sufficient preliminary planning/engineering to demonstrate that the project can be implemented within timeframes in the RWSP.
- Whether the project is a subsequent phase of a project that is underway.

Table 9-1.
Potential Funding Sources to Implement the SWUCA Recovery Strategy

Potential Funding Sources through 2020	
District NWSI funding through 2020	$122 million
Funding provided assuming one-half of the $122 million of District NWSI funds is used for projects that would be matched by a partner on an equal cost-share basis	$61 million
District WSRD program funding through 2020	$152 million
Funding provided assuming one half of the $152 million of District WSRD program funds is used for projects that would be matched by a partner on an equal cost-share basis	$76 million
Basin Board Cooperative Funding Program through 2020.	$46 million
Funding provided assuming one-half of the Basin Board Cooperative Funding program funds is used for projects that would be matched by a partner on an equal cost-share basis	$23 million
State of Florida, Water Protection & Sustainability Trust Fund for 2007	$7 million
State of Florida, Florida Forever Trust Fund through 2010	$72 million
State of Florida, Appropriations for FARMS	TBD
Federal Funding	TBD
Local, Regional Authority, Utilities Water Supply Development	TBD
Total potential funding sources through 2020	**$559 million**

(The potential funding sources include only those that could potentially be generated from fiscal year 2007 through fiscal year 2020. This allows the funding to be in place five years before water supply demand to provide sufficient time to construct the necessary infrastructure.)

Appendix 1

Peer Review:

Saltwater Intrusion and the Minimum Aquifer Level in the Southern Water Use Caution Area

Hydrologic Evaluation Section,
Southwest Florida Water Management District

August 21, 2002 Draft

Gordon Bennett
John Bredehoeft
Louis H. Motz

September 2002

INTRODUCTION
This report includes the Peer Review Committee's findings regarding matters set forth in "Attachment A: Scope of Work and Deliverables, Compensation and Expense Schedule," dated July 24, 2002, for the independent scientific peer review of a methodology to set a minimum aquifer level. The methodology reviewed by the Committee is documented in the August 21, 2002, draft report titled "Saltwater Intrusion and the Minimum Aquifer Level in the Southern Water Use Caution Area."

Seawater intrusion is a problem in coastal aquifers in many parts of the world. The problem is exacerbated where a highly permeable aquifer, such as the Upper Floridan aquifer, extends offshore beneath the sea floor. Under virgin conditions, before development, fresh groundwater flows outward at the coastline and discharges to the sea off the coast. This outward discharge maintains a sufficiently high hydraulic head within the aquifer at the coastline to maintain the seawater/freshwater interface offshore.

As development of the aquifer occurs, ground water that originally discharged beneath the sea floor is diverted by the pumping to wells. Groundwater levels decline in response to the pumping. With the decline in the hydraulic head, the seawater/freshwater interface moves toward the land, and ultimately it moves on shore. The seawater/freshwater interface moves in an attempt to reach a new stable configuration.

This is a general description of groundwater conditions within the Upper Floridan aquifer near the coast in the Southwest Florida Water Management District (SWFWMD). The seawater/freshwater interface is onshore and moving eastward (landward) within the most permeable portions of the aquifer. A number of investigations that included both data collecting and model analyses were conducted to investigate the position of the interface and its rate of movement.

Fortunately the movement of the interface is slow. The toe of the interface currently moves 1 to 1 ½ miles in fifty years, or at a rate of 200 to 300 feet per year. Given the current rate of movement of the interface, it would probably take something like 1,000 years to reach a new equilibrium position where the interface was no longer moving.

Even where the interface moves into the aquifer, the toe is very gently sloping; the slope of the toe is one to two degrees from seaward toward the land. Near the toe of the interface, the seawater is actually lying along the bottom of the aquifer. Pumping fresh water can occur in areas where the toe of the interface underlies the well. However, wells that overlie the interface are at risk to seawater contamination. The pumping can cause the underlying interface to be perturbed upward into the well — so-called upconing of the seawater.

Dynamic Equilibrium
With a given (1) distribution and (2) rate of pumping, water levels within the Floridan aquifer become stable quickly. The water levels stabilize within a matter of months to changes in the pumping. Associated with the stable water level is a rate of seawater intrusion. In other words, for each stable water level within the aquifer, there is an associated rate of movement of the seawater/freshwater interface. In general, the lower the water level, the faster the interface moves landward.

If one manages the aquifer to maintain the current water level, then one also stabilizes the current rate of the seawater intrusion — approximately 100 to 200 feet per year. If the objective is to slow the rate of movement, then one needs to raise the water levels (hydraulic head) within the aquifer. If we assume that the distribution of pumping remains distributed approximately as it is currently, then we can raise the water levels only by reducing the pumping. If the objective of the water management by the SWFMWD is to slow the rate of landward movement of the seawater/freshwater interface, it must reduce the pumping. Holding the current water levels within the aquifer will stabilize the rate of movement of the seawater interface at its current rate.

A MINIMUM WATER LEVEL

Florida law mandates that minimum water levels be established on priority water bodies — the Upper Floridan aquifer is considered a priority water body within the SWFWMD. The subject document addresses the establishment of a minimum water level.

Ten-Year Moving Average

The suggestion is not to select a single water level in time, but rather to average the water levels over a 10-year period. The thinking is that a 10-year period is sufficiently long to average out normal wet and dry periods, but not too long to obscure long-term trends. The Peer Review Committee agrees that using a 10-year moving average is a wise choice.

The period chosen for setting the minimum water level was chosen as 1999 and the preceding nine years — 1990–1998. The subject document shows that this is the highest 10-year average water level within the last several years. The hydrograph of the Sarasota 9 Deep observation well, Figure A1-1, indicates that water levels were more or less stable during the decade of the 1990s. The period 1990 to 1999 seems like a good choice, although we recognize that this period represents the highest average water level in recent years.

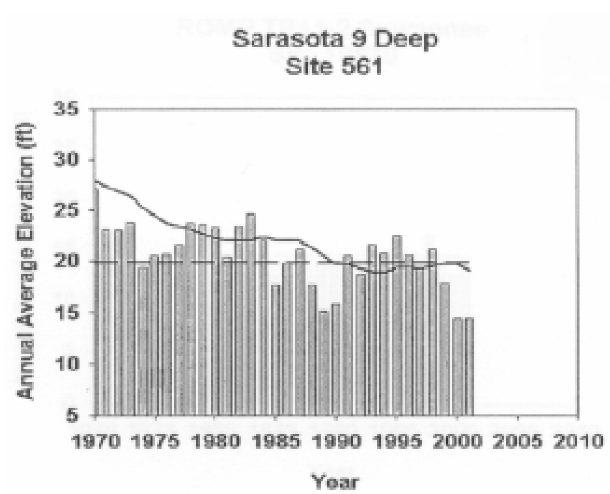


Figure A1-1.
Hydrograph of Sarasota Deep well. The solid black line is the 10-year moving average plotted for the last year averaged. (Figure 21—subject document)

The Area
The question is what area to consider in establishing the minimum water level. The document states:

"With respect to saltwater intrusion, the area of concern for which the minimum aquifer level is being established is the ETB MIA [Eastern Tampa Bay most impacted area]. The ETB MIA is an area of about 708 square miles that encompasses the coastal portions of southern Hillsborough, Manatee, and northern Sarasota Counties." (page 25)

However, a large cone of depression occurs in the potentiometric surface of the Upper Floridan aquifer at the boundary and to the east of the MIA. Figure A1-2 (Figure 12 from the subject document) shows the drawdown from predevelopment to 1999; the cone of depression is clear on this figure. Thus, part of a major pumping center apparently occurs landward (east) of the designated ETB MIA. Pumping from this area is reducing groundwater discharge in the coastal area and causing the interface to move farther inland. To control the rate of movement of the interface in the coastal ETB MIA area, it is important to control pumping in the area east of the MIA, as well as in the MIA. Pumping throughout the SWFWMD has an impact on the potentiometric surface and, as a consequence, the rate of movement of the interface. We suggest that the SWFWMD investigate the pumping to the east to determine its impacts on water levels within the MIA; it may be necessary to control this pumping to effectively control water levels within the MIA.

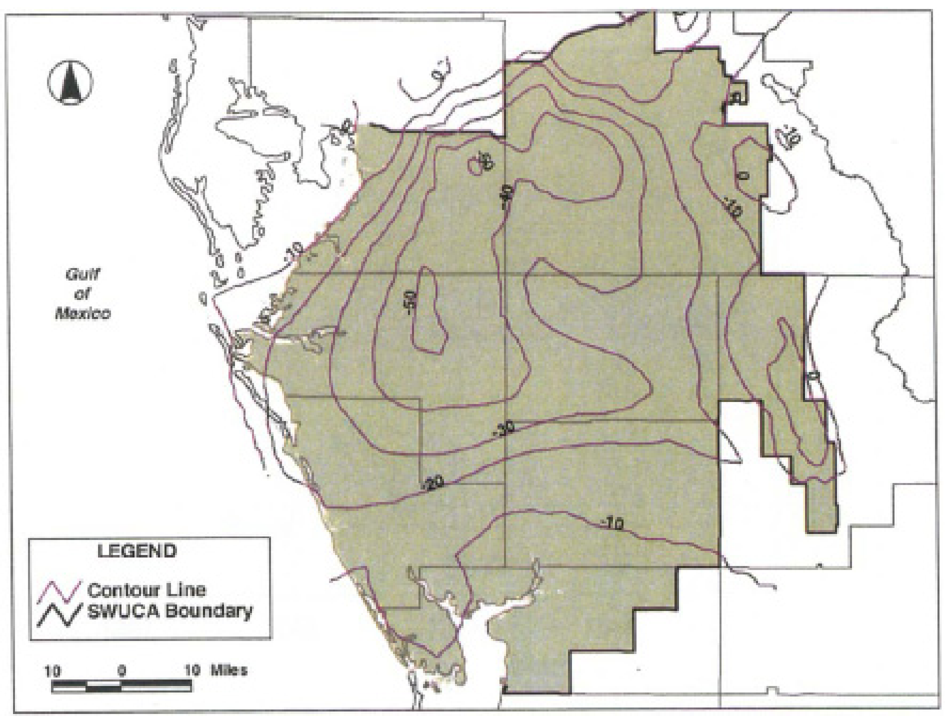


Figure A1-2.
Drawdown from predevelopment to 1999 in UFA. (Figure 12—subject document).

The Technique
The staff decided to suggest a single "average" water level for the area of concern as the minimum. A single value, average water level for the area has the advantage that it does not single out a single well or group of wells where pumping has created a deep cone of depression. Both low and high wells are averaged together to determine a single value.

Two procedures were discussed in the subject document (Section 6.3). The two alternative procedures were:

1. Average the water levels in a selected set of ~~16~~ **10** observation wells for the 10-year period.
2. Use the Geographic Information System (GIS) Arc/INFO to create a potentiometric surface for the area of interest and then use its capabilities to compute an average water level.

The report points out that both procedures give comparable results. It is ambiguous in the document which procedure the staff favors. In discussions with them, they prefer the Arc/INFO method; this should be made clear in the document. In anticipation of challenges and/or litigation, it is important that the procedure used by the SWFWMD to determine the average water level be described in such a way that the result is reproducible. Other experts using the same data and following the same procedure should get the same result.

The Peer Review Committee agrees that the Arc/INFO procedure, outlined in Section 6.3 of the subject document, will yield a reasonably formulated, average water level for the Upper Floridan/Avon Park aquifer within the most impacted area (MIA). The procedure does not yield a simple average, nor is it easy to give an exact formulation of the spatial weighting embedded in the calculated average; but we do not believe these considerations should preclude using this method. In our opinion, so long as the calculation is carried out consistently, the resulting water level average provides an effective index by which the relative rate of saline water encroachment in the aquifer can be gauged. For these reasons we prefer to refer to the average determined by the Arc/INFO procedure as an index.

Specifically, we believe that if the index is calculated according to the Arc/INFO protocol, outlined in Section 6.3, for two different time periods, the landward velocity of saline water movement, averaged both over the area normal to the flow and the time period of calculation, will virtually always be greater in the period for which the calculated index is lower. In other words, the total volume of saline water that moves landward in the aquifer within the MIA will be greater during the period for which the calculated index is lower. We assume that the rate of encroachment is visualized as the apparent velocity of a given concentration surface, rather than as the time rate of change of concentration at a given point in the aquifer.

The method of calculation, described in Section 6.3, was applied to the data collected from 16 selected monitoring wells in the decade from 1990 through 1999. The resulting average water-level elevation, 12.8 feet (above mean sea level — msl), is taken as the reference level or index. The panel agrees that this reference level is associated with the average rate of landward saline movement in the MIA during the 1990–1999 decade, and that for any 10-year period for which the index is greater than 12.8 ft-msl, the average rate of saline encroachment will be less than that during the 1990–1999 period. The Peer Review Committee thus agrees that the issue paper presents an effective methodology for determining whether the rate of encroachment is greater or less than that prevailing during the 1990s.

Recommended Further Work to Refine and Clarify the Method
While the committee agrees with the overall concept and procedure as presented in the subject paper, we feel that the SWFWMD and those who may be impacted by its decisions would be well served if (1) the relationship between the index and the hydrologic factors controlling it, particularly the pumping rate in the SWUCA, were explicitly quantified and discussed, and (2) the relationship between the index and rate of saline encroachment were similarly quantified. This could be done in the issue paper itself, or in a supporting document.

The index can be viewed as an intermediate variable, controlled by pumping and other hydrologic stresses, which in turn controls the rate of saline water encroachment. The rate of saline encroachment could itself be considered an intermediate term, since it determines the number of wells at risk in the aquifer at any given time (where the "at risk" designation implies that saline water is present within the aquifer beneath the well). In the subject document, a link is established between the pumping rate in the SWUCA and the number of wells at risk after 50 years time. While this presentation is enlightening, it gives no direct information on the intermediate variables — the water level index and the rate of encroachment. However, the policy mandated by the Governing Board is framed in terms of the water level; the water level index is to be the trigger, and the rate of migration is specified as the variable to be controlled.

We believe that an examination of the explicit relationships involving (1) pumping and (2) the rate of the interface movement is warranted. This would allow everyone involved to visualize what a given change in the index means, both in terms of the hydrologic stresses that caused it and the change in the encroachment rate that accompanies it. These insights could help the SWFWMD staff in formulating the best response to a given change in the index, and might help in winning public support for that response. We believe that much of the information required for such an analysis already exists in the results of completed simulations and, if necessary, further information could readily be generated through additional simulation.

As we understand the work done to date with the density-dependent flow and transport model (HydroGeoLogic, 2002), predictive simulations have been completed corresponding to pumping from the SWUCA of 400, 600, 800 and 1,000 mgd. In each case the pumping within the transport model domain was scaled as a fraction of the total pumping from the SWUCA. Lateral (fresh water) boundary conditions were taken from the results of parallel simulations using the southern District groundwater flow model (SWFWMD, 2001), which includes the entire SWUCA. The effects of pumping from areas of the SWUCA outside the density-dependent model domain are thus embedded in the boundary heads of that model. Initial conditions for the predictive runs were taken as those prevailing in December 2000. The results of these simulations were used in the analysis noted above that relates the number of wells at risk after 50 years of pumping at different rates. We recommend that the results be further processed (1) to calculate the water level index associated with each pumping rate and (2) to determine the rate of movement of the seawater/freshwater interface associated with each value of the index.

Calculating the index would involve retrieval of freshwater heads at nodes corresponding to the monitoring well locations, from those layers corresponding to the open or screened intervals in the observation wells. If there are cases where the screen or open interval extends over more than one model layer, an average of the heads in the represented layers, weighted by the layer transmissivities, should be used. The procedures of Section 6.3 would then be applied to the head values, except that time averaging over a 10-year period would not be required because the simulated levels would generally represent steady-state hydraulic conditions.

Calculation of the rate of seawater encroachment could be carried out, for example, by processing the transport results to develop a three-dimensional isochlor surface at two times during pumping at a given rate. These surfaces could be taken for a concentration of 1000 ppm, or could represent any other concentration considered characteristic of the transition zone. At evenly spaced locations, the horizontal and vertical components of the separation between the two surfaces would be divided by the time interval to obtain estimates of both the horizontal and vertical velocities of seawater encroachment. These velocity components could then be combined to yield the resultant velocity of saline water encroachment at each point. Averaging of these velocities over the cross-sectional area of flow within the MIA would then yield the average rate of migration associated with the calculated water level index. Averaging of the horizontal components of the migration rate over the MIA would also be of interest, as would averaging of the vertical components. The results of this analysis could be presented in a number of ways — for example, a plot of water level index vs. pumping rate, a plot of the average seawater migration rate versus the water level index, or plots of the average horizontal and vertical migration rates versus the water level index.

In carrying out the analysis, the information derived from the predictive simulations could be supplemented with information from the final post-development calibration run. We understand that this calibration represented the period from 1900 to 2000, and incorporated temporal pumping rates based on historical records, and changing landward boundary conditions based on parallel simulations with the southern District flow model. Again, we believe the dominance of the seaward boundary probably brought simulated water levels to equilibrium rapidly after each change in pumping and that the results could, therefore, provide additional data points for linking the water level index to pumping rate, and the rate of encroachment to the index. Particularly for the periods in which pumping was varied at four-month intervals, however, the assumption of hydraulic equilibrium should be verified by checking the simulation results at successive times.

One can imagine a series of new simulations that could be designed and implemented to supplement existing information. For example, it may be of interest to consider the effect of severe and prolonged drought on the rate of saline encroachment. This could be done through a series of simulations in which the general head boundary (GHB) heads on the uppermost layer were reduced to simulate a lower water table, inflows across landward boundaries were reduced, and pumping rates were increased to represent the heavier demands associated with drought.

SUMMMARY AND CONCLUSIONS

The Peer Review Committee found the following:

- If the objective of the water management by SWFMWD is to slow the rate of landward movement of the seawater/freshwater interface, it must reduce the pumping.

- Holding the current water levels within the aquifer will stabilize the rate of movement of the seawater interface at its current rate.

- The Committee agrees that using a 10-year moving average is a wise choice. Ten years is long enough to damp out normal wet and dry years, but not too long as to obscure the long-term trends.

- A single value, average water level for the area has the advantage that it does not single out a single well or group of wells where pumping has locally created a deep cone of depression.

- The period 1990 to 1999 seems like a good choice, even though we recognize that this period represents the highest average water level in recent years.

- The Peer Review Committee agrees that the Arc/INFO procedure, outlined in Section 6.3 of the subject document, will yield a reasonably formulated average water level figure for the Upper Floridan/Avon Park aquifer within the most impacted area (MIA).

- We prefer to refer to the average determined by the Arc/INFO procedure as an index (Florida state law may require it be called a "minimum water level").

- The Peer Review Committee agrees that the issue paper presents an effective methodology for determining whether the rate of encroachment is greater or less than that prevailing during the 1990s.

- We believe further analysis would be beneficial to link explicitly the Index (or the average water-level elevation) to both the rate of pumping and the rate of movement of the interface.

Finally we would like to compliment the staff on a job well done. The subject document presents a careful analysis of the seawater intrusion problem. It further suggests a thoughtful procedure for establishing a minimum water-level elevation for the Upper Floridan aquifer within the MIA.

APPENDIX

Notes on the Supporting Documents
As background, the Peer Review Committee reviewed in detail a number of supporting documents. Of particular interest was a series of model analyses that date back to the early 1990s — HydroGeoLogic, 1993, 1994a, 1994b, 2002. The earlier model analyses were done in two-dimensions utilizing cross-section oriented along flow lines. Two types of models were used: a sharp interface model and a density-dependent model. The 2002 analysis was done with a fully three-dimensional, density-dependent model. The model results are not identical, but the results present a coherent picture of the position and movement of the seawater interface. The fact that the results of the several analyses using different methods are coherent gives one confidence in the results.

The staff has utilized the results of the models accompanied by data collection to estimate the number of wells that will be underlain by the seawater interface during the next 50 years at various levels of groundwater pumping. Wells that are underlain by seawater are considered at risk for seawater contamination. It is helpful for management purposes to have an estimate of how wells might be at risk.

Notes on the Use of Simulation Models
The Peer Review Committee is agreed that a careful peer review of a model analysis involves independently running the actual model. We have not carried out such a full-scale review of the SWFWMD's three-dimensional, density-dependent flow and transport model (HydroGeoLogic, 2002) — we did not run the HydroGeoLogic (2002) model. However, we did review the report of the latest model analysis. On the basis of the documents we have seen, the model appears to be a well-formulated representation of the hydrogeologic system, and to offer the best approach to predictive calculations available at the present time. As with all simulation, the model is an approximation of reality which can and should be improved and refined continuously in the future; and as with all simulation, the greatest value of the model is not its predictive capability, but the insights and understanding which can be gained in that process of continuous improvement and refinement.

Simulation offers a vehicle for integrating the many complex processes controlling a hydrogeologic system; continuous updating and improvement of a model yields a continuous improvement in understanding of those processes and their interactions. We hope that the SWFWMD will view the model primarily in this context, i.e., as a dynamic and evolving vehicle for enhancing understanding of the system, rather than as a completed and static predictive tool.

We also recommend that as the transport model is refined and updated, a parallel effort be made to refine and update the sharp interface model (HydroGeoLogic, 1994b). Density-dependent flow and transport are inherently complex processes, and their analysis is inherently challenging. The maintenance of two models based upon different approaches would provide increased confidence in calculated results and increased opportunities to gain greater understanding of the hydrogeologic system. It is our understanding that the source codes of both HydroGeoLogic models are proprietary. If the source codes remain unavailable to the SWFWMD in the future, consideration should eventually be given to reformulating the models using public domain software of comparable capacity — e.g., SEAWAT (Guo and Langevin, 2002) for coupled flow and transport, or SHARP (Essaid,

1990) for an interface approach. This would ultimately enhance the SWFWMD's ability to use, modify and learn from the models.

A Note on the Saline Water Upconing Issue

Saline water contamination of an individual discharging well usually begins through the process of vertical upconing of saline water from beneath the well. The three-dimensional models of the ETB-MIA system that exist today lack the resolution to address this problem on an individual-well basis. This may change eventually as the resolution of those models increases. We believe, however, that some investigation of the vertical coning issue is warranted at the present time.

At least some wells that are considered at risk as suggested by the regional analyses carried out to date may actually have a measure of protection provided by the vertical hydrogeologic separation between the well bottom and the saline water. We recommend that studies based on single-well (r-z plane) simulation or analysis be undertaken to gain insights into the upconing process and its consequences. These studies might address, for example, the degree of protection afforded by a given vertical conductivity and thickness of geologic material, or the effectiveness of such measures as restricting pumping or plugging back the lower sections of a well. Hydraulic parameters typical of the Upper Floridan/Avon Park aquifer should be used, and well designs (particularly aquifer penetration ratios) typical of the MIA should be employed.

Reilly and Goodman (1985) provide a discussion and literature review of the saline upconing problem. An analytical solution by Motz (1992) can be used to make preliminary estimates of upconing. In the Motz solution, the critical pumping rate, relative to upconing of the seawater/freshwater interface, is determined in terms of aquifer properties and the screened (or open-hole) length of a pumped well.

A Note on Field Monitoring

We are not certain how the issue of potential changes in the density of water in the monitoring well columns will be addressed during implementation of the monitoring program. We recommend that fluid conductivity logging of the monitoring wells be carried out at regular, periodic intervals and that an updated density profile of the water inside the well column be maintained for each well. After each round of water level measurement, an equivalent freshwater head could then be calculated for each well based on the measured water level and the most recent density profile of the well.

We suggest that the water level index always be expressed in terms of equivalent freshwater heads.

Further Editorial Comments

p. 5: "They [Governing Board] further concluded that a minimum aquifer level should be established to achieve the management goal of slowing the rate of movement of the freshwater/saltwater interface."

The goal of the Governing Board should be accurately stated and consistently applied throughout the report. Generally, "slowing the rate of movement" of the interface relative to the 1990–1999 time period will require reducing the pumping rate below the 1990–1999 average pumping rate and maintaining average water levels above the minimum index water level based on 1990–1999.

p. 23: "The Governing Board…has determined that it is unacceptable to allow the rate of regional saltwater intrusion to increase beyond the current rates of movement. The methodology to establish a minimum aquifer level to protect against regional saltwater intrusion was thereby developed to achieve the management goal of slowing the rate of saltwater intrusion. The first step in management efforts to slow the rates of movement would be to stabilize the regional water level declines."

The first sentence is not consistent with the second sentence. If the Governing Board's goal is to prevent the rate of movement of the interface from increasing (i.e., the interface will continue to move inland at the same rate) relative to some time period, then the pumping rate that occurred during that time period should be maintained. On the other hand, if the Governing Board's goal is to reduce the rate of movement of the interface (i.e., slow the interface), then it will be necessary to reduce the pumping rate.

p. 27: "After examination, four of the wells were eliminated from the data set. Exclusion of a well could occur for one or more reasons."

Two of the wells are already mentioned, i.e., one (ROMP 50 Avon Park well) specifically and another well only generally. This sentence (or two) could be improved by stating specifically the reasons why the four wells were eliminated.

p. 28: "For comparison purposes, the same statistics were calculated using the 10 wells located within the MIA."

Only one method for calculating the average water level should be presented in the document. In anticipation of challenges and/or litigation, it is important that the procedure for calculating the average water level be described in such a way that the result is reproducible. Other experts should get the same result using the same data and procedure.

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Appendix 2

A Review of "Upper Peace River: An Analysis of Minimum Flows and Levels"

August 25, 2002 Draft by:
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November 2002

Executive Summary

This is a summary of the Scientific Peer Review Panel's evaluation of the scientific and technical data, assumptions, and methodologies used by the Southwest Florida Water Management District (SWFWMD) in the development of its proposed minimum flows and minimum levels (MFLs) for the upper Peace River.

To the best of its abilities, the Peer Review Panel has not only attempted to provide a critical review of the methods, data and conclusions of the SWFWMD, but has suggested a number of improvements and guidelines for future decisions on the restoration or rehabilitation of the upper Peace River. We consider the proposed MFLs to be a good *first* step in the management process, but cannot be the *only* step.

The resource management goals for the upper Peace River are to:

- Maintain minimum depths for fish passage and canoeing in the upper river
- Maintain depths above inflection point in the wetted perimeter of the stream bottom
- Inundate woody habitats in the stream channel
- Meet the hydrologic requirements of floodplain biological communities

These goals represent a reasonable subset of potential goals for an improved biotic community in the degraded upper basin. The rationale for choosing these goals is clearly presented and scientifically justified.

In general, the wetted perimeter approach does an adequate job to predict levels that will address the management goals, as described. As an initial step, maintaining fish passage, that is, the connectivity of the system, is a necessary goal. The assumption of a desired elevation of the channel at its deepest point being 0.6 feet above minimum elevation for fish passage is reasonable. The application of the HEC-RAS model to generate a wetted perimeter versus flow plot for each transect also is a justifiable scientific approach.

In order to complete an effective program of *rehabilitation* of the upper Peace River, we suggest that the current management goals may not adequately address the linkages between instream flow-related (hydraulic) habitat requirements of resident biota and discharge conditions over the range of life stages and functions of various species within the community. Future efforts to enhance the integrity of the upper Peace River may require that these linkages be established. We understand the constraints placed upon the current study and our comments are provided to encourage the SWFWMD to frequently revisit this study and to view the establishment of MFLs and rehabilitation goals as a *dynamic* process that results in improved flow criteria as new data and techniques are acquired.

The approach the SWFWMD adopted to investigate the relationship between floodplain systems and hydrologic patterns was reasonable and appropriate, based on the relationships presented in most of the published literature. However, in this system, the methods and analyses were not adequate to produce information that could be used to formulate recommendations regarding medium- and high-flow regimes on those surfaces. The SWFWMD was correct in declining to recommend specific flow criteria for that purpose. Recommendations for future studies of this nature include collection of more detailed data and adoption of a broader perspective regarding options for ecosystem management and restoration, to include actions other than flow regulation.

No specific quality assurance measures are described in the report. However, it seems clear that a variety of experienced professionals, both SWFWMD employees and consultants, were involved in project planning and subsequent field studies and analyses. If there was a failure in the quality assurance process, it was that the level of effort employed in the field studies was not carried through to data analysis and presentation of results. Much of the data collected are not presented or discussed in the draft report. In hindsight, it might have been a good idea to apply the "peer review panel" concept to the study plan development phase. This might have produced a more streamlined and more narrowly focused study plan.

The SWFWMD has completed a comprehensive data set for application to the *wetted perimeter method* for minimum flow analysis. However, the question of "best available data to establish minimum flows" cannot be entirely evaluated. There are many alternative techniques for predicting or analyzing minimum flows in fluvial systems. Some of these techniques would require more comprehensive instream physical data than reported in this study. For example, the linkage between hydraulic habitat requirements of species' life stages must be evaluated by an incremental evaluation, across each transect, of velocity, depth and substrate/cover criteria, as well as the development or acquisition of habitat suitability information for those target species. We do not know if these data were acquired as part of the generally excellent study design but not reported since they are not appropriate to a wetted perimeter estimate.

The Peer Review Panel has reviewed several techniques that it considers to be alternatives to the MFL procedures employed by the SWFWMD. All of these techniques would require a greater effort in data collection and analysis; however, the panel feels that such an analysis would lead to more sound management strategies to maintain the integrity of the catchment ecosystems. Specifically, we suggest that the instream flow incremental approach (IFIM) might be considered as the next management step as a means of connecting physical habitat requirements and availability to the MFLs already established. The software for the IFIM technique is the physical habitat simulation (PHABSIM), which combines hydrologic records (from gaging stations along the river), direct measurements of conditions at the site and biological information on the flow-related habitat requirements of various aquatic species. The output of the model is a prediction of the gains and/or losses of habitat with changes in discharge or with a proposed regulated flow regime. PHABSIM and IFIM are widely accepted as a basis for establishing acceptable flows to maintain the integrity of stream and river ecosystems. In general, instream flow analysts consider a loss of more than 15 percent habitat, as compared to undisturbed or current conditions, to be a significant impact on that population or assemblage. The analysis is completed with a time-series analysis of a yearly daily hydrograph of the stream to determine which time intervals contain long-duration low-flow periods. These are considered to be "bottlenecks" in the success of the population are management targets. We suggest that such a technique could be used for a monthly allocation process that targets remediating poor-habitat-producing, high-flow events in the upper Peace River catchment.

As noted, one of the weaknesses of the SWFWMD report is the ability to link maintenance of medium and high flows to maintenance of riparian floodplains. This linkage is a critical component for the maintenance of the integrity of the upper Peace River catchment. We suggest that the ultimate goal for restoration of that integrity will necessarily be the re-creation of that medium and high flows that establish these linkages. Regardless of the final management decisions and modeling techniques chosen by the SWFWMD to achieve this goal, there are a number of so-called building block models to provide a way to more closely mirror original hydrologic and hydroperiodic conditions within the basin. We have presented several of these building block approaches and suggest that the SWFWMD consider employment of these models as the next step in building upon an impressive and quite comprehensive data set.

Introduction

Under Florida Statutes, the Southwest Florida Water Management District (SWFWMD) provides for peer review of methodologies and studies that address the management of water resources within the jurisdiction of the SWFWMD. The SWFWMD has been directed to establish minimum flows and levels (designated as MFLs) for priority water bodies within its boundaries. This directive is by virtue of SWFWMD's obligation to permit consumptive use of water and a legislative mandate to protect water resources from *significant harm*. According to the Florida Water Resources Act of 1972, *minimum flows* are defined as "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" (Section 373.042, Florida Statutes). A minimum level is defined as "the level of ground water in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area." Statutes provide that MFLs shall be calculated using the *best available* information.

The process of analyzing MFLs for the upper Peace River is complicated by the fact that this portion of the river has been affected by substantively reduced flows that extend back at least 40 years. Establishment of MFLs generally is designed to define thresholds at which further withdrawals would produce significant harm to existing water resources and ecological conditions if these thresholds were exceeded in the future. These thresholds have been exceeded regularly for decades in the upper Peace River. Therefore, this report is focused upon determining the best scientifically defensible MFLs that if achieved in the future would reestablish improved river function and ecological conditions in the upper Peace River.

This review follows the organization of the Charge to the Peer Review Panel, addressing the questions posed and offering supporting explanation, analysis and recommendations for future management actions. It is the job of the Peer Review Panel to assess the strengths and weaknesses of the overall approach, its conclusions, and recommendations. This review is provided to the SWFWMD with our encouragement to continue to enhance water resource management in the SWFWMD and to strengthen the scientific basis for the decision-making process in the future.

1.0 THE CHARGE

The charge to the Peer Review Panel contains four basic requirements:

1. Review the SWFWMD's draft document that outlines methods used to develop provisional minimum levels for the upper Peace River.

2. Review additional documents, materials, and data supporting and/or criticizing the concepts or conclusions presented in the draft SWFWMD document.

3. Participate in an open (public) meeting at the SWFWMD's Tampa Service Office for the purpose of discussing directly all issues and concerns regarding the draft report, with a goal of developing this report.

4. Provide to the SWFWMD a written report that includes a review of the data, methodologies, models and conclusions outlined in the draft report. This report will include suggestions for additional data acquisition or suggest alternative approaches to establishing MFLs for the upper Peace River.

We acknowledge that some statutory constraints and conditions affect the SWFWMD's development of MFLs and that the Governing Board may have also established certain assumptions, conditions and legal and policy interpretations. These givens include:

1. The selection of water bodies or aquifers for which minimum levels have initially been set.

2. The determination of the base line from which "significant harm" is to be determined by the reviewers.

3. The definition of what constitutes "significant harm" to the water resources or ecology of the area.

4. The consideration given to changes and structural alterations to watersheds, surface waters and aquifers, and the effects and constraints that such changes or alterations have had or placed on the hydrology of a given watershed, surface water or aquifer.

5. The adopted method for establishing MFLs for other water bodies and aquifers.

In addition to the draft report and appendices, various types of supplementary data provided by the SWFWMD were examined as part of this review. These included reports on the hydrology of the system, selected cited literature, raw and summarized vegetation data, and spatial information provided in a GIS format. The latter showed transect locations, topographic data and the distribution of National Wetland Inventory wetland types within the study area.

The draft report puts much emphasis on documenting historical influences on the river system, and thereby establishes a historic frame of reference for understanding the changes that have taken place over the past century. This approach has allowed a careful reconstruction of historic flow patterns, with an appropriate use of climatic data to isolate actual human influences from natural patterns of variation. In addition, the SWFWMD has explicitly recognized that the concept of minimum flow must necessarily encompass a variety of complex issues if it is to reflect a broader standard of ecosystem functionality and sustainability. We commend the SWFWMD for taking this approach and encourage continued emphasis on ecosystem integrity and process in future studies of this kind.

This review was undertaken with the understanding that the upper Peace River system represents a worst case — the thorough historical overview and presentation of historical hydrologic data documents that this system is already far below any reasonable standard of ecological integrity. So, we wish to make it clear that we do not consider the standards of adequacy adopted or recommended in this report to be applicable to low-flow analyses that may be undertaken elsewhere in the region. In this case, we recognize that the SWFWMD is dealing with a severely degraded system, and the focus is rightfully on halting the decline and beginning a slow process of recovery. This necessarily differs from other systems where the aim would be to prevent degradation of functional systems.

All comments relative to instream habitat analysis, as well as wetland and floodplain studies, are provided in the context of the limitations put on these data in the report. That is:

1. The report concludes that the only recommendations that can be made at this time are for minimum flows at low-flow conditions. No specific flow criteria are recommended for floodplain and wetland systems; therefore, many of the questions posed to the reviewers are not directly relevant to those systems

2. Because of this, all comments relative to floodplain and wetland systems are directed toward the objectives of eventually formulating a recovery plan and of improving the approach for conducting analyses in other systems.

3. Therefore, with regard to riparian systems, the comments of the reviewers are framed in terms of how future studies might be structured to take advantage of lessons learned during this effort. Basically, the question is, have these studies been pursued in the appropriate way to eventually be used in setting mid- and high-flow criteria? In the case of riparian vegetation communities, the studies undertaken were a reasonable first step toward understanding the riparian ecosystem and its interaction with the stream system. There are various deficiencies in procedures and presentation (discussed below) that should be rectified in future studies, but the effort demonstrated or indicated some important points:

    a. The hydrologic controls on floodplain forest composition and structure are complex, and analyses of historic hydroperiod and flood frequency patterns are unlikely to account for all of the community variation that exists or may occur in the future. Indeed, this recovery plan must, eventually, incorporate an analysis of an incrementally altered flow regime to address seasonal changes in overriding functional and ecological needs.

    b. The data collection procedures should be refined for future studies, with the goal of understanding how community composition and structure are maintained. More detailed vegetation data and more attention to site characterization will be required if forest characteristics are to be a focus of future ecosystem assessment and management programs.

    c. The recognition by the SWFWMD that ecosystem integrity incorporates more complex concepts than simple "low-flow" criteria should be expanded if ecosystem recovery is to be effective. While some ecosystem processes can never be fully restored, other elements of ecosystem function might be particularly responsive to management, even where hydrology is irreversibly altered. With regard to riparian systems, areas that might be appropriate for further investigation include spatial considerations (such as wildlife corridors), management to assure habitat continuity for wildlife species dependent on certain community types or successional stages, and a particular focus on sites and communities where aquatic and terrestrial interactions potentially can be maintained (such as cypress swamps). Attention to these and similar areas of inquiry may represent opportunities to partially restore and sustain the overall "health" of the riparian system, even if full hydrologic restoration is not possible.

2.0 RESULTS OF THE PEER REVIEW

The draft report has established four resource management goals:

- Maintain minimum depths for fish passage and canoeing in the upper river
- Maintain depths above inflection point in the wetted perimeter of the stream bottom
- Inundate woody habitats in the stream channel
- Meet the hydrologic requirements of floodplain biological communities.

The report stated clearly that a primary objective of setting MFLs is to provide adequate hydrological conditions for the aquatic biota of the upper Peace River. The management goals include minimum depths for fish passage and canoeing, maintain depths above inflection points in the wetted perimeter of the stream bottom, inundate woody habitats in the stream channel, and meet hydrologic requirements of floodplain biological communities. These goals represent a reasonable subset of potential goals for an improved biotic community in the degraded upper basin. The rationale for choosing these goals is clearly presented and scientifically justified.
In general, the wetted perimeter approach does an adequate job to predict levels that will address the management goals, as described. As an initial step, maintaining fish passage, that is, the connectivity of the system, is a necessary goal. However, in order to complete an effective program of rehabilitation of the upper Peace River, we suggest that these goals may not adequately address the linkages between instream flow-related (hydraulic) habitat requirements of resident biota and discharge conditions over the range of life stages and functions of various species within the community. Future efforts to enhance the integrity of the upper Peace River may require that these linkages be established. We understand the constraints placed upon the current study and our comments are provided to encourage the SWFWMD to frequently revisit this study and to view the establishment of MFLs and rehabilitation goals as a *dynamic* process that results in improved flow criteria as new data and techniques are acquired.

The accompanying discussion appropriately distinguishes between the importance of maintaining periodic linkages between aquatic and floodplain systems (particularly focusing on productivity of both) versus the influence of "hydroperiod" in maintaining plant community mosaics. The stated approach is to focus on plant communities and associated periods of inundation. A separate effort is directed toward developing an analysis of the relationship between hydrologic zones and the life history requirements of selected fauna.

Our comments are framed in response to the tasks established for the Peer Review Panel by the SWFWMD.

Task 1: Determine whether the method used for establishing the minimum flows and levels is scientifically reasonable.

(a) Supporting Data and Information

The supporting data and information have been drawn from a variety of sources and summarized in the first three chapters of the report. The general supporting data include (1) basin characteristics, (2) hydrologic trends and water quality, and (3) ecological resources and key habitat indicators.

The basin characteristics include watershed location, climate and rainfall, physiography, river channel and floodplain morphology, hydrology and hydrogeology, and a chronology of watershed development. A useful map of the Peace River drainage basin is presented (Figure 2-1) that locates the catchment, urban areas, the upper basin and the U.S. Geological Survey (USGS) gage sites. The climate and rainfall data are comprehensive and provide a reasonably long-term record back to 1940. Physiographic provinces are derived from a geomorphic analysis by White (1970). Larger scale river channel and floodplain morphology come from USGS elevation surveys in the region. Hydrology and hydrogeology data are compiled from reports from the South Florida Water Management District and USGS, and these data provide a good overview of regional hydrology and hydrogeology. The chronology of watershed development is thorough and a useful overview to the changes that have occurred in the upper Peace River from 1800 to the present. We agree that the background data on basin characteristics is a thorough compilation and scientifically reasonable.

Hydrologic trends for discharge and water levels are based on three USGS gage sites in the upper Peace River basin. The Peace River gage dates from 1939, the Fort Meade gage from 1974, and the Zolfo Springs gage from 1933. Data quality for discharge is estimated at an accuracy of 5 to 8 percent. Trends can be accurately determined, especially from the two gages with records back to the 1930s. There also is a series of reports and papers dating from 1990 that document declining flows in the Peace River. Analyses methods and statistics are reasonable and properly applied. Exceedance flows were used to examine long-term trends, and these analyses strongly support the conclusion of declining flows in the upper Peace River basin, particularly from the 1980s to the present. Water levels also declined significantly over the period of record and are analyzed correctly.

The draft report also analyzed the factors affecting flow in the upper Peace River. Declines in the artesian aquifer levels in the upper Peace basin are large for peninsular Florida and contribute significantly to declining flows. Other factors, such as long-term changes in rainfall, groundwater withdrawals, wastewater discharges and structural modifications within the basin, also are presented in depth. We particularly commend the SWFWMD for a thorough and perceptive analysis of climate variability that impacts rainfall and runoff at the decadal time scale. These longer-term effects on precipitation and discharge are beginning to be linked to sea surface temperature patterns worldwide and are important when examining long-term trends. The analyses of the four sub-basins that make up the upper Peace River basin (Peace Creek, Saddle Creek, Zolfo Springs and Payne Creek) are informative and rigorous. We strongly concur that the proposed minimum flows will require some type of recovery as the data show that they are not presently being met.

Water quality also is considered in the draft report. Total phosphorous levels in the upper Peace River are exceptionally high due to the parent geology of the region and extensive phosphate mining in the basin. Increased agricultural impacts on water quality are indicated by the highly significant increase in solute concentrations of potassium through time. In general, data support the interpretation that improving water quality in the upper Peace in recent years is linked to a reduction in mining activity and improved wastewater treatment.

Given the objectives of the study, data collection for the riparian zones was approached in an appropriate way. The historic analyses of hydrology and designation of hydrologic "zones" along multiple transects was a good way to establish a framework for subsequent investigations of plant distribution and animal life history analyses. Although neither of these latter studies was able to answer many of the questions they were intended to address, they were reasonable first steps in what will be a stepwise, adaptive learning process. Basically, if the vegetation and soils studies are viewed as a pilot effort intended to guide future work in this basin and others, then the data collection approach was reasonable.

No specific quality assurance measures are described in the report. However, it seems clear that a variety of experienced professionals, both SWFWMD employees and consultants, were involved in project planning and subsequent field studies and analyses. If there was a failure in the quality assurance process, it was that the level of effort employed in the field studies was not carried through to data analysis and presentation of results. Much of the data collected are not presented or discussed in the draft report. In hindsight, it might have been a good idea to apply the "peer review panel" concept to the study plan development phase. This might have produced a more streamlined and more narrowly focused study plan.

The only explicit "exclusion" of data discussed in the report concerned the parsing of historic flow data to exclude periods of anomalous rainfall patterns. This appears to be a reasonable thing to do. With regard to the vegetation data, some analyses and discussion that would have been anticipated based on the data collection methods did not appear in the report. Specifically, there was little reference to the understory and seedling composition data, which presumably were collected specifically to examine patterns of change in response to altered hydrology and hydroperiod.

The SWFWMD has completed a comprehensive data set for application to the *wetted perimeter method* for minimum flow analysis. However, the question of "best available data to establish minimum flows" cannot be entirely evaluated. There are many alternative techniques for predicting or analyzing minimum flows in fluvial systems. Some of these techniques would require more comprehensive instream physical data than reported in this study. For example, the linkage between hydraulic habitat requirements of species' life stages must be evaluated by an incremental evaluation, across each transect, of velocity, depth and substrate/cover criteria, as well as the development or acquisition of habitat suitability information for those target species. We do not know if these data were acquired as part of the generally excellent study design but not reported since they are not appropriate to a wetted perimeter estimate. We offer comments on alternative study designs for the future in our Task 3 response, below. With respect to floodplain communities, this is a moot question since no relevant flow criteria were recommended. However, the report states that there is intent in the future to address medium and higher flows relevant to floodplain systems, and there are a number of possible avenues to be explored in future studies (see Task 3 response, below).

(b) Technical Assumptions

The technical approach for establishing MFLs included field studies and hydraulic modeling. The hydraulic modeling and statistical analyses of streamflow records were coupled with the field studies of river transects in the upper Peace Basin to evaluate fish passage depths and the inflection points for the wetted perimeter of the channel. The hydraulic modeling used the HEC-RAS model developed by the U.S. Army Corps of Engineers. This is a relatively new model and is typical of a growing number of unlinked models using hydrographic techniques to estimate minimum flows (Gore and Mead 2002). We consider the HEC-RAS model an appropriate tool for assessing flow-stage relationships at various points along the river. The assumption of a desired elevation of the channel at its deepest point being 0.6 feet above minimum elevation for fish passage is reasonable. The application of the HEC-RAS model to generate a wetted perimeter versus flow plot for each transect also is a justifiable scientific approach.

Cross-sectional surveys of instream and floodplain habitats were carried out at 18 transects throughout the upper Peace River basin. This is a valid technique to address the types of habitat that would be affected by increased base flows, higher water levels and the role of medium and high flows for connectivity with wetland ecosystems. The cross-sectional data were entered into the HEC-RAS model to determine inundation characteristics for various habitats. This is a scientifically reasonable approach. A relatively complete set of 13 habitat types was mapped and GPS coordinates taken. Wetlands also were classified during the cross-sectional surveys. There does not seem to be an indication as to whether the wetland classification and characterization played any role in setting MFLs for the upper Peace River.

The assumptions relevant to floodplain systems are stated clearly enough and focus on addressing the overall management goal to "meet the hydrologic requirements of floodplain biological communities." The principal assumptions made are that the "riparian hardwood and cypress swamps" require seasonal flooding to maintain "biological integrity," and that the lower and upper floodplain zones require enough periodic sustained flooding to at least exclude upland vegetation. Specific comments on these assumptions are:

a. <u>Maintenance of biological integrity in lower elevation swamps</u>

   Chapter 4 of the <u>report</u> provides some discussion of the concept of "biological integrity" that includes consideration of interactions between aquatic and terrestrial systems. These complex interactions are represented in the analysis by focusing on the life history requirements of selected amphibians (frogs and toads). To an extent, the use of anurans as surrogates for a broad suite of floodplain wildlife (and other aspects of "biological integrity") is reasonable, considering the limited charge to the SWFWMD to use "available information" to guide the development of minimum flow recommendations. There is considerable merit in using these groups, as they represent a range of dependence on the presence of surface waters — from animals using temporary pools for reproduction (e.g., toads) to animals that are essentially aquatic and require permanent or near-permanent ponds or channel flow (e.g., bullfrogs). However, the focus on this range of habitat use was not carried through the analysis, which did not recognize that the temporary nature of some surface waters was as important as long-duration flooding in others. Also, in the future, we think more focus could be placed on other groups of animals, such as breeding birds and fishes that use off-channel habitats, even if only in terms of literature review and inference. Similarly, future studies should include more detailed discussions (literature-based) of other aspects of "biological integrity," such as nutrient interactions with aquatic systems.

b. <u>Periodic sustained flooding is needed to maintain upper and lower floodplain vegetation</u>

> This assumption is reasonable, based on the body of published literature, which repeatedly focuses on flood frequency and duration as the principal determinants of floodplain vegetation characteristics. But, as this study demonstrates, even very careful hydrologic analyses spanning half a century or more of record is difficult to specifically relate to observed vegetation patterns in lowland forested systems. Floodplain forests simply do not respond in a dramatic fashion to reductions in flooding — woody species' dominance patterns change slowly and respond to a variety of environmental factors besides flooding. Based on the soils and site information provided in the report, even invasion by upland species is unlikely to occur rapidly, and probably will never occur over large areas. It is clear that the upper and lower floodplain zones are complex systems that maintain hydric conditions in many areas due to precipitation storage and groundwater interactions in addition to the effects of flooding. Therefore, although the basic assumption reflects widely accepted ecological theory, in many ways it is too simplistic.

Thus, the assumptions upon which the riparian studies were based were probably too generalized, but they should not have been "eliminated" for that reason. Additional assumptions may have been appropriate, and probably should be incorporated into the design of any future studies of this type. Other analyses, discussed elsewhere in this review, would certainly be appropriate in the future, based on what was learned in this effort. However, they would not likely require "fewer assumptions." Rather, they would provide a more complete understanding of this complex system.

(c) Procedures and Analyses

The output from the HEC-RAS model and the field investigation at the 18 surveyed transects served as the basis for establishing recommended MFLs. Fish passage depths and wetted perimeter inflection point analysis were used to set MFLs. The report purposely focuses primarily on MFLs and recommendations at this time. We agree that this is a reasonable approach for this substantively degraded river ecosystem.

Minimum flows for fish passage are proposed to be set at 16 cubic feet per second (cfs) at Bartow, 27 cfs at Fort Meade and 45 cfs at Zolfo Springs. The report recommends that these MFLs be achieved at least 95 percent of the time annually. We believe these are scientifically reasonable target values with defensible justification to support of connection of currently isolated stretches of river and to promote fish passage.

Flows required to inundate transects to the surveyed "inflection" points provided similar values (17 cfs at Bartow, 26 cfs at Fort Meade and 26 cfs at Zolfo Springs). Based both on fish passage and wetted perimeter analyses, low minimum flows of 17 cfs at Bartow, 27 cfs at Fort Meade and 45 cfs at Zolfo Springs are recommended for exceedance 95 percent of the time annually. The data analyses support these recommendations made in the report.

Channel characteristics of the upper Peace River establish a landscape setting for the determination of MFLs. Many of these features, however, remain disconnected, hydrologically, except under medium or high flows, which are not considered for recommendations within this report. Lateral and vertical habitat distributions were analyzed in detail with a particular emphasis on woody instream habitats. These habitats are particularly critical for aquatic invertebrates in lowland rivers and a focus on this habitat component is well justified. Inundation patterns for large woody debris and tree roots make good sense as attributes to consider when evaluating both MFLs and annual flow regime requirements.

The SWFWMD report discusses the need for a range of flows for numerous biological requirements of river and riparian biota. No firm recommendations are made, but some guidelines are suggested for biofilm development, aquatic invertebrates and amphibians. A similar hydrologic overview is presented for wetlands in the upper Peace River corridor. Wetland classification and vegetation distributions are presented, along with inundation patterns for many of the relict swamps and wetlands in the upper basin. Although useful in the context of establishing present conditions, these data do not play a significant role in the setting of MFL recommendations. In the Task 3 section, below, we discuss the alternatives that must be considered in order to incorporate support of other aquatic life uses to establishment of a minimum flow management strategy.

The use of floodplain habitats by wildlife focuses upon amphibians. The large number of vertebrate and invertebrate species that utilize the floodplain necessitates working with a subset of organisms. Amphibians were chosen for their potential value in assessing wetland conditions due to the variable hydrologic conditions required of different species. These inundation requirements for frog and toad breeding habitats make these species potentially valuable integrative indicators of present condition in the upper basin and possible indicators of improved conditions if inundation periods increase in the future in riverine wetlands within the upper Peace River basin.

Minimum flows and water levels are proposed for adoption at the three USGS gages in the upper Peace River basin. These flows and water levels are based on fish passage requirements and improved wetted perimeters based on surveyed geomorphic inflection points. The scientific analyses used to establish these recommended flows and levels are adequately described within the report and scientifically justifiable. Consideration of channel flow characteristics under these minimum discharge recommendations would be an additional factor worth evaluating, since support of both macroinvertebrate and vertebrate populations have been linked to these conditions (Statzner et al. 1988, Heede and Rinne 1990). The recommended minimum flows and water levels in this report, however, are based upon good hydrologic data, a well-established modeling protocol and detailed measurements of channel habitat at multiple locations. We concur that the recommended MFLs represent thorough scientific analyses of good quality historic and present data sets, and the recommendations are scientifically defensible and justifiable to meet the state management objectives.

Task 2: If a proposed method is not scientifically reasonable, the consultant shall address deficiencies and remedies.

Competent professionals conducted the data collection and analysis and we did not find any of the proposed methods to not be scientifically reasonable. The report provides a thorough review of basin characteristics, hydrology trends, water quality trends, ecological resources of concern and key habitat indicators. The technical approach for determining MFLs included HEC-RAS modeling to determine fish passage depths and wetted perimeters, cross-sectional surveys of instream and floodplain habitats, and analyses of inundation characteristics of instream and floodplain habitats as a function of discharge and water levels. These methods are scientifically reasonable and appropriate. Additional information on flow velocities associated with MFLs would enhance the overall analyses, but the proposed methods are appropriate for the task of establishing MFLs for the upper Peace River to meet the stated management objectives.

Although they do not require remedy with respect to this report, some deficiencies in the evaluation of the riparian zones should be noted:

1. Combination of all vegetation data within a zone obscured any within-zone site variation.

2. Use of simple frequency as a descriptive statistic for vegetation obscured any dominance shifts that might be detectable.

3. Focus on anurans as surrogates for overall "biotic integrity" has some reasonable basis. However, the logic used in that analysis is difficult to follow. The report might also have benefited from more extensive discussions (based on literature) of other ecosystem functions that are dependant on interactions between the aquatic and floodplain systems.

As mentioned early, deficiencies in the vegetation studies do not require remedy with respect to this report. For reasons unrelated to the study results, the SWFWMD is not recommending flow criteria relevant to vegetation maintenance. However, for future studies in this or other systems, a number of changes might be appropriate in the approach and analysis, and some of these are described in the Task 3 response, below. For the purposes of this report, however, the discussion presented in Section 6.6.2 might be revisited to improve clarity. With regard to the discussion of minimum inundation criteria to support anuran populations, some additional explanation and clarification also is in order.

The deficiencies that require remedy for the purposes of this report involve some revision of the narrative and tables pertinent to vegetation data summarization and the discussion of anuran minimum-inundation requirements. The problems in the vegetation summary can be partly remedied by improving the tables, particularly Table 6-9, and more directly relating them to the points made in the discussion. Then, a more explicit discussion would be appropriate regarding how the vegetation data did or did not answer fundamental questions posed by the study. Were any patterns detected of vegetation change relative to the hydrologic record? Why not?

Similarly, an expanded discussion would be appropriate regarding the logic behind adopting a 90-day, 3-year criterion for anuran habitat. The report (Section 6.7.1) states that "…the bullfrog is an indicator of healthy river hydroperiods…," yet the recommended minimum inundation period is far shorter than that presented as necessary to sustain bullfrog populations. This would seem to require further explanation, yet none is offered.

All of the deficiencies that are pertinent to the recommendations made in this report can be remedied with revisions of the text, as described above. There are also deficiencies in the basic study design which do not influence the recommendations made in this report, but should be addressed in any future studies of this nature. Specific suggestions for improving the study design are offered in the response in Task 3, below.

Task 3: If a given method for establishing minimum flows or levels is scientifically reasonable, but an alternative method is preferable, the reviewer shall list and

describe the alternative scientifically reasonable method(s) and include a qualitative assessment of the effort required to collect data necessary for implementation of the alternative method(s).

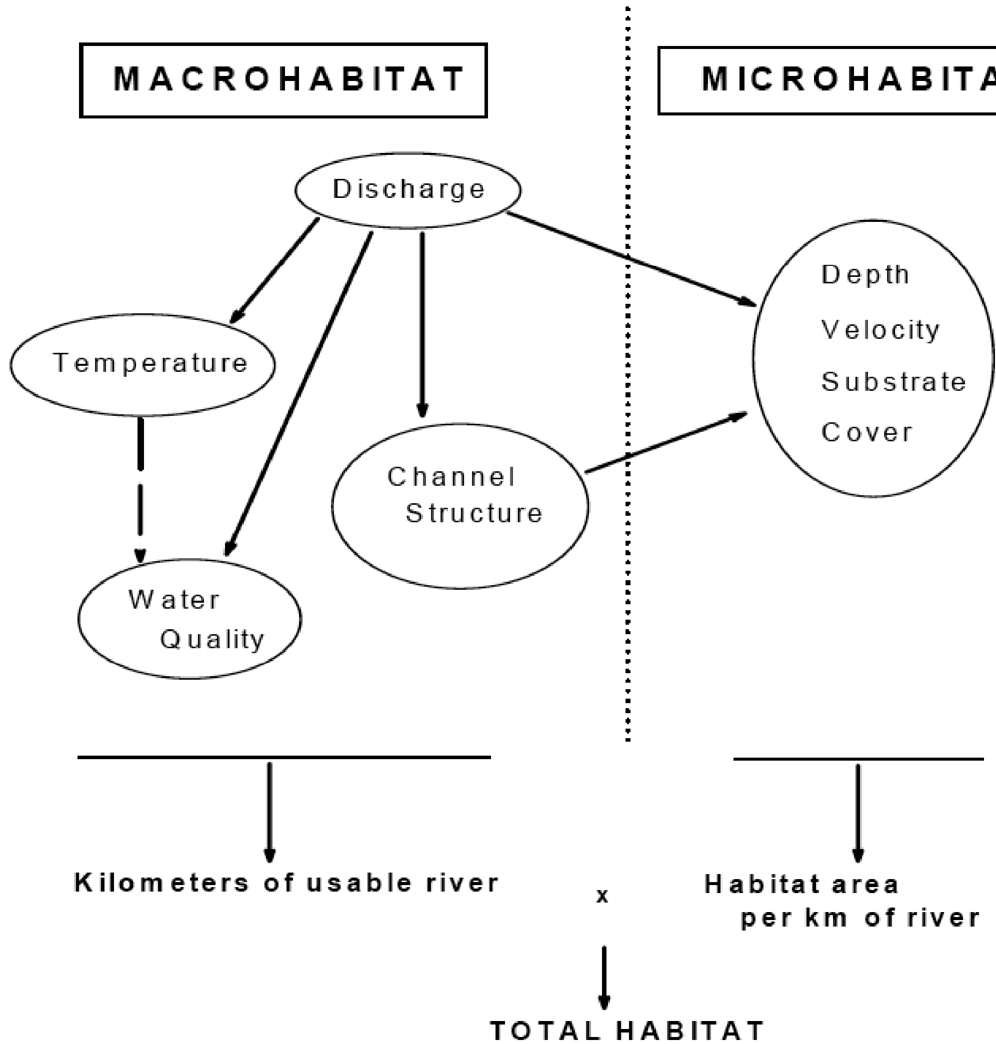
We believe that the methods used for establishing MFLs for the upper Peace River are scientifically reasonable and an adequate initial step to creating a minimum-flow management strategy that will act to enhance a deteriorating river condition. The proposed MFLs are a good first step in the goal of rehabilitating the upper Peace River. However, one additional analytical component could be added to the analysis and decision-making process for establishing flows and levels. This would be an analysis of how MFLs would impact flow conditions; that is, hydraulic habitat in the river. As previously mentioned, certain fish and macroinvertebrate species, in particular, may require certain ranges of velocities or other complex hydraulics (as combinations of depth, velocity and substrate; see Bovee 1986, Layzer and Madison 1995, and Gore et al. 2001) for successful reproduction, incubation and sustained viability. A modeling study of flow velocities at various locations in the upper Peace River, coupled with field measurements under appropriate flow regimes, would be a helpful addition to the otherwise thorough study used to determine MFLs.

The SWFWMD has chosen to use the wetted perimeter technique, among the most popular techniques to attempt a combination of habitat data and hydrographic information (Nelson 1980, Gore and Mead 2002). It is generally assumed that providing and maintaining a wetted riffle promotes secondary production, fish passage and adequate spawning conditions. A modification of this approach is to select a set of cross-sections that represent the range of habitats available. A coefficient of the sensitivity to dewatering may also be applied to each cross-section. As might be expected, the shape of the cross-section of the channel has considerable influence on the ability of this method to be useful in making management decisions. Thus, the wetted perimeter technique is most useful at cross-sections that are wide, shallow and relatively rectangular. As cross-sectional geometry becomes more complex, the ability to detect a distinct MFL becomes more difficult. Indeed, the SWFWMD report acknowledges that not all transects were able to demonstrate a distinct "breakpoint" where the wetter perimeter was complete.

Although the wetted perimeter technique has done an excellent job in predicting the wetted perimeter and levels necessary for fish passage, the stated management goals of the SWFWMD report, we do not believe that these minimum flows will ultimately guarantee the ecological integrity of the upper Peace River. The next step in the rehabilitation of the upper Peace River will be to explore the relationship between hydraulic habitat at various discharges and the distribution of biota in the upper Peace River. Indeed, the data set already presented lacks only velocity measurements at intervals along each transect from being able to accomplish this sort of analysis. The Instream Flow Incremental Methodology (IFIM) (Bovee et al. 1998) and its software, the Physical Habitat Simulation (PHABSIM) require the type of data already acquired in the report, plus the additional effort of determining the physical habitat requirements of target biota.

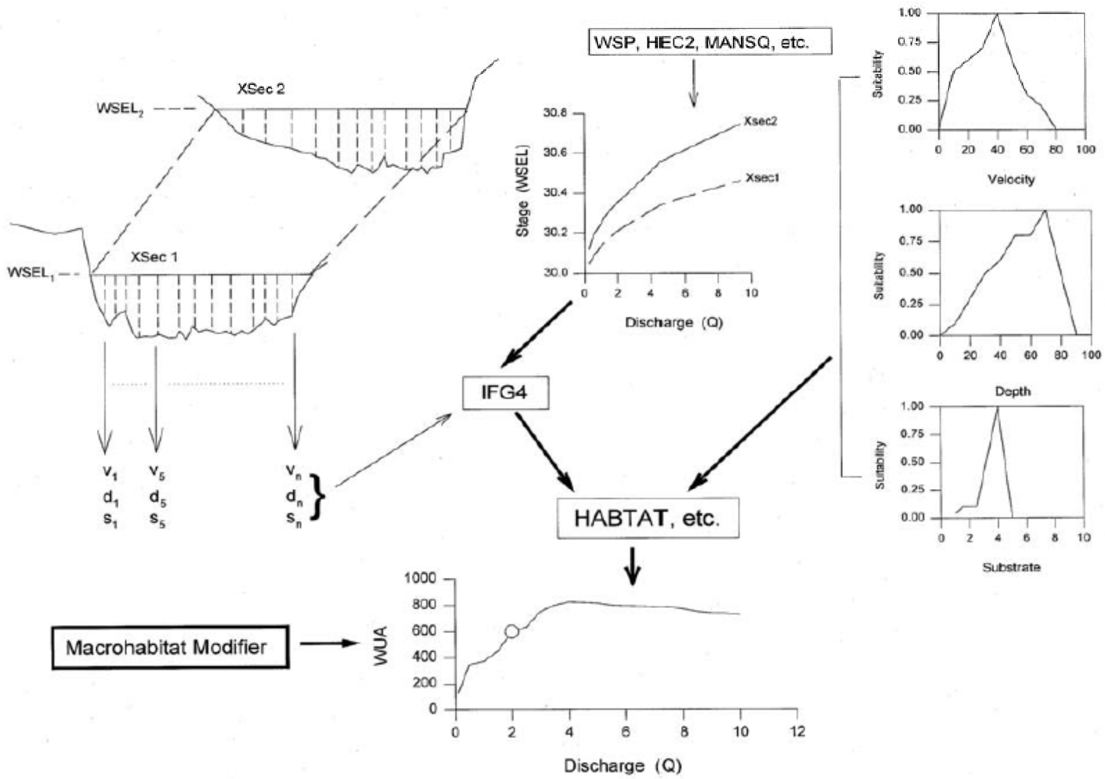
In general, there are five major hydraulic conditions that most affect the distribution and ecological success of lotic biota. These are suspended load, bedload movement and water column effects such as turbulence, velocity profile and substratum interactions (near bed hydraulics). Singly, or in combination, the changes in these instream conditions can alter distribution of biota and disrupt community structure. Within a stream reach the interactions of these hydraulic conditions upon the morphology and behavior of the individual organisms govern the distribution of aquatic biota. IFIM attempts to describe these interactions in a relatively simple modeling technique.

IFIM and PHABSIM are often thought to be synonymous. In fact, IFIM is a generic decision-making model that employs systems analysis techniques. IFIM guides stream managers in the process of choosing appropriate targets, endpoints and data requirements to achieve the management goal. At one level or another, IFIM requires a substantive knowledge of how aquatic habitat value changes as a function of incremental changes in discharge. This knowledge must be employed a priori, during the negotiation phases of the decision-making process. Replicate habitat sampling, biological sampling for the development of habitat suitability curves, sediment and water routing studies, as well as physical habitat, temperature and water quality simulations may be necessary to properly depict the condition of the catchment under new operating scenarios (Sale 1985). In IFIM, habitat suitability is treated as both macrohabitat and microhabitat. Macrohabitat suitability is predicted by measurement and/or simulation of changes in water quality, channel morphology, temperature, and discharge along the length of the managed reach. Much of these data requirements has already been collected and reported in the current SWFWMD study. These conditions may have an overriding impact upon decisions made at the microhabitat level. Microhabitat suitability consists of individual species' preferences for these same criteria, reflected as depth, velocity, substrate or channel condition, and cover. Those individual preferences are incorporated into PHABSIM to obtain predictions of changes in available habitat at a selection of stream segments, "typical" of the reach being managed. In combination, microhabitat and mesohabitat provide the information necessary to adequately determine management alternatives.



[Adapted from Stalnaker et al. 1995, Gore and Mead 2002]

The microhabitat evaluation within the IFIM methodology is completed through PHABSIM. Through a series of subroutines programs contained within PHABSIM, a prediction of the amount of available habitat (as weighted usable area, WUA) for a target organism over a range of discharges is created. HABTAT and its associate programs require hydrologic information in the form of transect (cell-by-cell) information on depth, velocity, cover value and/or substrate composition) and biological information in the form of preferences or suitabilities for these conditions by the target organism. Where possible, the hydraulic information for each transect should be measured. However, there are several "desk-top" simulations that can also simulate these data when field measurements are not available or impossible to measure (in the case of very large rivers or those with rapidly varying, unsteady flow). In addition to simulations within PHABSIM (routines such as WSP, MANSQ and IFG4), other hydraulic simulations are frequently used. These include steady-state models such as HEC-2 (USACE 1982) and dynamic flow models such as RIV1H and BIRM (Johnson, 1982,1983). Regardless of how the hydraulic information is provided to PHABSIM, stage-discharge relationships are provided to the hydrologic simulation (usually IFG4) that predicts changes in velocity, cell-by-cell, with changes in water surface elevation. This prediction is accomplished through a series of back-step calculations through Manning's equation or, at the option of the user, Chezy's equation. This assumption assumes that substrate or channel geometry will remain stable over the range of discharges to be simulated. As an alternative, Jowett (1998) has suggested that on-site measurement of changes in hydraulic geometry provide estimates comparable to the back-step predictions contained within IFG4.



[Schematic of the PHABSIM model. The circle on the WUA/Discharge plot (above) represents the discharge at which 15 percent of habitat is lost]

Thus, the PHABSIM model, in its current form, represents, at best, a quasi-two-dimensional model, since it distributes velocities and discharges laterally along each transect. Cell-by-cell evaluations of weighted usable area (the product of preference criteria for each of the hydraulic conditions simulated and the total surface area of each cell) are computed through HABTAT and related subroutines. Although the WUA/Discharge relationship can provide information on the potential gains and losses of habitat with changes in discharge and can provide information on the apparent optimum and minimum flows, the output of PHABSIM is often not the product from which flow decisions are made. It will still be necessary to determine the relationship between optimum and minimum flows and their duration during wet and dry conditions. That is, the decision-makers must decide what percentage of the time a selected flow is met or exceeded during an average hydrographic and during unusually wet or dry years. This is accomplished through the Habitat Time Series (HTS) component of IFIM (Milhous et al. 1990). Such conditions as median habitat value over 10 or 20 years of record, the percentage of available habitat if certain magnitudes of flood were attenuated or enhanced, and the duration of low habitat conditions are typical predictions of a HTS evaluation. Decisions are usually based upon an established goal (most often no greater than a 15 percent loss of available habitat).

Traditionally, the IFIM technique has focused on habitat availability of target fish species. Gore and Nestler (1988) believe that habitat suitability curves can be thought of surrogates for basic niche. That is, the derived suitability curves reflect maximized density when preferences approach unity. This should not, however, be interpreted as the equivalent of the carrying capacity of the system. The conversion to WUA is an attempt not to predict density changes, but changes in relative habitat quality and availability.

Habitat suitability information can come from a variety of sources. Most frequently, resource managers use published suitability curve information (the so-called "Blue Book" series published by the U.S. Fish and Wildlife Service). However, on-site development of habitat suitability criteria often produces the most accurate predictions (Bovee 1986). Among fish species, habitat suitability is most often generated for spawning, incubation, fry, juveniles and adult stages. Frequently, when several life stages are involved, several different release scenarios must then be considered to assure the success of all life stages. In salmonid streams, this type of evaluation is relatively simple. However, as the number of species of concern increases, the decision-process to provide adequate releases to support all species and life stages becomes quite complex. Competitive interactions between species assemblages can result in significantly different species preferences among several streams in the same catchment (Freeman et al. 1997); thus, making transferability of standard curves impossible. In warm water streams, where fish communities can be dominated by a variety of species using distinctly disparate habitats, Leonard and Orth (1988) have suggested that "habitat guilds" are more appropriate than individual life stages or species-specific habitat suitability criteria. These kinds of compromises support Gore and Nestler's conclusion that the appropriate use of IFIM, in its current composition, is as a predictor of habitat quality rather than as some surrogate of density or productivity.

The instream flow requirements for benthic macroinvertebrates received equal attention during the development of IFIM (Gore and Judy 1981). However, most stream managers have largely discounted these considerations because of perceived difficulties in collection (large sample size), taxonomic identification and habitat suitability curve generation, as well as inability to assign "benefit" to the maintenance of benthic communities. Instead, many regulatory agencies and managers have concluded that enough flow for target fish species (and their individual life stages) is also sufficient for benthic species. Only recently have benthic macroinvertebrate habitat conditions become a frequent component of IFIM analysis. These applications have been quite generic, based upon curves created from literature surveys (the Delphi approach, Bovee 1986) or broadly-defined curves (at the ordinal level; Peters et al. 1989). However, Statzner et al. (1988) and Gore and Bryant (1990) have demonstrated that different macroinvertebrate life stages require different hydraulic conditions to achieve completion of life cycles, just as fish species have very different spawning, incubation and maintenance requirements. Most recently, Gore et al. (2001) demonstrated that inclusion of macroinvertebrate criteria often dramatically alter decisions on flow reservations when previously made, based upon fish species alone.

The level at which the SWFWMD may want to employ such a modeling system will vary with the management goals. The table below (adapted from Gore and Mead 2002) suggests the possibilities.

Target for Evaluation	Type of Model
Longitudinal succession	One-dimensional macrohabitat models – temperature, dissolved oxygen, other dissolved chemicals. Evaluate: degree-day accumulations of temperature, thresholds of tolerance and extent of available acceptable conditions.
Habitat segregation or patchiness	Two-dimensional microhabitat models – depth/velocity or complex hydraulics (especially shear for mussels) in association with substrate materials and cover in small streams.
Variable meteorological processes	Time-series analysis: total amount of usable habitat in the aggregate over the stream network. Evaluate seasonal occurrence and duration of ecological bottlenecks associated flood, drought or human-created water demands.

IFIM procedures and PHABSIM software are widely known and easily accessible through Internet links to the USGS Midcontinent Ecological Science Center (http://www.mesc.usgs.gov/). Since the SWFWMD has already surveyed a comprehensive set of transects for this study, it would be a relatively easy task to revisit those same transects and to record changes in velocity distribution and substrate/cover characteristics at regular intervals along each transect. These data, combined with stage/discharge relationships for each transect, provide the calibration data for PHABSIM. The most time-consuming and labor-intensive portion of the process would be in the acquisition, more likely development, of habitat suitability criteria for target fish species of concern in the upper Peace River. Only a relatively few species (Florida gar, bluegill, largemouth bass, black crappie, gizzard shad, golden shiner, threadfin shad, brown bullhead and channel catfish) are currently available. However, the acquisition of field data to create the habitat suitability criteria is fairly easily accomplished within a few months time. Macroinvertebrate criteria are currently available (Gore et al. 2002) and the USGS have "Blue Book" criteria for recreational boating (canoeing and kayaking, for example) as another management tool for use in the IFIM process.

We suggest, then, that in its planning process for further rehabilitation and management of the upper Peace River, the SWFWMD consider IFIM procedures that link hydraulic habitat of target biota to the already obtained hydrological and physical data described in this report.

Regarding the evaluation of riparian wetlands, we recommend a set of specific changes for any future studies of floodplain systems, either in the upper Peace River or in similar stream systems. These are based on the lessons learned in the upper Peace so far, as well as other work in lowland forest systems of the southeastern United States.

1. The historic hydrologic analysis, establishment procedures for transects and designation of major ecological zones should all be retained and used for additional studies if possible. However, additional work should be done to recognize fairly subtle subdivisions within those zones, particularly in terms of geomorphic settings that differentially influence ponding and soil moisture conditions. The data provided for review clearly indicate that, within a single transect segment (zone), there is considerable variation in drainage conditions. It seems likely that there are many sites that are

strongly influenced by precipitation storage and shallow subsurface flows, and these factors can easily mask any changes in seasonal stream overflow patterns. For example, the allusion to certain areas as "flatwoods" and the identification of hydric soils in the highest floodplain zone tend to support this view of precipitation storage and soil saturation as an important factor in determining overstory composition. Similarly, the distribution of species like Carya aquatica across all zones suggests that small depressions are present throughout the system. National Wetland Inventory mapping rarely is sufficient to detect such microsite variation — it must be recognized and classified in the field (though soil survey mapping is sometimes sufficient). However, by combining all vegetation into a single belt transect "plot," this study assured that minor site variation within each zone was not detected by the field studies. The use of frequency of occurrence as the principal descriptor of vegetation further blurred differences between and within zones. The discussion indicates that there are strong dominance tendencies associated with each zone, easily recognizable in the field, but these cannot be described adequately unless the samples are stratified by drainage, soils and/or geomorphic setting, and the sample data are summarized quantitatively (e.g., using relative dominance based on basal area).

2. One of the basic purposes of this effort was to detect changes in composition that could be related to the documented changes in hydrology over time. This was an ambitious goal, and it is one that is difficult to address in most lowland forest systems. In fact, we are aware of no studies that could demonstrate specific and clear effects of altered hydrology on southeastern lowland forest composition and structure, except in cases of distinct increases in water levels, or in communities at the extreme ends of the hydrologic gradient (e.g., bald cypress stands along lakeshores). However, given the carefully reconstructed hydrologic record for the study sites used in this project, it may be possible to detect such changes if the vegetation sample sites are stratified as described above. Seedling and sapling composition can then be examined within a subset of those samples where forest openings have occurred within the period of the hydrologic record. This will reduce or eliminate the influence of shading on seedling survival, and may produce a clearer picture of any trends toward a shift to a "drier" forest within a zone. However, this approach definitely requires that site variation due to ponding and interflow be accounted for.

3. Recognition of site variation and the importance of internal water storage and movement in maintaining plant communities produces a different conceptual model of ecosystem processes than the one that guided this study. Rather than focusing exclusively on flooding as a control on riparian characteristics and functions, the system might better be conceived as a series of terraces (rather than floodplain zones), each of which has and will retain unique wetland characteristics regardless of flooding regimes. In that sense, they function as part of the river corridor, even if direct interactions with the aquatic system have been reduced. The unique functions and processes that occur on these sites, both flood-related and otherwise, should receive attention as part of the overall resource management and recovery program.

4. Regardless of the effects on plant communities, changes in flooding will certainly have significant effects on a variety of other ecological interactions. Even without additional field studies, there is ample ecological literature to support a thoughtful assessment of the likely effects of altered hydrology on stream-floodplain interactions (nutrient

exchange, use of floodplain sites by aquatic species, etc.). Similarly, terrestrial wildlife use of the riparian area can be evaluated in considerable detail simply from life history requirements, as was done for the assessment of probable anuran responses in the draft report. The feeding habitat needs of various waterfowl, for example, can be considered in terms of the availability and timing of water bodies of various depths. The analysis of amphibian habitat used in the report (keying on duration of inundation) can be complemented by an assessment of the presence of temporary (usually precipitation- or groundwater-based) pools, which are important to many amphibians due to the absence of fish predators. Spatial and temporal considerations also can be brought into play in developing adaptive management approaches for systems such as the upper Peace. For example, nesting by colonial water birds may require that stands of particular tree species be available, and that those stands be of sufficient size and contain trees of sufficient stature to support nesting by the target species. Under natural conditions, such stands may have been initiated at regular intervals by channel migration and the creation of new substrates, followed by colonization by pioneer species that would form even-aged stands in patches throughout the system. Under modern conditions, providing such habitats may require more active intervention, such as planning for periodic regeneration of large stands of trees in sites scattered throughout the riparian corridor. It may also require that those target sites be isolated from human disturbance. Similar management strategies can be developed to address neotropical migrants, small mammals such as bats, and a wide variety of other species. The point is, ecological management of a river corridor in the modern, developed environment should focus on potential restoration and management actions beyond recovery of minimum flow levels, or even flow regimes. Whatever the flooding regime that can be established and maintained, there must be a healthy riparian system interacting with it if full ecological benefit is to be realized. This in turn must be based on the recognition that some processes that once operated in these systems have not been lost, while others cannot be fully recovered — they must be replaced either with direct management, or new models of ecosystem function should be adopted that reflect the reality of the altered environment. Taking such an approach will allow limited resources to be applied where they can do the most good, rather than being expended trying to recover an unrecoverable condition.

As previously mentioned, one of the weaknesses of the SWFWMD report is the ability to link maintenance of medium and high flows to maintenance of riparian floodplains. This linkage is a critical component for the maintenance of the integrity of the upper Peace River catchment. We suggest that the ultimate goal for restoration of that integrity will necessarily be the re-creation of that medium and high flows that establish these linkages. Regardless of the final management decisions and modeling techniques chosen by the SWFWMD to achieve this goal, there is a number of so-called building block models to provide a way to more closely mirror original hydrologic and hydroperiodic conditions within the basin.

The assumptions behind building block techniques are based upon simple ecological theory: that organisms and communities occupying that river have evolved and adapted their life cycles to flow conditions over a long period of pre-development history (Stanford et al. 1996). Thus, with limited biological knowledge of flow requirements, the best alternative is to re-create the hydrographic conditions under which communities had existed prior to disturbance of the flow regime.

The most simple of these allocations models was proposed by Bovee (1982), who recommended that a surrogate of the natural annual pattern of streamflows could be approached by allocating the median (exceeded 50 percent of the time) monthly flow. Again, this technique requires an extended period of undisturbed flow records or the ability to reconstruct these records.

There is a wealth of research to indicate that hydrological variability is the critical template for maintaining ecosystem integrity. The use of this natural variability as a guide for ecosystem management has been widely advocated in the past decade. Thus, even the simplest of monthly allocations based upon some sort of restoration of a natural hydrograph are preferred to a standard allocation. Although variability is a key to ecosystem maintenance, some sort of predictability of variation must be maintained. It must be realized that survival of aquatic communities is contained within the envelope of that natural variability (Resh et al. 1988). Thus, the simplest of the building block models may not include sufficient variability. In addition to the seasonal pattern of flow, such conditions as time, duration and intensity of extreme events, as well as the frequency and predictability of droughts and floods, may also be significant environmental cues. Also, the frequency, duration and intensity of higher and lower flows can affect channel morphology and riparian vegetation, and thus change aquatic habitat. Indeed, the rate of change of these conditions must also be considered (Poff and Ward 1989, Davies et al. 1994, Richter et al. 1996).

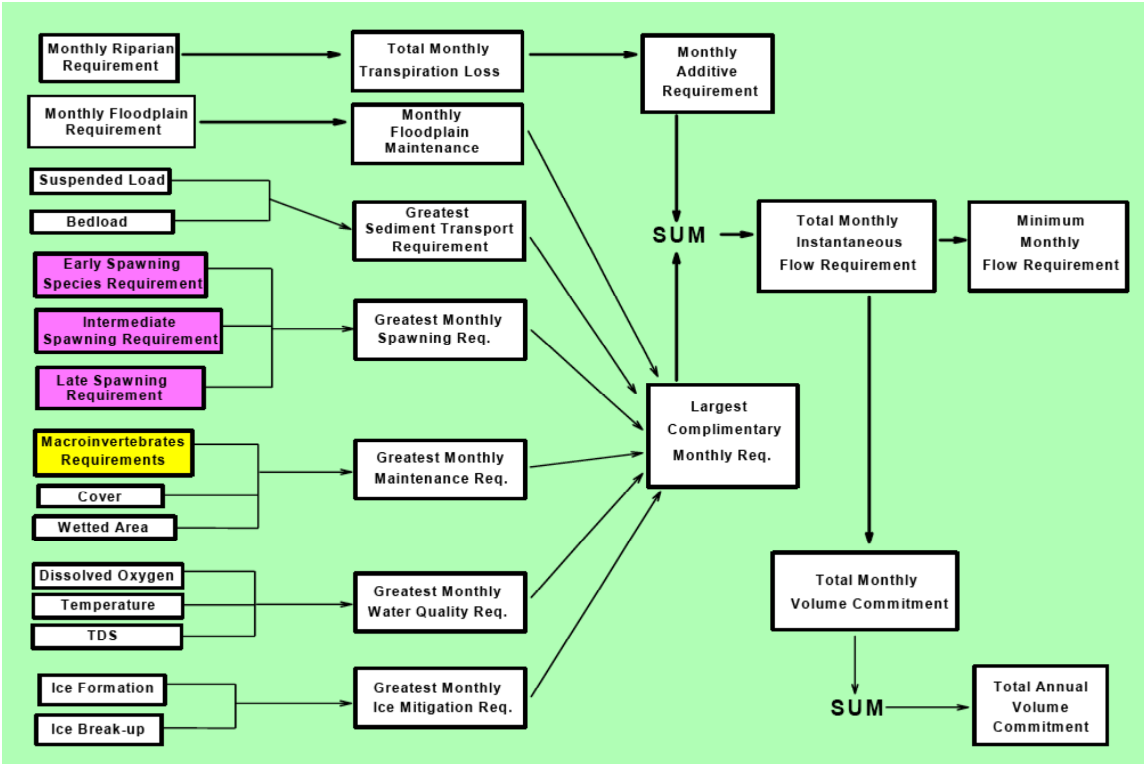
In order to include conditions that reflect greater variability yet maintain some of the natural predictability, Arthington et al. (1991) proposed a method that draws upon features of the daily flow record for flow allocations in dryland regions such as Australia and South Africa. Four attributes of the natural flow record are analyzed: low flows (based upon an arbitrary exceedance interval), the first major wet-season flood, "medium-sized" flood events, and "very large" floods over a period of record (usually 10 to 20 years). These are progressively summed (as "building blocks") to recommend a modified flow regime that provides predictable variability in duration, intensity and frequency of flood and drought events.

Richter et al. (1996, 1997) have suggested a more sophisticated "building block" model, termed the "Range of Variability Approach" (RVA). This approach is specifically designed as an initial, interim river management strategy that attempts to reconstruct the natural hydrograph. By a statistical examination of 32 hydrological parameters most likely to change ecological conditions, the RVA establishes management targets for each of these characteristics and then proceeds to establish a negotiation session in which a set of guidelines are established to attain these flow conditions. This analysis requires that greater than 20 years of daily streamflow records be available for this analysis. The RVA requires that, during each subsequent year, the hydrograph created by RVA be compared to the target streamflows and new management strategies be created to more closely match the RVA. This process of revisiting the management strategy allows ongoing ecological research to contribute new information that may result in the change of RVA targets. These iterations continue until the management targets are achieved.

The building block models are the "first-best-approximation" of adequate conditions to meet ecological needs. More often than not, resource agencies have kept hydrographic records for long periods of time when little or no biological data have been maintained. Even when poor hydrographic records have been collected (or for less than 10 consecutive years, Larson (1981) suggested that a surrogate indicator for minimum flows could be assigned as 0.0055 m3/s for each square kilometer of drainage area during dry months with adjustments for spawning flows.

Hydrographic and "building block" models have the advantage of being easy to explain to the public and decision-makers and, because they are rapid and less time-consuming, are frequently chosen to make water resource management decisions. The greatest potential misuse of the building block models, as in any ecohydrological model, is the institutional assumption that the first answer from a model is the only answer necessary to make adequate management decisions. That is, there is a tendency in regulatory agencies to make long-term management decisions from the first set of output data provided by the model. It is almost always the case that the first iterations of any model are based on the smallest amount of calibration information. With the building block models lacking any ecological information, it can be quite dangerous to make long-term decisions on the first output from these models. There are no assurances that the goal for the reservation will be met. Indeed, the "resource" goal may not have been correctly identified. Yet, it often occurs that "permits" to utilize the resource are issued for a period of five or more years; thus, reevaluation of the strategy can only occur at those intervals. However, as suggested by Richter et al. (1977), these management strategies must be revisited on an annual basis and modified, as ecological research determines more accurate information on flow requirements to sustain ecological processes. This process is in significant conflict with the resource user who prefers a known release schedule for as many years in advance as possible in order to make sound business decisions about supply to customers. This is a conflict that still must be addressed by the users of all of the models.

Although it is rarely used in such a manner, the IFIM procedure is ideal for a building block approach to restoring or mimic hydrographic variation. For example, in some of the earliest work on the development of IFIM, Bovee et al. (1978) suggested combining IFIM results with other models to create just such a set of building blocks to provide minimum monthly flow requirements, which are combined to produce a manageable annual hydrograph and a total annual volume commitment (see diagram below).



Current stream managers do utilize PHABSIM results to allocate different monthly discharges during the year. However, the focus remains upon the hydrological needs to maintain the biotic component of the system. However, it is quite apparent that such phenomena as floodplain maintenance and water quality are also ecological integrity issues linked to maintenance of a certain hydrograph. In that respect, building block models probably provide better management of the physical integrity of catchment ecosystems. These models, then, by combining a more complete model of hydrological change within the fluvial corridor with a sophisticated model of ecosystem response to these flow changes, could be used to assess not only restoration potential, but the vulnerability of these systems to continued disturbance from catchment alteration.

Finally, these building blocks can be used to make sound management decisions about the future integrity of the river ecosystem. Cardwell et al. (1996) have suggested an optimization model as a planning tool that combines both the size and frequency of water shortages with habitat requirements to suggest appropriate water management schemes. Indeed, Cardwell et al. suggest that if we can express political, economic or other social concerns as a linear combination of storage, release and/or diversion in a given time period, these can be used as additional constraints in the model. Such integrated approaches that link theoretical models, ecological phenomena and institutional concerns will be the next great step in better allocating water of the upper Peace River catchment to the demands of the residents of the SWFWMD while maintaining the integrity of the riverine ecosystem.

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Appendix 3

A Review of "A Multiple-Parameter Approach for Establishing Minimum Levels for Category 3 Lakes of the Southwest Florida Water Management District"

June 2001 Draft by D. Leeper, M. Kelly, A. Munson and R. Gant

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EXECUTIVE SUMMARY

This is a summary of the Scientific Peer Review Panel's evaluation of scientific and technical data, assumptions and methodologies used by Southwest Florida Water Management District in the development of its proposed minimum levels for Category 3 Lakes. It is the second independent peer review that the District has undertaken regarding the lake resources in the Tampa Bay area. The first review, which included other water resources (wetlands, ground water, Tampa Bay Canal) in the Northern Tampa Bay Water Resource Assessment Project Area, focused on Category 1 and 2 lakes. Both Category 1 and 2 lakes have fringing cypress wetlands that are greater than 0.5 acre, whereas Category 3 lakes are not contiguous with cypress-dominated wetlands, or if fringing cypress wetlands are present, they represent < 0.5 acre. Both panel members for this peer review also served as panel members in evaluating the methodology for establishing minimum levels for Category 1 and 2 lakes in 1999. This peer review is focused on the methodology proposed by the District in the development of provisional minimum levels for 14 Category 3 lakes in the draft document titled "A Multiple-Parameter Approach for Establishing Minimum Levels for Category 3 Lakes of the Southwest Florida Water Management District."

One of the most salient differences between the Panel's reviews of the methods employed in establishing minimum levels for Category 1 and 2 lakes and those used for Category 3 lakes is the presence of significant stands of cypress in the former and the absence of cypress, except for remnants in the latter. This has led to two major distinctions in establishing minimum levels between the cypress-dominated (Categories 1 and 2) and cypress-depauperate (Category 3) lakes. First, cypress tree buttressing has been widely accepted as being a reliable hydrologic indicator of the normal pool. This indicator has been used in the Category 3 lakes whenever there were remnant trees available; but in those lakes where cypress trees are absent, other less reliable hydrologic indicators were applied.

Second, and more importantly, the ecological health of cypress-dominated lakes was centered entirely on the fringing cypress trees. It is believed that if the fringing cypress community is protected, then all other lake attributes (recreation, aesthetics, water quality and other biological resources) will also be protected. However, lakes without significant stands of cypress trees, such as Category 3 lakes, need other sentinel indicators for determining appropriate protective efforts. This requirement of alternative indicators has significantly changed the methodology of setting minimum lake levels for Category 3 lakes from what had been adopted for Category 1 and 2 lakes. Instead of just one key protective measure (i.e., that of protecting the viability of fringing cypress wetlands), the District has advanced no less than eight equally weighted parameters (sediment resuspension; aesthetics; herbaceous wetland area; maximum depth of colonization of the submerged aquatic vegetation; species richness; dock usage; basin interconnectivity; and skiing/recreation) in the consideration of setting minimum levels. These eight parameters encompass the goals advanced by the current Water Resource Implementation Rule for protecting Florida's water resources and environmental values while considering natural seasonal fluctuations in water levels.

The Panel finds that the approaches taken by the District to determine minimum levels represent appropriate starting points for further methodological development and provide a sound basis for interim management. The Panel recognizes that many of the issues raised in setting minimum levels in Category 3 lakes have not been successfully addressed elsewhere

previously, and the District's effort in taking on this task is commendable. Given the dwindling supply of freshwater resources worldwide, the issues raised and alternatives explored through the District's efforts will be repeated many times by others in the water resources field.

The Panel, to the best of its ability, has provided not only a critical review of the methodology used by the District, but also has attempted to provide guidance for future efforts to refine the process of setting minimum levels. To aid in conveying the Panel's findings on specific tasks given in the Charge to the Scientific Review Panel, a summary table of responses to specific questions accompanies this executive summary.

The Panel finds no significant deficiencies in the manner in which data were collected or applied, although a few small errors were noted. Quality assurance appeared acceptable and the information utilized appeared to be the best available. Review of the technical assumptions leads the Panel to conclude that there were no significant deficiencies in the reasonableness of the assumptions, with one exception that involved exclusion of data from the setting of minimum levels. The Panel found inadequate justification for discarding significant change standards where the water level associated with significant change is higher than the Historic P50. If the highest water level associated with a significant change was applied, 12 of the 14 lakes in the Category 3 lake data set would have had minimum lake levels higher than the estimated Historic P50 level. In such cases, it is understandable that the minimum lake level would not be set higher than the Historic P50, but the discarding of the higher significant change standards means that the minimum lake level will always be set lower than the Historic P50, with concurrent impact on resources and possible loss of uses.

There appear to be few alternative analyses with comparable results that require fewer assumptions. After review of a range of permutations of the proposed parameters (e.g., use of medians or means of all values), it was concluded that simply setting the minimum lake level at the Historic P50 elevation was defensible and required many less assumptions. However, application of the proposed methodology is necessary on a larger scale before an appropriate level of comfort with such a simplified approach can be developed. With regard to proposed analyses, the derivation of a significant change standard for maximum depth of colonization of the submerged aquatic vegetation could be improved. The Panel found the research basis for this parameter to be compromised by low-lake sample size and a preponderance of the exotic submergent aquatic plant *Hydrilla verticillata*, which is known to thrive at very low-light levels. In lieu of the model adopted from the published source, the Panel suggests that depth, aquatic plant biomass and species, and water transparency data be collected from a subset of Category 3 lakes and a new regression model developed. This would provide a database for lakes within the District's boundaries and would yield a more accurate regression model.

The Panel finds that the District was diligent in its development of significant change standards, but expresses concern over the limited level of development and application of significant change standards for some of the parameters. This resulted in a limited role for herbaceous wetland area and maximum depth of colonization for submerged plants in the currently proposed approach. Although a well-defined and supported method (i.e., the dynamic ratio) for determining the significant change standard for sediment resuspension was developed, it suffered from a lack of sensitivity when applied to the Category 3 lakes.

The Panel suggests improved methods for enhancing the significant change standards for aesthetics and skiing/recreation, although the currently proposed standards are applicable.

From independent reviews by experts in avian biology and from public comments by interested parties, the most controversial of the eight lake parameters is the bird species richness standard. This was examined extensively by the Panel, which finds that the methodology did suffer from some of the deficiencies pointed out by the other parties and reviewers. Nevertheless, the research upon which the significant change standard is based represents the best available information as of December 31, 2000, and the resulting significant change standard of one species lost with a 15 percent decrease in surface area is conservative in protecting species richness across other communities such as fish and aquatic macrophytes. Moreover, the time, expense, and likely outcome of conducting a follow-up study would in all probability not significantly alter the currently proposed approach of setting minimum lake levels, or the final minimum lake level endpoint.

Subject to correction of several minor errors and contradictions, the overall application of the procedure for establishing a water level regime for Category 3 lakes has been performed in a logical fashion with supportable results. As in any rule-making process, there are limitations and imprecisions. They appear to have been addressed in the overall context of developing the methodology, including the development of the concept and database for the Reference Lake Water Regime. Possible consideration of additional factors in the establishment of minimum lake levels, such as the relationship between water level and septic system function, or the influence of recent watershed development and drought, was found to be potentially useful in the future, but not essential to the appropriate application of the proposed multi-parameter approach.

Although the methodologies for establishing minimum levels for Category 3 lakes are generally acceptable, deficiencies in their application and consideration of additional parameters require future adjustment. While not a direct criticism of the proposed methodology, the Panel found the application of the methodology in establishing the minimum lake level too exclusive of those lake standards whose significant changes were above the Historic P50. Under the currently proposed approach, those parameters would be discarded from further consideration in establishing the minimum lake level, even though there is a demonstration that significant change occurs in one or more lake attributes.

The Panel recommends that for those lakes where one or more of the significant change standards fall above the Historic P50 elevation, the minimum lake level be established at the Historic P50 elevation. Not only does this better protect those lake attributes whose significant change standards fall above the Historic P50, but it also is more consistent with the definition of the minimum lake level as approximating the Historic P50 elevation. If this alternative approach was adopted, it would result in only a minor effect on lake surface area, as between 1 and 15 percent more lake area would be added at the new minimum levels of those 12 lakes affected. However, the mean depth of those 12 lakes would increase by 0.7 feet compared to the depths corresponding to the proposed methodology of the District. Other advantages of considering the alternative method for setting the minimum lake level include minimization of assumptions and a better alignment with the Historic P50 elevation, which has been reduced from the pre-development Historic P50.

The Panel examined 11 alternative methods. These were not intended in lieu of any of the eight parameters currently contained in the proposed methodology, but as possible additions or modifications to the existing eight. Most would require only a limited dedication of resources for adequate evaluation. Besides suggestions on developing significant change standards for stratified lakes, maximum depth of colonization of submerged vegetation and the herbaceous wetland area, the enhancements of the significant change standards for recreation/skiing and aesthetics are also presented. The Panel investigated several new parameters, including trophic state and the benthic invertebrate community (mollusks). Although these two parameters hold promise as future add-ons in establishing minimum lake levels, more data (and assumptions) are needed before they could be scientifically justified as contributing sufficient power to the multiple parameter approach.

Lastly, the charge to the Peer Review Panel specifically called for areas of agreement and disagreement between each of the reviewers concerning responses and comments on each task to be identified. Although each reviewer had his own opinions of the strengths and weaknesses of each of the procedures presented by the District staff or suggested alternatives, the differences were never substantial enough that consensus could not be reached. Therefore, this Final Report of the Peer Review of "A Multiple-Parameter Approach for Establishing Minimum Levels for Category 3 Lakes of the Southwest Florida Water Management District" does not contain any areas of disagreement between the two reviewers.

Summary of Peer Reviewers' Responses to Questions Posed in the Charge

		Yes	Somewhat	No
	Evaluation of Scientific Reasonableness			
1.a.1.	Was data collection properly done?		**X**	
1.a.2.	Was the quality assurance adequate?	**X**		
1.a.3.	Is exclusion of data justified?			**X**
1.a.4.	Do data represent best information available as of December 2000?	**X**		
1.b.1.	Are assumptions clearly stated?		**X**	
1.b.2.	Are assumptions minimized?	**X**		
1.b.3.	Are there alternative analyses with comparable results and fewer assumptions?		**X**	
1.c.1.	Are procedures appropriate, reasonable and based on best available information?	**X**		
1.c.2.	Do procedures incorporate all necessary factors?		**X**	
1.c.3.	Have procedures been correctly applied?		**X**	
1.c.4.	Have limitations and imprecisions in the information been handled reasonably?	**X**		
1.c.5.	Are procedures repeatable?	**X**		
1.c.6.	Are conclusions from procedures supported by the data?	**X**		
	Evaluation of Deficiencies			
2.a.	Do scientific deficiencies exist and have errors been introduced?		**X**	
2.b.	Can the deficiencies be remedied?	**X**		
2.c.	How would remedies be applied and at what level of effort?	**See Section 3.3**		
2.d.	If deficiencies cannot be remedied, what alternative methods might be available?	**See Section 3.3**		
	Evaluation of Alternative Methods	**See Section 3.3**		

1.0 INTRODUCTION

Under Florida statutes, the Southwest Florida Water Management District (District) provides for Peer Review of methodologies developed to aid management of water resources within the jurisdiction of the District. Setting minimum lake levels has become a priority in light of declining levels over the recent decades and increasing demand for water by human residents of the area. The first Minimum Flows and Levels Panel addressed several areas related to a broad spectrum of water resource issues in the north Tampa Bay area. Included in these minimum flow and water level priority areas was the issue of appropriate methods for setting target lake levels for Category 1 and 2 lakes, lakes with fringing cypress wetlands of greater than 0.5 acre. This Panel has been assembled to review the proposed method for setting minimum levels for Category 3 lakes, lakes without fringing cypress wetlands of greater than 0.5 acre.

This review follows the organization of the Charge to the Peer Review Panel, addressing the questions posed and offering supporting explanation and analysis. It is the job of the Peer Review Panel to assess the strengths and weaknesses of the overall approach and its component parts. This review is offered in the spirit of enhancing water resource management within the District, and strengthening the overall science of water resource management.

2.0 THE CHARGE

The charge to the consultants of this Minimum Flows and Levels Panel had four elements, paraphrased as follows:

1. Review the District's draft document that outlines a multi-parameter method for setting target lake levels for Category 3 lakes (lakes without fringing cypress wetlands of 0.5 acre or more).
2. Review additional documents that provide background, support or criticism of the proposed approach.
3. Participate in a public meeting for the purpose of receiving comments and discussing directly the issues, strengths and weaknesses relating to the proposed approach.
4. Provide a written report to the District that reviews the proposed method within the framework established for Peer Reviews for the District. This includes determining if the method is scientifically reasonable, describing any deficiencies and proposing any alternative methods that appear preferable.

Several review constraints have also been set. "Givens" include:

1. The selection of lakes for which minimum levels have initially been set. The District has a priority list and an orderly approach to setting minimum levels that is not part of the review process.
2. Determination of the baseline from which "significant harm" is to be determined. Water level changes attributable to structural alteration of outlets, drainage systems and other lake or watershed features are not expected to be reversed as a consequence of the proposed method for setting target water levels.
3. Definition of what constitutes "significant harm" to the water resource. Where a change has been quantified as harmful by the District, the associated threshold that defines the change is to be accepted.
4. The adopted method for establishing minimum levels for lakes with fringing cypress wetlands greater than 0.5 acre. This method is based on maintaining the cypress wetlands and has been the focus of a previous Peer Review Panel.

Both consultants for this Peer Review Panel served on the previous Minimum Flows and Levels Panel that addressed Category 1 and 2 lakes, and are familiar with the process and the methods adopted to date. Similar constraints were imposed on the first Panel, and one has posed distinct difficulty in each case: #3, the definition of "significant harm." For the Category 1 lakes, the sole determinant of significant harm was the water level (assessed as P10 or P50) in relation to the normal pool as determined from cypress buttresses; "significant harm" is based on the premise that if an adequate water level was not maintained, the integrity of the cypress wetland would be threatened. For Category 2 lakes, which are structurally altered such that the water level regime does not fully protect the cypress wetland, the same significant harm standard was applied, but with the normal pool determined from data other than cypress buttresses (elevation of the control point or the Current P10, whichever was greater). A Category 2 aquatic system may be clearly harmed by structural alteration, but the method emphasizes consistent application of a threshold from a defensible starting point, defining "significant harm" in a relative manner.

This approach acknowledges that factors beyond current control of the District may cause harm to the system and sets up a process whereby significant harm is defined based on factors within the District's control. It also sets a numerical threshold for harm, much like water quality standards do for contaminant concentrations. This is a common and accepted approach, but suffers from the inability of thresholds to adequately describe what is really a gradient of harm. To overcome this limitation, thresholds may be set to provide adequate protection under all but the most unusual cases, building in a margin of safety. Alternatively, if a defensible margin of safety cannot be determined, the threshold may be set to provide adequate protection under "average" conditions. This causes considerable dissension upon implementation in many cases, as one or more parties may feel that the threshold is too restrictive or not restrictive enough. The whole approach of setting thresholds is fairly contentious, and the constraint on the Panel is intended to eliminate this issue and focus effort on the overall method of setting minimum lake levels.

The definition of significant harm is even more problematic for the Category 3 lakes, however, since the multi-parameter approach considers as many as eight possible measures of significant harm. The term "significant harm" has been largely abandoned in the District draft document in favor of "significant change." Considerable discussion was devoted to this definition and its determination at the public meeting, and it is difficult to properly review the methodology without some consideration of the definition of "significant change." We will note situations where this is a problematic issue in our review of the method, but we will abide by the charge to the extent possible and devote relatively little discussion to this aspect of method development.

Along these same lines, it is important to note that the development of a method for setting target water levels is largely decoupled from the sources of water level decline and the possible restoration approaches. For those working in water resource management, including the Panel members, it is difficult to focus on just the methodology for setting minimum levels and to ignore the broader picture of why such a methodology is needed or how it will be used within the context of restoration and water resource management.

Discussion at the public meeting, review of data for the target lakes and review of reports provided by the District (Emery, 1992; Leggette, Brashears and Graham, 1995) revealed several sources of water level decline, including structural alteration of outlets, alteration of drainage patterns within watersheds, drought, and direct or indirect withdrawal of water for human uses. This review makes no supposition regarding the relative importance of these factors, but must consider them in reviewing the development of parts of the proposed method, such as the Reference Lake Water Regime (RLWR), which is dependent upon historic conditions that may have been affected differentially by these factors.

In terms of implementation of programs to restore lake levels to some desired distribution over time, this review makes no supposition regarding how this will be accomplished. We do, however, note the challenging nature of such a proposition and commend the District for facing it now. Many other areas of the United States will have to deal with this problem eventually, and few have made much headway to date. The options are limited and generally center on alteration of human water sources or uses. The charge states that the baseline from which significant harm is determined is a given, and that baseline includes changes in water levels caused by structural alteration. Drought is not within the control of any human organization at this time. It has historically been difficult to reverse watershed alterations that affect flows and lake levels, although additional alterations (e.g., channel creation, pumping) could offset past alterations to some extent. This leaves direct and indirect withdrawals as the most easily controlled factors, and directly affects human users within the area.

3.0 RESULTS OF THE PEER REVIEW

3.1 Evaluation of Scientific Reasonableness

Overall, the method is reasonable. It incorporates multiple measures of potential impact to Category 3 lakes within the framework of the minimum levels Approach for Category 1 and 2 lakes, assessing significant change based on variables other than contiguous cypress wetlands greater than 0.5 acre in area. The selection of the eight parameters for establishing the MLL encompasses the recommendations made by the Scientific Review Panel during the establishment of minimum levels for Category 1 and 2 lakes. That is, additional indicators (i.e., lake volume, lake area and littoral plant assemblages) of lake condition should be applied to the development of minimum levels to the extent possible. The selection of the eight parameters also covers the current Water Resources Implementation Rule (Chapter 62-40, Florida Administrative Code), which states that consideration shall be given to recreation, fish and wildlife habitats and passage of fish, transfer of detrital material, aesthetic and scenic attributes, filtration and absorption of nutrients and other pollutants, sediment loads, water quality, and navigation. District staff has addressed all these lake qualities in one or more of their multi-parameter assessment.

Considerable effort has gone into developing indicators of impaired lake function as a consequence of reduced depth, area or volume. This is a scientifically complex area of environmental evaluation and regulation, however, and there is not an extensive body of experience from which to work. Refined or additional analyses can be envisioned and may be developed, but these would tend to add to, rather than replace, the proposed approach.

3.1.a. Review of data and information

The proposed approach relies on measures of lake and watershed area, lake bathymetry, indicators of normal pool elevation, any outlet control point elevation, water levels over multiple years, elevation of shoreline structures and biological features of lakes. The approach applies both generalized relationships between water level and lake functions and lake-specific information.

3.1.a.1. Were data properly collected?

We do not have all original data or associated collection procedures in our possession, but collection procedures appear proper based on the data that were provided. Furthermore, experience with data collection procedures from the previous MFL Panel (for Category 1 and 2 lakes) indicates that the process is likely to have been conducted properly and with enough redundancy to evaluate methodological precision and estimate accuracy. For example, measurement of normal pool elevation is based on biological indicators and for any given lake typically exhibits a range of up to 0.5 ft. A mean elevation is reported as the normal pool elevation, based on multiple measures, and provides a reasonable assessment of central tendency. Elevations are reported to the nearest 0.01 ft NGVD, about the limit of measurement precision and more exact than necessary, based upon biological variability.

Other elevation values are collected similarly, calculated as the mean of multiple measurements reported at the numerical limit of the survey methodology. The use of central tendency measures allows statistical analysis of variability and its possible effect on minimum levels, although no such analysis has been provided to us. Any error in the average elevations derived in this manner is likely to be on the order of 0.1 ft or so, which does not appear to be an important deviation within the overall minimum levels framework. This could be an issue in the enforcement of minimum levels, such as when the target MLL is missed by 0.01 ft, but we have no knowledge of the enforcement aspect of this program.

Other analyses depend upon published literature, and those methods have been scrutinized by District staff as well as outside parties. A few of the methods were questioned by members of this Peer Review Panel and outside parties. This has led to the reliability of the resultant relationships being questioned on the grounds of both measurement approach and the substitution of short-term data sets from multiple lakes for lake-specific data over longer time periods.

Initially, we felt more work needed to be done on the dynamic ratio since there is an apparent lack of sensitivity to the parameter in the 14-lake data set in Table 4-1 of the Draft Report (Leeper et al., 2001). There was only one lake (Big Fish) that had dynamic ratios greater than the 0.8 cutoff, but even then, both dynamic ratios corresponding to the Current P10 and P90 elevations were >0.8, indicating that the entire lakebed is subject to resuspension part of the time over the entire dynamic range of water elevations.

To be certain that the dynamic ratios at the Current P10 and Current P90 lake stage elevations were computed correctly, we recalculated the dynamic ratios for a subset of four lakes (Table 1). Since the lake depths corresponding to the Current P10 and P90 elevations were not given in the report, we calculated them by determining the water volume at each of those elevations from the lake stage vs. lake volume figure, and then dividing by the respective areas provided in the Draft Report.

Table A3-1. Comparison of the dynamic ratio values calculated by the Southwest Florida Water Management District (District) and the Peer Reviewers corresponding to the Current P10 and Current P90 stage elevations of four Category 3 lakes. Z = lake water depth was calculated by the quotient of the lake volume divided by the lake area.

	Current P90			Current P10		
	Z (m)	Dynamic Ratio		Z (m)	Dynamic Ratio	
		District	Peer		District	Peer
Big Fish	0.9	1.0	0.2	0.6	2.5	2.8
Raleigh	1.7	0.1	0.1	3.0	0.1	0.1
Rogers	1.7	0.2	0.3	2.9	0.3	0.2
Starvation	1.1	0.3	0.4	1.9	0.3	0.3

There is generally good agreement between the two groups of scientists except for Big Fish Lake at the Current P90 lake stage elevation, which may have been due in part to the interpolation of the lake volume from the lake stage vs. lake volume graph by the Peer Reviewers. Nevertheless, Big Fish Lake is the only lake in the data set whose dynamic ratio changes from greater to lesser than 0.8 between the Current P10 and Current P90 elevations. This means that the lake is less likely to experience resuspended sediment the shallower it becomes, a rather counter-intuitive result.

Another example of data collection methods that has been challenged is the relationship between bird species richness and Florida lake area. Ornithologists have been critical (Rodgers, 2001; Jackson, 2001) of its development by scientists other than avian biologists, the lumping of certain bird species into larger taxonomic groups, inclusion of rare species, and the failure to examine feeding guilds or other measures of ecological significance instead of simple taxonomic richness. Additionally, the lack of abundant data for specific systems that have undergone areal changes over time necessitates reliance on an assumption of transferability for the multi-lake richness-area relationship to individual lakes over time.

Similar empirical relationships between lake area and species richness for aquatic plants and fish have been applied with slightly higher results (28 to 30 percent difference in areal loss necessary to cause presumed loss of one aquatic plant or fish species vs. 15 percent areal loss for a one species decrease in the avian fauna), but collection methods have been less criticized for these variables. This suggests that either the relationships are reasonable or there is an unknown, underlying flaw that negates the whole process of judging species richness by lake area. However, it is unlikely that the relationship between species richness and lake surface area is a flawed concept, since it has been shown to exist in other studies. For example, Nürnberg (1995) reported that fish species richness in northern lakes was positively correlated to lake area ($r^2 = 0.41$ for all lakes in the data set; $r^2 = 0.61$ for non-acidic [i.e., neutral] lakes). The main controversy over the use of species richness as a significant change standard relates to how to use data to decide on an appropriate limit of impact.

A potentially more severe inadequacy pertains to the data collected in the Canfield et al. (1985) study that was used as the basis for establishing the maximum depth of colonization (MDC) for submersed aquatic vegetation (SAV). There are some drawbacks in using that database which we feel could be examined and redressed for limited effort and cost. Canfield et al. (1985) included emergent and floating vegetation in their 26-lake data set, which we feel are not nearly as physiological-dependent on underwater light penetration as is the submersed aquatic vegetation community. Subtracting the number of lakes with floating or emergent vegetation, the data set is reduced from 26 to 18 lakes. Furthermore, of those 18 lakes, 11 of them were dominated by hydrilla (*Hydrilla verticillata*), which biases the regression coefficients toward this exotic species that is known for growing in low-light environments. We propose an alternative method under Task 3.

3.1.a.2. Was QA adequate?
It is difficult to fully evaluate quality assurance procedures without all raw data in hand, but there is no evidence that QA was inadequate and past experience with the previous MFL Panel suggests that QA in District operations relating to minimum lake levels has been adequate. We have not been provided with duplicate measures, other than the field measures for the hydrologic indicators, or other comparative diagnostic assessments that would facilitate more detailed review of QA procedures. However, it should be noted that the use of central tendency measures limits the impact of an occasional inaccurate or imprecise measurement. Furthermore, consideration of comparable measurements from adjacent lake basins (e.g., normal pool elevation at nearby lakes) was used as a check on the accuracy of lake-specific measures and did result in the discarding of one measured normal pool elevation (Rogers Lake, based on data for nearby Raleigh Lake).

3.1.a.3. Is exclusion of any data justified?
The most obvious case of data exclusion evident in the materials provided is the above-noted rejection of the normal pool elevation for Rogers Lake obtained from low-limit elevation of saw palmetto and pine. This normal pool elevation was several feet higher than that calculated from adjacent and hydrologically connected Raleigh Lake based on cypress buttress measurements. This is particularly enigmatic considering that the stage level decrease in Lake Rogers was more dramatic after 1964 (Fig. 6-53 in Leeper et al. 2001) than it was in Lake Raleigh (Fig. 6-48 in Leeper et al. 2001). This should have produced normal pool elevations for saw palmetto that were lower than the cypress tree elevations in Raleigh Lake. As experience with normal pool estimation from cypress buttress inflection points is substantial and this approach has been fairly reliable at Category 1 and 2 lakes, rejection of the normal pool elevation determined from saw palmetto and pine position appears justified in this case.

A second less obvious example is found at Hobbs Lake (p6-97 in Leeper et al. 2001), where the narrative notes that the water level data between 1946 and 1962 pre-date regional withdrawal impacts, but do not meet the criteria for historic data. From the graph on p6-102 (in Leeper et al. 2001), the reason for this is not evident, and choice of data to establish the Historic P50 has a substantial impact on regulatory water levels. More support is needed for this rejection of data, especially since Lake Hobbs was classed as a Category 1 lake during the first Peer Review of Category 1 and 2 lakes. It was only one of 6 lakes out of 22 that had acceptable historic data (see Appendix B: Reference Lake Hydrographs of the Northern Tampa Bay Minimum Flows & Levels White Papers, March 19, 1999).

A separate form of data rejection that should be discussed is the discarding of minimum water level indications from significant change standards when the resulting water level is higher than the Historic P50. Several examinations of the provided materials failed to reveal why the minimum level would not be set at the Historic P50 in such a case. In other words, if there is an indication that significant change is occurring at a water level higher than the Historic P50, it is understandable that the MLL might not be set higher than the Historic P50, but it is not clear why the indication of significant change would be ignored in determining the MLL. As this is less a question of data collection than data use, it will be taken up further under Sections 3.1.b.1. and 3.3 of this review.

A yet additional form of data exclusion involves abandoning the effort to develop certain significant change standards because there was no clear relationship between water level and data for possible impacts that could be discerned or translated into a workable analysis. Such exclusion was done with adequate explanation, and an insightful summary table of the benefits and drawbacks of each possible indicator of impact was provided, but it may be possible to find a way to include such data and analysis with further examination and additional assumptions. For example, it is suspected that decreased mean depth could lead to undesirable changes in trophic state, but no method for assessing that change in a meaningful manner could be devised based on the available data and assumptions made in the review of procedure development. Possible analyses toward this end are discussed in Section 3.3.

3.1.a.4. Do data represent the best information available?
As we have limited knowledge of any additional data, the data do appear to represent the best information available. There may be additional data of relevance, and there may be ways to use additional data that have not been considered, but the data presented appear to be generally appropriate for the intended use in setting minimum levels at the target lakes.

There are, however, a couple of important exceptions where additional existing data, or data easily acquired, would strengthen the procedures developed for establishing MLL for Category 3 lakes:

- Although there are 14 identified lakes presented in the Draft Report as being classed as Category 3 lakes, the reality is that there are only 10 independent lake systems. This is because of three groups of lakes that are interconnected by their surface hydrology: Raleigh and Rogers; Church and Echo; Helen and Ellen and Barbara. The lakes within each of those lake systems are not truly independent of each other and, therefore, may be expected to function similarly, especially in response to lake level fluctuations. It would add more robustness to the overall analysis of the procedures used to set MLL in Category 3 lakes if more Category 3 lakes (totaling ~ 20 independent lakes) were added to the data set. However, the choice of lakes for which minimum levels are being set at this time is a given in the Charge to Consultants.
- Instead of relying on a regression equation found in the literature pertaining to other Florida lakes in developing a significant change standard for the MDC of SAV, more current, site-specific and numerically superior data should be acquired. A more complete explanation of the procedure is found in Task 3.3.

3.1.b. Review of assumptions

3.1.b.1. Are assumptions clearly stated?

Assumptions are not always clearly stated in the discussion of development of the minimum level procedure, but procedure development is laid out in such a way that assumptions are usually apparent and easily understood.

Several assumptions are critical to the overall procedure of setting water level targets for Category 3 lakes. Those associated with Category 1 and 2 lakes as well have been addressed by the previous MFL Panel and were not found to be fatal flaws. Examples include the correspondence of normal pool indicators to the approximate Historic P10 level, and that harm to contiguous cypress wetlands constitutes harm to the lake. For Category 3 lakes, apparent assumptions include:

- *An additional RLWR is needed for lakes in the Central Hernando-Eastern Pasco County Region, as the North Tampa Bay RLWR is inappropriate for this region* – This appears to be a valid assumption, based on the data provided for the one lake in this region with reliable historic records. Nevertheless, basing a RLWR on records for one lake only is suspect. The use of 22 lakes to establish the RLWR for North Tampa Bay seemed adequate, and it was suggested that there might be classes of lakes within that grouping that could form separate RLWRs with lesser within-group variability. However, it would be preferable to establish a RLWR from more lakes than the 16 years of data from Crews Lake. The use of the Central Hernando-Eastern Pasco RLWR to set regulatory water levels for only 1 of 17 lakes minimizes the impact of this assumption.

  It should be further noted that the development of any RLWR from historic data assumes that the influences that shaped that RLWR remain constant. This will never be completely true, and may be substantially false where watershed features have been altered to a large degree or where climate has changed. Concern is expressed over what appears to be increasing variability in water level data sets (not just declining water levels) that may reflect a change in the RLWR from what has been established from data collected as much as six decades ago. The use of central tendency measures (as with the North Tampa Bay area lakes) will minimize potential impact, and it is not clear that changes in the RLWR are large, but the validity of the assumption is not certain.

- *The normal pool elevation in the absence of cypress trees can be determined from other vegetation patterns* – Many other wetland mapping exercises use vegetation pattern to assess boundaries that relate to hydrologic conditions, so the approach is sound in theory. However, there are multiple types of wetlands (and uplands) with differing relations to area hydrology (e.g., depression wetlands, slope wetlands). To be useful, normal pool indicators must reflect hydrology that is closely tied to lake level. This relationship may not hold up in cases of non-equilibrium of ground water with lake level or for facultative plant species that depend on factors other than just water level for their distribution. The choices for Category 3 lakes appear reasonable, but factors other than lake level may be responsible for variability in normal pool estimates for any given lake, such as the one seemingly aberrant normal pool indication for Rogers Lake. The use of cypress buttress measures to establish the normal pool for 13 out of 17 target lakes minimizes the impact of this assumption.

- *Declining water levels can affect the thermal structure of the lake and the resuspension of sediments* – This is a reasonable assumption, but is difficult to put into practice as a significant change standard and has a limited role in the currently proposed approach. Certainly a loss of depth in a previously stratified lake can disrupt or prevent future stratification, but most of the target lakes have been described as minimally stratified even at full depth. There may be some concern that intermittent stratification occurs and is important to water quality and overall lake ecology, but we have no data to evaluate this premise at this time.

  Additionally, since the data for the target lakes clearly show that average depth and lake area decline together in a fairly linear fashion, the effect of declining water level on the dynamic ratio is not especially striking as calculated. The dynamic ratio is useful for evaluating the potential for resuspension within a lake, but is not overly amenable to evaluating impacts of changing water depth without a change in the calculation method. That change would involve acknowledging that the exposed area is still part of the lake and subject to erosion while exposed or resuspension when water levels rise. Calculation of the dynamic ratio would employ a stable water level (Historic P50, P10?) for a range of average depths, illustrating the full impact of changing water level. Yet this alternative approach did not yield substantially increased sensitivity, as will be addressed in Section 3.3.

- *Water levels should be maintained to allow reasonable use of docks constructed in accordance with permitted practices* – A dock constructed in accordance with past permits should have 1 to 2 ½ feet of water under its deep end to facilitate access with minimal bottom damage, depending on when and where it was built. These docks provide a historic representation of some frequently occurring water level, although whether or not that level corresponds to the Historic P50 is not clear. While there is room for debate over the depth of water that should be maintained and at what frequency, the assumption that this use should be preserved is reasonable and ties water levels to use, an important aspect of most regulatory systems. Note that the establishment of the dock standard is based on two feet above the substrate elevation of the 10th percentile among existing docks (not the shallowest one), which assumes that some small percentage of docks may have been constructed improperly.

- *Water levels should be maintained to allow fish and boat passage among historically connected basins of a lake* – This is a reasonable assumption that ties water levels to lake use by humans and non-humans alike. There is room for debate over the depth necessary for motorized watercraft passage (currently set at 2 ft) or non-motorized watercraft and fish passage (currently set at 1 ft) and over what the frequency of the target water level should be (currently set at the Historic P50), but it is appropriate to manage for access to all basins.

- *The area of a lake should be maintained to avoid the loss of species* – This is a reasonable assumption that is applied by setting the acceptable loss of area at the level at which one species would be lost, based on a regression of species richness on lake area. The bird richness regression was the most conservative, at a species lost with 15 percent decrease in area, and was applied instead of the fish or aquatic plant regressions, which indicated loss of a species at a 28 to 30 percent decrease in area. There has been criticism of the application of regressions based on many lakes over a short time span to a single lake over a longer period, and of the details in regression line derivation, but the theory is sound and the conversion to an applied form is reasonable. Further research on what happens at individual lakes over time is worthwhile and might be used to modify the regressions in the future.

We support the use of the significant change standard based on the relationship between bird species richness and lake area (15 percent); not so much because we believe that this relationship is beyond challenge, but because it provides a margin of safety over the 28 to 30 percent area change associated with the loss of one plant or fish species. The applicable statutes provide for protection of biotic resources and do not specify the loss of a species as acceptable. Additionally, loss of species from other faunal groups (e.g., benthic invertebrates, which have been visibly decimated by recent low water levels) have not been examined, so the bird species loss regression is not necessarily the most sensitive one.

- *Water levels should be maintained to avoid major shifts in littoral vegetation and fringing emergent wetlands* – This is a reasonable assumption that represents an extension of the argument used to establish water levels for Category 1 and 2 lakes. Application is hindered, however, by the more transient nature of herbaceous plant communities. Little effort appears to have gone into evaluating impact to contiguous wetlands not dominated by cypress, but with the expertise developed by the District working with Category 1 and 2 lakes, there is probably good reason, even if it has not been clearly stated. Instead, the proposed approach focuses on emergent vegetation and floating plants.

  Even though the large sample size (295 lakes) helped to statistically validate the ≤ 4 ft depth optimum by lowering the variation in herbaceous plant community positions relative to fluctuating water levels (both for high and low water depths), use of the colonized area could prove difficult for an individual lake, as the zone of colonization moves fairly quickly with changing water depth. Development of a more quantitative significant change standard for either HWA or SAV seems desirable, but will involve more assumptions and a change in approach. This is addressed in Section 3.3.

- *Water levels should be maintained to provide a reasonable level of aesthetic appeal for human users* – This is a bold but reasonable assumption that is supported by expressing human expectations in terms of "normal" and "altered" water levels. Development of a significant change standard depends upon acceptance of a change from the Historic P50 level to the LGL, or P90 level, as aesthetically unappealing. While this could be debated in terms of what human expectations are involved, it is a reasonable starting point and is supported by visual depictions of the associated change in some lakes and our own impressions from visiting some of the target lakes. This standard could be refined by further study, and may require less assumptions about user preference as a result, as discussed in Section 3.3.

- *Water levels should be maintained to provide continued safe water-skiing and related recreational use where such use has existed in the past* – This is a reasonable assumption based on maintaining existing uses in a water body, and relies on providing a safe area for water-skiing based on Coast Guard requirements and a literature review of boating impacts on lakes. The application of this assumption is not very rigorous; it requires only that one water-skier be accommodated, while many more may have been historically able to use the lake at the same time. It also assumes a standard area and shape for water-skiing that may not be entirely applicable. An alternative would be to maintain boatable acres, defined as the area that can be safely used by motorized watercraft with minimal environmental damage as well. However, the use of this assumption as proposed is appropriate at the most basic level of continuing to support an existing use. Enhancement of this standard is addressed in Section 3.3.

- *The RLWR adequately reflects the water level regime in the absence of withdrawals* – This assumption was reviewed and generally accepted as part of the Peer Review process for Category 1 and 2 lakes, with recommendations for improvement (Bedient et al., 1999). The issue of more recent development impacts affecting water level variability to a greater extent than reflected in the RLWR for the Northern Tampa Bay area was highlighted during the August 2001 public meeting held in relation to Category 3 lakes. There may indeed be greater current variability than that induced by water withdrawals, as a function of both development in the watershed and multiple drought years since 1989. Sorting out the relative influence of each factor is problematic, however, and requires additional assumptions. While it is advisable to examine the effect of development and recent drought on the RLWR, the established RLWR is not highly inaccurate or less preferable based on available data at this time. A preliminary evaluation of grouping lakes as isolated or connected by surface hydrology revealed minimal changes in the resulting RLWRs (See Section 3.3).

- *Where a significant change standard suggests a MLL higher than the Historic P50, that significant change standard is to be discarded in setting the MLL for the lake in question* – The discarding of significant change standards where the water level associated with significant change is higher than the Historic P50 (as determined by historic data, current data or the normal pool elevation minus the RLWR50) is a more troublesome assumption for which adequate justification has not been found. In such cases, it is understandable that the MLL would not be set higher than the Historic P50, but the discarding of higher significant change standards means that the MLL will always be set lower than the Historic P50.

  There is an exception to the above situation, but it did not arise for the test lakes. If either of the two aquatic plant parameters, herbaceous wetland area (HWA) and maximum depth of colonization (MDC) for SAV, result in a significant change relative to the Historic P50 area of herbaceous coverage or maximum depth of SAV colonization, then the MLL can be equal to the Historic P50. This approach would be valid as long as elevations associated with the significant change standards of the remaining six parameters are above the Historic P50 elevation. This was never the case for any of the 14 Category 3 lakes because of the lack of sensitivity and inadequate establishment of significant change standards for the HWA and MDC (elaborated on elsewhere).

  As the definition of MLL incorporates approximation of the Historic P50, the MLL could be justifiably set at the Historic P50 when a significant change standard indicates a higher MLL. The MLL values resulting from the proposed approach by the District (without defaulting to the Historic P50 if any of the significant change standards exceed the Historic P50) result in a loss of 1 to 15 percent of the lake area at the Historic P50, not a major reduction, but one that does not seem justified when any significant change standard exceeds the Historic P50.

Another aspect of discarding significant change standards if they suggest a MLL greater than the Historic P50 deserves consideration. The Recreation/Ski and Dock-Use Significant Change Standards frequently are higher than the Historic P50 (8 of the 14 Category 3 lakes had critical minimum elevations for either of these two parameters exceeding the Historic P50 elevation). This means that dock usage and recreational skiing are placed as lower priorities because their critical minimum elevations exceeded the P50 elevation. On the other hand, if their critical minimum elevations were just a small amount below the Historic P50, then the MLL would likely be established at those critical minimum elevations. In other words, skiing and dock-use activities on a lake will be curtailed if their critical minimum elevations are above the Historic P50 elevation, but not if they are just below the Historic P50. The current guideline for establishing MLL appears to penalize these two lake attributes vis-à-vis the other six parameters, although we are not suggesting that the MLL be set higher than the Historic P50.

Still a more conservative approach, and one that would be easier to administer, is to simply set the MLL at the Historic P50 level for all Category 3 lakes. The largest deviation between MLL and Historic P50 for the 14-lake Category 3 data set is a lake surface area that is 15 percent less than the surface area corresponding to the Historic P50, using the District's proposed approach. If the MLL is set to the Historic P50 for any lake that has one of the significant change standards above the Historic P50, then the argument that the MLL for all Category 3 lakes should *a priori* be set equal to the Historic P50 is considerably strengthened. This is because only 2 (Lake Rogers and Round Lake) of the 14 Category 3 lakes in the data set do not have any of their significant change standards above the elevation for the Historic P50. This will be discussed more as an alternative approach in Section 3.3.

3.1.b.2. Are assumptions minimized?

In general, assumptions are minimized, as analyses that require more assumptions or more complicated logic have been deleted from consideration. Issues relating to the impact of changing water level on lake water chemistry and overall trophic state bear further analysis, but were found during the procedure development to call for too many assumptions (or too much data) to be useful at this time. Some assumptions may indeed be warranted, but they will add to the list, which is now manageably small.

If the MLL was simply set as equal to the Historic P50, further minimization of assumptions would be achieved, but the useful exercise of testing the multi-parameter method would be negated. The multi-parameter method appears to minimize assumptions to the extent possible within the context of its development and application.

3.1.b.3. Are there alternative analyses with comparable results and fewer assumptions?

There also do not appear to be alternative analyses with comparable results that require fewer assumptions, except possibly for the MDC of SAV (discussed below). There may indeed be worthwhile alternative (or more likely in this case, additive) analyses to be considered, but these will mostly require additional assumptions. If those additional assumptions are offset by increased power to the procedure, they may be worthwhile, but we have not perceived that minimum levels can be set with alternative analyses relying upon less assumptions. Setting the MLL equal to the Historic P50 appears to provide comparable results with fewer assumptions, but this would not be known if the proposed analyses were not conducted, and represents an alternative approach, not an alternative analysis.

The analyses conducted for the 14 Category 3 target lakes (3 lakes in the 17-lake data set were Category 2 lakes, which did not require any of the eight parameters) resulted in the use of all five well-developed significant change standards, suggesting that all assumptions made in the development of those standards were needed. However, the remaining 3 parameters (Lake Mixing/Stratification, MDC for SAV, and the herbaceous wetland area) do not have well-developed significant change standards. One of these in particular, the MDC for SAV is likely to be amenable to alternative analyses with better results and fewer assumptions. The methodology is presented under Task 3.3.

3.1.c. Review of procedures

3.1.c.1. Are procedures appropriate, reasonable and based on best available information?

Overall, the procedures are based on the best available data and are appropriate and reasonable. There may be additional analyses that could enhance the power of the overall procedure by adding significant change standards, and there are a few aspects of the proposed analyses that may warrant modification, but the procedure appears sound. Primary issues warranting further discussion are addressed below and in Section 3.3 of this review.

Lake Mixing and Susceptibility to Sediment Resuspension

As the District staff has pointed out, lake mixing and sediment resuspension are not the same. Certainly when sediments become resuspended, it can safely be said that the water column is no longer stratified with respect to temperature and dissolved oxygen and, therefore, the water column is also mixed. However, destratification can occur without resuspension of sediments and may on its own constitute a significant change to the lake.

Thus there are really two issues the District is trying to address. The first is how frequently do sediments within a lake become resuspended? Secondly, how often does the lake stratify/destratify if indeed there is little or no sediment resuspension? In either case, the end result is the likelihood of nutrient and particle entrainment within the water column. As described in the paragraphs immediately below and in Section 3.3, the selection of the dynamic ratio as a measure of sediment resuspension and vertical depth profiles of dissolved oxygen and temperature for assessing stratification/destratification are reasonable. However, more development in the interpretation of the data associated with stratification/destratification (lake mixing but not necessarily accompanied by sediment resuspension), especially as related to a significant change standard, is desirable.

Due to a lack of sensitivity to a cutoff standard of 0.8 for the dynamic ratio among the 14 lakes classified as Category 3 in the data set, an alternate standard was explored. An alternative standard that may deserve consideration is a more stringent one of 0.35, which corresponds to the dynamic ratio where 50 percent (instead of 100 percent at a ratio of 0.8) of the lakebed is disturbed some of the time (Bachmann et al. 2000). However, the maximum percentage of time that a 50 percent disturbance in the lakebed of any one of the 7 lakes in the original 36 Florida lakes studied by Bachmann et al. (2000) with dynamic ratios between 0.35 (the proposed alternate new standard) and 0.8 (the currently proposed standard by District staff) is only 1 percent. This does not represent a significant difference from the originally proposed 0.8 ratio standard, which corresponds to no disturbance of the lakebed at any time. Moreover, even a 0.35 standard would not change the sensitivity problem given the ranges of dynamic ratio values calculated for the 14 Category 3 lakes in Table 4-1 of Leeper et al. (2001).

It appears that most of the Category 3 lakes are deep enough with respect to their surface areas that resuspension will not be a problem between Current P10 and Current P90 elevations. There may be some minimum depth cutoff, such as 4 ft, below which resuspension may be expected independently of lake area, but this situation did not arise with the test lakes. We therefore see no reason to alter the 0.8 dynamic ratio standard as currently proposed by District staff, which was chosen based on an appropriate scientific study using Florida lakes (Bachmann et al. 2000).

Species Richness

District staff considered three communities (aquatic macrophytes, fish and birds) in its search for finding the most sensitive community to lake area changes. They found that among the three communities, the bird community was the most sensitive to water surface area changes; bird species decreased at a rate of one per 15.6 percent decrease in lake area according to a 46-Florida lake study by Hoyer and Canfield (1994).

The assumptions, methods, quality assurance and scientific reasonableness of the Hoyer and Canfield (1994) paper, as well as the assumptions and procedures employed by the District staff in applying the regression models to Category 3 lakes, have been reviewed by three avian biologists, K.L. Bildstein, J.A. Rodgers, Jr. and J. Jackson. Independent reviewers provided opposing opinions in their assessments of the scientific integrity of the Hoyer and Canfield (1994) study, and the subsequent use of the results from that study by the District staff in setting minimum levels for Category 3 lakes. Bildstein (2001) reported that Hoyer and Canfield used the correct scientific methodology and drew the correct conclusions in their original 1994 study, and that District staff had interpreted and applied the results of that study correctly to the Category 3 lakes. On the other hand, Rodgers (2001) and Jackson (2001) stated that the Hoyer and Canfield (1994) study was too simplistic, and were pessimistic as to its utility as a basis for establishing bird species richness in Category 3 lakes. Further lack of consensus opinions on this subject were expressed in letters from the personnel in the Public Utilities Department of the City of St. Petersburg and Environmental Protection Commission of Hillsborough County.

Our initial reaction coincides with many of the other government entities and both Rodgers and Jackson: a lengthier period of study (> 2 years) with more frequent sampling (monthly) on Category 3 lakes where bird species are better identified, as well as other obvious habitat factors such as the slope of the lake bottom, percentage of emergent vegetation, water depth and shoreline development would be ideal. However, there are serious technical, time and budgetary constraints that prevent such an undertaking. Below we elaborate on four types of these constraints.

1. Time Delays and Expense with Only Marginal Improvement in the Significant Change Standard

Initiating a study that is greater than two years in length as suggested by some reviewers would delay the whole minimum flows rule making by more than the time period of the study once the extra time for data analysis, report writing and peer review are considered. Such a long-term study would be expensive. The delay and expense may be justified only if there is a reasonable chance that the conclusions reached at the end of the study would be significantly different than the conclusions reached by Hoyer and Canfield (1994). We did not discern from our reading of the reviewers' reports that there would be a definite and significant change in the significant change standard if the study was repeated, although the possibility exists. Indeed, the more recent work by Hoyer and Canfield (2001) suggests that the 1994 study provided reliable results. In their more recent paper on a single lake that evaluated for bird richness and abundance over five years (Hoyer and Canfield, 2001), 76 percent of all bird species were observed in the first year, and those observed thereafter were usually rare in abundance. Annual variation in richness and overall abundance was not striking, although there were certainly significant variations in abundance for individual species.

2. <u>"Best Available Science"</u>

Although some of the reviewers criticized the methodology utilized and the expertise of Hoyer and Canfield as non-ornithologists, as well as the validity of the statistics and the variance of the data, in arriving at the one species lost per 15.6 percent decrease in area metric, none of them suggested that there was a better study completed by the end of 2000 that should be used in place of the Hoyer and Canfield (1994) study. This means that the District staff used the best available science at the time in arriving at the significant change standard for species richness. One of the independent reviewers provided a positive review of the Hoyer and Canfield (1994) paper, clearly indicating that District staff had used the best available science in an appropriate manner in the establishment of the significant change standard for species richness.

3. <u>Technical Merits and Robustness of the Adopted Significant Change Standard</u>

There is little argument among the reviewers that lake surface area *per se* is an overriding variable in determining avian species richness. This is well documented in the literature and shows up as being the single-most important variable (r^2=0.74) in accounting for species richness in the Hoyer and Canfield (1994) study. This is a highly statistically significant variable, which should not be ignored considering that the Florida lake data set from which it was derived consisted of surface areas in the same range as the Category 3 lakes (see below for more detailed discussion). Other influences, such as trophic state, proved much less influential than lake area (Hoyer and Canfield, 2001).

The major controversial conclusion in the Hoyer and Canfield (1994) study is the statistic that indicates that for every 15.6 percent decrease in lake surface area, one bird species will be lost. This value was rounded down to 15 percent to establish a significant change standard. For the various reasons stated by the reviewers, this number could increase or decrease. One of the reasons for a change in this percentage is that crows, terns and gulls were not identified by species (rather by families or sub-families). Complete separation of these families and sub-families into species would have the effect of increasing the number of total bird species on a lake, which in turn may result in a more stringent (i.e., less percentage decrease in a lake's surface area per one decrease in bird species) significant change standard. How much of a percentage decrease would depend on how many species made up each of those families and sub-families, and how sensitive each of the species was vis-à-vis the other species within the family to water level changes. We suspect that the effect on the significant change standard would be minor, but literature review or re-analysis of existing data might be undertaken to evaluate this effect.

Moreover, a more detailed study (e.g., longer period of study, site-specific, more frequent observations) that results in a significant change standard less than 15.6 percent is likely to have a limited impact on the final selected MLL because there would be only minor lake level changes going from a 15 percent reduction in lake area from the Historical P50 to 10 percent or even 5 percent. Alternatively, the significant change standard could rise from the present 15 percent to a higher value as a result of more in-depth and site-specific studies. Again, an increase in 5 percent or 10 percent (to 20 or 25 percent) probably wouldn't substantially affect the final selection of the MLL because the increase in the significant change standard would result in a small change in the MLL, or another of the significant change standards would replace it.

4. Considering Other Communities in the Determination of a Significant Change Standard for Species Richness

There is some resistance to using bird communities rather than fish or aquatic macrophytes (more truly aquatic indicators) as the most sensitive community relative to lake area, but that is what the data support. Data for communities other than fish and macrophytes are insufficient to generate significant change standards. Alternative analyses of fish or macrophyte data might yield different results, but are not clearly preferable.

Unpublished macrophyte data from the University of Florida were used to determine the relationship between macrophyte species and lake surface area. The regression model depicting that relationship is provided in the District's Draft Report (Fig. 4-4, Leeper et al., 2001). Inspection of Figure 4-4 reveals that a large range of surface areas (< 1 ha to >10,000 ha) was used in the development of the regression model. Many of these lakes therefore have surface areas that exceed the surface area of the largest lake (Big Fish Lake with HMLL and MLL corresponding to 250 and 65 ha, respectively) in the Category 3 data set. Using a regression model developed from a data set that includes lakes of larger surface areas than the typical Category 3 lake poses a risk; lakes with higher surface areas in the original data set may skew the regression slope or intercept to values that are significantly different than if the range was decreased to bracket the surface areas of the target lakes. For example, it is possible that the relationship between lake surface area and number of species loss may not be log linear at higher surface areas (e.g., 1000-10,000 ha) if the littoral zone inhabited by macrophytes represents less on a percentage basis of the total surface area than in lakes with smaller surface areas.

For this Category 3 lake data set, it would be insightful to delete lakes with surface water areas that are >250 ha from the original University of Florida data set, and recalculate the regression coefficients. Then check to see whether the 30 percent loss of surface area still equates to the loss of one macrophyte species. Inspection of the subset of data points representing lakes <250 ha in Fig. 4-4 gives us the impression that the correlation coefficient (r-value) will decrease and the lake surface decrease necessary for the loss of one macrophyte species may be >30 percent, which would put the macrophyte community even further removed as the most sensitive community of the three. Nevertheless, to be scientifically certain, the deletion and subsequent recalculation exercise should be undertaken.

The same concern expressed above also applies to determining fish community sensitivity to lake level changes. The fish species richness vs. lake surface area model deployed by District staff for Category 3 lakes originated from Bachmann et al. (1996), who developed the regression relationship based on a 65-Florida lake data set. If the range of lake area is similar to that expected for future lakes for which minimum levels will be set, no action is necessary. If the range is much wider than that for expected target lakes, however, some recalculation of the regression may be in order after deletion of inapplicable lake data.

However, the District included data from larger lakes in anticipation of application of this significant change standard to larger lakes in future years. While there may be classes of lakes with differing species richness vs. area regressions, the development of a single regression and associated significant change standard provides consistency and maximizes the size of the data set used to develop the regression. After considerable discussion of the benefits and drawbacks of this approach, we concur that the District has acted properly and reasonably in the development of this significant change standard, which is based on bird communities.

3.1.c.2. Do procedures incorporate all necessary factors?
In general, necessary factors are incorporated, but all factors that may be useful may not have been incorporated. Section 3.3 outlines possible additional factors to be considered in the overall approach to setting minimum levels for Category 3 lakes.

3.1.c.3. Have procedures been correctly applied?
Overall, application of the procedure for establishing a target water level regime for target lakes has been performed in a logical fashion with supportable results. There are, however, a few errors that should be corrected in the interest of accuracy of the supporting narrative (Leeper et al., 2001):

- In the discussion on p3-6 (1st paragraph, line 6) under Establishing Minimum and Guidance Levels for Category 1 and 2 Lakes, the "difference between the Current P10 and Current P50 is greater than…" should be changed to "difference between the Current P10 and Current P50 is less than…".
    - An apparent contradiction in setting the critical minimum elevation for the
- Recreation/Ski Standard occurs on pages 4-24 and 5-15. It is not clear which is correct. Perhaps lines 7-13 in the middle paragraph on p4-24 could be reworded so that they read something like: "Use of a significant change standard based on safe skiing would be appropriate for lakes with a critical minimum elevation that is higher than the Low Guidance Level, as these lakes would be considered to have historically supported skiing for at least 90 percent of the time. Use of a significant change standard based on safe-skiing for lakes with a critical minimum elevation lower than the Low Guidance would not be appropriate. Under such conditions, the standard would identify the elevation at which the lake would no longer support safe skiing for 90 percent of the time." Still, it is uncertain as to whether it really makes a difference whether the critical minimum elevation is greater or lesser than the LGL since some of the lakes had critical minimum elevations that were above, while others were below, the LGL. The only lake (Fairy) whose MLL depended on the Recreation/Ski Standard had a critical minimum elevation that was 31.0 ft (Recreation/Ski Standard = 32.1 – 1.1 ft for the RLWR5090), which was lower than the LGL of 31.3 ft (Table 6-26 in Leeper et al., 2001).
- The step-by-step instructions for a multiple-parameter approach for establishing MLL for Category 3 lakes are sometimes nebulous, and other times confusing. Beginning on p5-10 and ending on p5-15 in Leeper et al. (2001):
    - Lake Mixing and Stratification: In Step 1, the elevation range for calculating the dynamic ratios is between the HGL and LGL. Yet in Section 6 when the dynamic ratio is being applied to different lakes, the District staff uses the Current P10 and Current P90 as the range.
    - Lake Mixing and Stratification: As is written now, every Category 3 lake undergoing the establishment of a MLL would proceed to Step 2 if they have a dynamic ratio of > 0.8 (indicative of sediment resuspension) within their Current P10 and P90 ranges. Since it can be safely assumed that sediment resuspension would automatically destratify a lake, there would be no need for additional data (i.e., dissolved oxygen conentration and temperature profiles) to be collected on those lakes.
    - Lake Mixing and Stratification: There is no quantitative "benchmark" provided in Step 2 for determining when stratification is significant enough to warrant examining

a significant change standard for lake mixis (see discussion on Anoxic Factor presented in Section 3.3). This "benchmark" would be something analogous to what the dynamic ratio is to sediment resuspension.

- Herbaceous Wetland Coverage: There is also lack of a "benchmark" under this parameter's instructions. In Step 2, the objective is to "identify basin elevations where change in lake stage would result in substantial change in potential wetland area." Lack of a metric that defines when a "substantial change" occurs will limit application of this standard.
- Submersed Aquatic Vegetation Maximum Depth of Colonization: Similar to the Herbaceous Wetland Coverage immediately above, there is no guidance provided on what constitutes "substantial change in area of potentially colonized plants" in Step 4.
- Submersed Aquatic Vegetation Maximum Depth of Colonization: Steps 3 and 4 appear to be out of sequence and might be switched.
- Recreation/Ski: There's a contradiction between the U.S Coast Guard recommendation of a ski corridor as defined as a circular area with a **diameter** of 418 ft and depth of at least 5 ft (p4-24 in Leeper et al., 2001) and the procedure described in Step 1 which states "…ski corridor delineated as a circular area with a **radius** of 418 feet." The 1999 document from the Office of Boating Safety of the U.S. Coast Guard does not provide a diameter or radius specification for the ski area, but does describe a "skiing course" that should be at least 2000-3000 feet long with 100 feet of buffer space one either side (rectangular in shape). However, the Leeper et al. (2001) report on p4-23 cites the U.S. Coast Guard Office of Boating and Safety (2001) as recommending that "ski corridors" be at least 200 by 2000 feet (~ 9 acres, assuming the corridors are rectangular in shape, or ~ 13 acres assuming the corridors can be delineated by a circular area). Based on the equations for determining the circumference and area of a circle, we have determined that a **radius** (and not a **diameter**) of 418 feet is correct. Thus the reference to a 418 ft **diameter** at the top of page 4-24 should be changed to a 418 ft **radius**. At the same time, it may be possible to fit a ski area into a lake with having an available radius of 418 ft, simply by changing the shape of the ski area. Some provision for this exception appears to be needed.
- Recreation/Ski: It seems unnecessary to proceed to Step 5 if, under Step 1, the basin does not contain enough area to develop a Recreation/Ski Standard.
- Recreation/Ski: It seems unnecessary to make a distinction in Step 3 of comparing the critical minimum elevation to the LGL when the implementation of the Recreation/Ski Standard to the Category 3 lakes in Section 6 included lakes where some had critical minimum elevations that were above, while others were below, the LGL. See discussion above.

• Big Fish Lake, p6-6, lists the HGL= current P10, when it should be the CP. Tables 6-1 and 6-2 correctly list the HGL as the CP elevation, so this error did not impact the establishment of water levels.

• Lake Calm, p6-18, 1st paragraph, line 13. Historic P50 elevation should be changed to High Guidance Level.

• Church and Echo Lakes, p6-32&33. The CP chosen for No. 3 (=33.75 ft NGVD), is not the high point in the channel (No. 2), which has an elevation of 34.92 ft NGVD. Several other issues with choice of CP elevation have been noted, and it seems preferable to set the CP at the elevation of an actual structure, not a high point in a channel that may be created by temporary sediment accumulation. This may account for some of the CP elevations given, but requires documentation.

- Crenshaw Lake, p6-43, either the recreational/ski standard of 55.1 ft NGVD is incorrect or the procedure incorrectly applies the dock standard of 53.45 ft NGVD as the significant change standard from which the MLL is established. It appears from the available data that the recreation/ski standard should have been 50.1 ft NGVD, so the choice of the dock standard in setting the MLL appears correct.
- Fairy Lake, p6-66, Historic P50 is calculated as HGL-RLWR50 for the North Tampa Bay RLWR, which is 1.1 ft. However, the difference between the current P10 and the current P50 is 1.06 ft, and should be used to determine the Historic P50 according to the flow chart on p5-19. This results in an error in the Historic P50 of only 0.04 ft, but it does appear to be an error.
- Fairy Lake, p6-68. The CP chosen was No. 3 (=32.18 ft NGVD), and not No. 1, which is higher (=33.0 ft NGVD) and closer to the lake. (See note for Church and Echo Lakes above).
- Lake Raleigh, p6-105, 1st paragraph, lines 3 and 4. The Recreation/Ski Standard is not lower than the Historic P50 elevation as stated (see Table 6-45 on p6-107).
- Round Lake, p6-128, 1st paragraph, line 3. The period of record shown in Fig. 6-58 indicates that the period of record is from January 1974 through July 1982 (and not July 1996).

Each of these points of confusion has been discussed with District staff, and even though the staff was in agreement with our findings, we retained this section in the final report since the raised issues were contained in the original draft report that we were charged to review. The resolution of the CP elevation discrepancies is pending until a resurvey can be completed by the District engineers.

3.1.c.4. Have limitations and imprecisions in the information been handled reasonably?

Limitations and imprecisions appear to be handled reasonably. Reasons for rejecting various possible regulatory water levels have been stated and the reporting format provides sufficient supporting information to allow independent review and consideration. The precise elevations established by the procedure may be subject to some debate, as there is variability in most measurements and no analysis of uncertainty has been provided. However, any change in results is not likely to involve a large change in any regulatory water level. Applied significant change standards tend to reflect a definite loss of use or impact to the resource, not fine gradations of use impairment or impact.

One imprecision over which concern has been raised in discussion with interested parties is the RLWR applied when appropriate historic water level data for a target lake is lacking. This was a concern for the Peer Review Panel considering Category 1 and 2 lakes as well. That panel concluded that the chosen RLWR for North Tampa Bay area lakes was reasonable, but might be improved with additional data and subdivision into additional lake categories (mostly by geographic grouping). The same criticism applies to the Category 3 lakes, with possible subdivision based on whether or not a lake is isolated from other lakes in terms of surficial hydrologic connection. We will examine this potential modification in Section 3.3, but it is not clearly better than the chosen approach.

The additional concern about RLWR raised during the deliberations of the Category 3 lakes panel is that development in the watersheds of target lakes may have altered the RLWR by increasing hydrologic variability, a common impact of development. Several reports prepared for the City of St. Petersburg (Emery, 1992; Leggette, Brashears & Graham, 1995) support this contention. It was suggested that the maximum P10-P50 and P10-P90 values might be applied instead of the mean for reference lakes. This might provide some correction for variability induced by development, but would eliminate the use of central tendency that minimizes the impact of measurement imprecision. Such an approach would not clearly be superior to that applied, but might be an option with further investigation.

Alternatively, lake-specific data might be used to generate a RLWR for each target lake. This would involve assessing variability within the context of all existing impacts on lake level, including development, drought, structural alteration of outlets, and withdrawals. Again, this might correct for development impacts, but would also reflect other impacts and introduce other sources of imprecision and error. As recent data would be used to incorporate development impacts, and since the period of 1989 to 2001 is among the driest on record in Florida, RLWRs generated in this manner would not necessarily be any more representative of the true RLWR than the chosen approach. It might be worthwhile to examine water level data for lakes with long-term records to see if various influences could be quantified, but this approach is not possible for all lakes and would involve extrapolation for use at other lakes that is functionally no different than that applied in the chosen approach.

3.1.c.5. Are procedures repeatable?
The procedures are repeatable, and although repetitive data collection and analyses might lead to changes in assigned regulatory water levels, expected changes would be small unless specified assumptions were altered.

3.1.c.6. Are conclusions from the procedures supported by the data?
Except where reporting or calculation errors were encountered, the conclusions from the procedure are generally supported by the data. The Peer Review Panel cites a number of concerns over the development of significant change standards, but based on what the District has established, the conclusions are supported.

There could be some concern that the MLL is being set too low in many of the target lakes, as current data were used to establish the water level regime upon which other analyses depend, but the data do support the conclusions. At issue is whether it is sufficient to "hold the line" on further decreases in water level, or if it is necessary to increase the water level in the target lakes to restore historic conditions. Only 3 of 14 lakes subjected to the procedure are assigned MLL values substantially above what occurs now in those lakes, yet the water level data provided for nearly all lakes show wider variability in water level than considered natural for this area and many show downward trends in lake level over the period of record. Further degradation will be prevented through the use of the proposed procedure, but restorative mandates appear few. This moves into the area of determining the baseline from which significant harm (or change) is to established, and is outside the scope for this evaluation (it is one of the "givens" for this review).

3.2 Evaluation of the Deficiencies

Most of the procedures do not contain deficiencies, and most potential adjustments constitute additional or preferred analyses that increase the power of the procedure or address shortcomings that are not fatal flaws in the overall approach.

3.2.a. What scientific deficiencies exist and what errors are introduced?

The scientific deficiencies of concern relate mainly to establishing quantitative significant change standards. This is a difficult process and the District is to be commended for its efforts to develop defensible standards. Only one significant change standard was applied to Category 1 and 2 lakes: impact to cypress. The absence of dominant cypress stands around Category 3 lakes necessitated alternative measures, and this places the District on the cutting edge of biological impact assessment for lakes. This effort and situation not withstanding, enhancement of the scientific basis of some significant change standards is desired.

At least two (herbaceous wetland area [HWA] and maximum depth of colonization [MDC] for submergent aquatic vegetation [SAV]) of the suggested eight parameters suffer from a lack of sensitivity in that they never appear as a quantitative measure in determining the MLL of any of the 14 Category 3 lakes. This is because there is no guidance provided as to what corresponds to a "substantial change in potential wetland or SAV colonization area." In effect, significant change standards cannot be calculated for these two parameters as long as a critical minimum or maximum coverage is not specified.

Consequently, these two parameters have been relegated to a "second-tier" status behind the other six parameters that have quantitative significant change standards associated with them. The outcome of this approach is invariably a sentence near the end of the Summary of Data and Analyses Supporting Minimum and Guidance Levels section for each of the 14 Category 3 lakes that reads: "Changes in potential herbaceous wetland area and area of potential aquatic macrophyte colonization with lake stage also did not indicate that use of any of the identified standards would be inappropriate." Without a defined significant change standard for these plant parameters, their importance and use in defining MLL will be based on only a subjective interpretation of the data. From what has been provided in Leeper et al. (2001), this subjective and arbitrary interpretation results in a minor to negligible role played by these plant communities.

Yet there are some apparent significant quantitative changes associated with water level changes in some of the Category 3 lakes. For example, the HWA at the Historic P50 elevation and LGL for Big Fish Lake is ~ 175 and ~ 100 acres, respectively (Fig. 6-7 in Leeper et al., 2001). This represents a loss of ~ 75 acres, or 43 percent of the HWA at the Historic P50 elevation, which is probably a significant change to most aquatic biologists and limnologists. Changes in the HWA appear to be around 25 to 30 percent between the Historic P50 and LGL elevations (Fig. 6-69 in Leeper et al., 2001) in Starvation Lake. Both Cypress Lake and Lake Raleigh have HWA and SAV coverage shifts that approximate a 20 percent change. These analyses indicate that there are substantial changes in the coverage of herbaceous wetlands and SAV with decreasing water elevations in some of the Category 3 lakes, but without some definition of what constitutes a significant change, no weight is assigned to these changes in the establishment of MLLs.

The most logical source of support for a quantitative SAV standard might be its relation to the fish community or fish populations of particular interest. Unfortunately, the most relevant research (Canfield and Hoyer, 1992) suggests that there is no major shift in bass population features over the range of 10 to 85 percent SAV coverage. An alternative approach to developing a significant change standard for SAV is clearly needed.

Another scientific deficiency in the establishment of significant change standards relates to the aesthetic standard. The current approach assumes that a reduction in the P50 to the LGL would be perceived by human lake users as an aesthetic impairment. We concur, but submit that user perception surveys might provide a more accurate appraisal of acceptable change in water level. Such surveys have been successfully applied to determination of the acceptable level of change in water clarity (Smeltzer and Heiskary 1990) and appear applicable to determining the acceptability of water level changes. As such surveys have not previously been conducted, and require time and financial resources, the District acted reasonably in establishing the aesthetic significant change standard as it did. However, user perception surveys are recommended as a means to improve this standard.

Additionally, the establishment of the recreation/ski significant change standard depends upon fitting a minimum circular area with a minimum depth into the lake, and presumes no impact as long as one such area can be fitted into the lake. If a lake that supports 20 water-skiers at once is reduced in area to the point that only one water-skier can be safely accommodated, most users would perceive an impact. Alternatively, water-skiing may still be accommodated by a linear path or other shape even if the minimum circular area (radius = 418 ft) does not fit in the lake at a reduced water level. The chosen approach relies on complete elimination of a use before an impact is declared, and may not apply the most appropriate measure of use impairment. The oversimplification of the measurement of impact on recreation/skiing can be corrected only by a more complicated procedure, but enhancement of this significant change standard is possible.

3.2.b. Can the deficiencies be remedied?

Yes, if we consider them to be actual deficiencies. These are addressed mainly in Section 3.3 of this review, and include application of significant change standards that place the MLL above the Historic P50, enhancing the aesthetic, recreation/ski and stratification standards, and development of significant change standards for herbaceous wetland area and submergent aquatic vegetation.

3.2.c. How would any remedies be applied, what is the precision and accuracy of the adjusted procedure, and what level of effort is necessary to apply it?

Most adjustments are intended to increase the power of the procedure, not to be essential remedies for deficiencies. As such, their value must be carefully weighed against the effort necessary to apply them. More detail is provided in Section 3.3.

3.2.d. If deficiencies cannot be remedied, what alternative methods might be applied?

See Section 3.3 for suggested improvements.

3.3 Evaluation of Alternative Methods

There are several supplementary analyses that may be preferable to existing analyses or may be worthwhile to add to the proposed approach. These proposed supplementary analyses and the level of effort necessary to collect data and apply them are discussed below.

Several issues warrant further discussion as relates to adjusting the proposed procedure for maximum applicability to the range of target lakes envisioned and most effective and defensible establishment of minimum lake levels. These include:

- Setting the MLL equal to the Historic P50 without any further use of significant change standards
- Discarding significant change standards if the resulting MLL is higher than the Historic P50
- Alternative use of significant change standards: averages and medians
- Additional steps for establishing a significant change standard that indicates trophic state changes
- Development of a significant change standard for stratified lakes
- Development of a significant change standard for the maximum depth of colonization (MDC) for submergent aquatic vegetation (SAV)
- Development of a significant change standard for herbaceous wetland area (HWA)
- Recreation/ski significant change standard enhancement
- Aesthetic significant change standard enhancement
- Possible benthic invertebrate significant change standard
- Consideration of septic system influences
- Adjustment of the Reference Lake Water Regime (RLWR)

3.3.a. Setting the MLL equal to the Historic P50 without any further use of significant change standards

Since these Category 3 lakes do not have a historical record, the "Historic" P50 is determined from the HGL minus the RLWR50. "Historic" should not be construed to mean "based on historic data" in such cases, but is rather an approximation of conditions that would be expected to exist in the absence of influence from withdrawals. Such conditions may indeed differ substantially from true historic conditions.

The first lettered column (**A**) in Table A3-2 represents the difference between the normal pool (NP ~ Historic P10) as determined by the hydrologic indicators and the HGL as determined by either the CP, Current P10, or the NP. The 1.4 ft mean difference represents the average reduction in lake level at the P10 elevation due to "current conditions" (i.e., surface runoff diversion, structural alterations and groundwater withdrawal). This is the "handicap" that the lakes have sustained from previous manipulations within the lake and its watershed.

Table A3-2. Comparison of the elevational differences among different proposed methods in establishing the minimum lake level for Category 3 lakes.

Lake	HGL Ref. Pt.	NP - HGL (ft) **A**	Dist. MLL (ft)	Determining Parameter	Hist P50 (ft)	Hist P50 – Dist. MLL (ft) **B**	Hist P50 – Dist. MLL* (ft) **C**	Mean of Significant Parameters (ft) **D**	Dist. MLL – Mean of Sign. Para. (ft) **E**	Hist P50 – Mean of Sign. Para. (ft) **F**
Big Fish	CP	0.4	73.05	Sp. Richness	73.45	0.4	0.4	74.5	- 1.4	- 1.1
Calm	CP	1.9	47.31	Aesthetics	48.41	1.1	1.1	45.3	2.0	3.1
Church/Echo**	CurrP10	2.2	33.54	Aesthetics	34.64	1.1	1.1	33.0	0.5	1.7
Crenshaw	CurrP10	1.9	53.45	Dock-Use	54.52	1.1	1.1	53.3	0.2	1.2
Cypress	CP	2.5	46.75	Aesthetics	47.85	1.1	1.1	47.2	- 0.4	0.7
Fairy	CurrP10	1.9	32.10	Ski	32.42	0.3	0.3	31.0	1.1	1.4
Helen/Ellen/ Barbara	CurrP10	1.9	52.10	Basin Connec.	52.37	0.3	0.3	51.4	0.7	1.0
Raleigh**	NP	0.0	42.82	Aesthetics	43.92	1.1	1.1	42.1	0.7	1.8
Rogers**	NP	0.0	42.82	Aesthetics	43.92	1.1	0.0	39.4	3.4	4.5
Round**	CurrP10	1.7	53.26	Dock-Use	53.42	0.2	0.0	52.6	0.7	0.8
Starvation	CP	0.6	50.65	Sp. Richness	51.72	1.1	1.1	50.7	- 0.1	1.0
Mean		**1.4**				**0.8**	**0.7**		**0.7**	**1.5**
S. D.		**0.9**				**0.4**	**0.5**		**1.25**	**1.4**

* Lakes Rogers and Round are defaulted to zero because they are the only two lakes in the data set that do not have any of their Significant Change Standards above the Hist P50.

** Category 3 Lakes considered to be more hydraulically "isolated" compared to those which are more "flow-through."

The second column (**B**) in Table A3-2 is the average water depth (0.8 ft) that would be added to the currently proposed District guidelines if the MLLs were instead set equal to the Historic P50 in all cases. The justification for this is that most of the lakes have one of their significant change standards that lie above the Historic P50 elevation.

Accepting a process for establishing the MLL as being equal to the Historic P50 has considerable practical advantages and scientific rationale:

- If the idea of establishing a MLL is to preserve the Historic P50 lake level elevation, then why not set the MLL equal to the Historic P50? Keep in mind that the Historic P50 elevations for these lakes are not the true historical P50 elevations (pre-development), but instead reflect "current conditions" which include impacts from dredging, diversion, control structures, augmentation and groundwater withdrawals. As such, the Historic P50 elevation is already 1.4 ft less than it was, on average, prior to basin developments according to the NP and HGL comparisons (column **A** of Table A3-2). Thus setting the MLL equal to the Historic P50 ensures that further reductions in lake levels beyond what has already occurred will not take place over the long-term.
- There has been a lot of consternation expressed regarding the inadequacy of significant change standards for some of the parameters, either because of a lack of sensitivity (i.e., dynamic ratio), or lack of a quantitative standard (i.e., MDC for SAV and herbaceous wetland area), or challenges to some of the supporting studies in the development of the significant change standard (i.e., species richness). These deficiencies become irrelevant if the MLL is set equal to the Historic P50.
- The "penalty" that a parameter suffers if its standard elevation lies above the Historic P50 is diminished. Under the District's proposed methodology, any parameter whose standard elevation is above the Historic P50 is ignored and the MLL is set equal to the next highest parameter, which in all cases results in a MLL that is less than the Historic P50. As pointed out before, for the 14 lakes in the Category 3 data set, only 2 of those lakes did not have parameters that were above the Historic P50. Thus, according to the proposed District methodology, most of the Category 3 lakes are "penalized" by discarding parameters associated with standard elevations that lie above the Historic P50.
- Although the adoption of the procedure that equates the MLL to the Historic P50 would result in an average increase of 0.8 ft in lake level elevation compared to the District's methodology (column **B** in Table A3-2), the areal differences are minor (worse case is 15 percent).
- The simplicity of equating the MLL to the Historic P50 would make it easier and less costly to administer. This change in approach would require less effort than the proposed approach, although its validity depends partly on comparisons generated from the proposed approach.

3.3.b. Discarding significant change standards if the resulting MLL is higher than the Historic P50 and then setting the MLL equal to the Historic P50

Given the discussion above in relation to the "handicap" already in place for Category 3 lakes evaluated so far, allowing further declines in the target water level seems undesirable unless it can be demonstrated that no loss of uses or impairment of resources occurs. Wherever a significant change standard results in a target MLL higher than the Historic P50, discarding that standard completely results in a loss of utility and probable impairment. This is counter to the purpose of setting MLLs. The case has been made that setting the MLL higher than the Historic P50 may not be defensible, but we are not convinced that any parameter that causes the MLL to be set higher than the Historic P50 should be discarded. Rather, it seems appropriate to set the MLL equal to the Historic P50 in such cases, maintaining the use or avoiding impairment to the extent possible while not setting an MLL higher than the Historic P50.

The result is not greatly different than setting the MLL at the Historic P50 in all cases, from an overall perspective. Column (**C**) in Table A3-2 is the same as column **B** except that values for the two lakes (Rogers and Round) which do not have any of their significant change standards indicating a MLL above the "Historic" P50 elevation are set equal to zero, since they would have MLL set equal to the District's current MLL elevation under the currently proposed District procedure. Doing this results in only a slight decrease (0.1 ft) in the average elevation of the MLL compared to setting the MLL at the Historic P50 for all the lakes. The difference is substantial for only one (L. Rogers) of those two lakes.

Since the focus of the MLL is to maintain uses and resources, it seems fair to allow a decrease in the MLL below the Historic P50 when no significant change standards are exceeded by that MLL. If, however, any parameter in the multi-parameter approach suggests a MLL higher than the Historic P50, setting the MLL equal to the Historic P50 appears appropriate. This change in approach requires no additional effort.

3.3.c. Alternative use of significant change standards: averages and medians
Still another approach would be to average all the standard elevations attributed to a single lake (column **D** in Table A3-2). If this was done, the net result would be an appreciable reduction (mean of 0.7 ft) in the MLL for most of the lakes as compared to the District's proposed methodology (column **E** in Table A3-2). It would be even a larger decrease (1.5 ft) compared to the Historic P50 (column **F** in Table A3-2). It is not a consistent decrease, however, and exhibits no pattern that suggests there is any bias in the District's proposed methodology.

The same general pattern of MLLs applies to using the median of all elevations derived from all applicable parameters (Table A3-3), but most differences are smaller. There is some merit to using the median instead of the mean, as there is no clear indication that the values for any lake are normally distributed. In that case, the change in MLL from that proposed by the District is minimal (<0.1 ft) for 5 lakes and large (>1.0 ft) for only 2 lakes.

If the purpose of setting a MLL is to protect uses and resources, taking an average or median serves no useful purpose. Measures of central tendency are appropriate when all the values being averaged have a reasonable probability of approximating the same "true" value. The up to eight different parameters applied in the District's approach are not expected to yield identical results for any lake, and the use of eight parameters is an acknowledgement that different features may be the most sensitive at different lakes.

Table A3-3. Differences between MLLs calculated by proposed District methodology and either the mean or median of all parameter values.

Lake	Dist. MLL-Mean MLL (ft)	Dist. MLL-Median MLL (ft)
Big Fish	-1.45	0
Calm	+2.73	+2.86
Church/Echo	+0.57	+0.21
Crenshaw	+0.17	+0.01
Cypress	-0.42	0
Fairy	+1.07	+0.78
Helen/Ellen/ Barbara	+0.72	+0.41
Raleigh	+0.69	+0.41
Rogers	+3.44	+2.61
Round	+0.64	+0.02
Starvation	-0.10	+0.01

The approach of establishing the MLL as an average or median of the elevations for all parameters that apply to a lake is not recommended because of the following two reasons:

- Lake uses and biotic integrity are likely to be compromised. Some significant change standards will have corresponding lake level elevations above the MLL as determined by average or median. For example, Lake Rogers would have a MLL that is 3.4 ft lower (at 39.42 NGVD) than the currently District-proposed MLL at 42.82 ft (NGVD) if an average MLL was applied. This would result in a violation of the species richness standard since its elevation is set at 40.00 ft elevation (NGVD) for the lake. Likewise for Fairy Lake, the aesthetic standard would be affected since it lies at 31.32 ft (NGVD), which is between the District's proposed MLL of 32.1 ft (NGVD) and the MLL elevation based on an average of all the pertinent parameters (31.0 ft NGVD).
- Acceptance of any method that yields a lower MLL than the one currently proposed by the District would result in an even further departure from the Historic P50 elevation, which by definition is supposed to approximate the MLL.

3.3.d. Additional steps for establishing a significant change standard that indicates trophic state changes

As noted in the District's proposed plan (Leeper et al., 2001) and in discussion at the August 2001 public meeting, there is interest in incorporating one or more measures of impact on trophic state into the multi-parametric approach for determining MLL and related water levels. This has proved difficult, but several options are explored here.

Dynamic Ratio and Related Measures of Resuspension

The proposed approach incorporates efforts to assess the impact of changing water level on trophic state only to the extent that if the dynamic ratio (DR) crosses the 0.8 boundary between expected resuspension of sediments by wind action and no such resuspension, some consideration may be needed in setting the MLL. No numeric standard was developed. Subsequent effort by the Peer Review Panel failed to find a better way to use the DR or the related Osgood Index. The problem stems from the nature of those indices. That is, they can be used to quantitatively compare two lakes of different area but similar mean depth, or two lakes of similar mean depth but different area, but are not especially sensitive to comparing a single lake over time, where both mean depth and area decline together.

Examination of two alternatives was undertaken. The first alternative involves holding the area constant, since reduced depth does not only alter the probability of resuspension, but also exposes sediment that will oxidize and release nutrients back into the lake in runoff or when water levels rise. This approach could be considered to violate the intended process of the DR, as wind mixing is not a major process operating on the exposed sediment, but it seemed worthwhile to see what might result. Reworking the data for Big Fish, Raleigh, Rogers and Starvation lakes (Table A3-4) indicate only a slight change from the DR calculated as intended, in comparison to the 0.8 threshold. Lack of sensitivity (and using the index for a purpose for which it was not intended) limit its utility in the multi-parameter approach.

Table A3-4. Dynamic ratio values under varying assumptions

Lake	Area at Current P10		Mean Depth at Curr. P10	Area at Current P90		Mean Depth at Current P90	Dynamic Ratio for Curr. P10	Dynamic Ratio for Curr. P90	Altered DR (Area for P10, Depth for P90)
	(Acres)	(Sq. Km)	(Meters)	(Acres)	(Sq. Km)	(Meters)			
Big Fish	724	2.92	0.6	11.7	0.04	0.9	2.8	0.2	1.9
Raleigh	26.7	0.11	3.0	12.4	0.05	1.7	0.1	0.1	0.2
Rogers	95.1	0.38	2.9	54	0.21	1.7	0.2	0.3	0.4
Starvation	75.5	0.30	1.9	37.1	0.15	1.1	0.3	0.4	0.5

Considering the shallowness of the test lakes, the DR may not even be applicable in its original, intended form. At some lower limit of depth, possibly as deep as 10 ft and almost certainly at 4–5 ft, sediment resuspension is possible without much of a fetch upon which the wind can act. This leads to the alternative approach, which considers the change in area that obviously interacts with the water column. This approach assumes that any area exposed by reduced depth can affect water quality, as can any area <4 ft deep. Deeper areas may well affect water column as well, but these assumptions also incorporate biological elements; exposed sediments can support herbaceous wetland vegetation and the area <4 ft deep coincides with the zone in which herbaceous aquatic plants have achieved peak density.

The premise is that as depth is reduced, exposed area increases and the area <4 ft deep will change in accordance with bathymetry. If the area <4 ft deep declines, there may be no major change in the area of obvious interaction between sediment and water quality. If the area <4 ft deep is similar to or greater than what it was at the higher water elevation, the area of obvious interaction will increase and trophic state may be affected. The starting point would logically be the Historic P50, representing the long-term average water level. The key to such a significant change indicator is the selection of a percentage change in the size of this area of interaction that represents an unacceptable (or significant) alteration. No clear guidance could be found, but it seems logical that an increase of 10 to 20 percent could have a detectable effect on water quality.

With a starting point of the Historic P50, an acceptable change of 15 percent would make this index identical to the species richness parameter for birds. At least the bird richness parameter had some empirical support, and it was criticized for lack of rigor. Without some form of empirical support for the postulated impact of changing water level on interaction between sediments and the water column, this approach offers no improvement over the species richness parameter and does not appear useful.

Empirical Trophic State Models

Empirically developed models of the relationship between loading of nutrients (especially phosphorus) and in-lake concentrations have been used to project the impact of changing land use or water management on trophic conditions. Application to the test lakes in complete form would require a loading analysis that some might consider onerous and others might consider inadequate, but it may be possible to apply the models without an accurate appraisal of loading. The intent would be to establish a representation of the phosphorus status at the Historic P50, then to evaluate the percent change at a lower MLL.

The significant change threshold for this approach would logically be on the order of 10 to 20 percent, based on visibly perceptible changes in algal density or water clarity. It should be noted that response to a change in phosphorous concentration is likely to be visible only at lower phosphorous levels and corresponding higher water clarity, but the high clarity of target lakes viewed in August 2001 suggests that such an approach may be applicable. Some states apply numerical change standards (e.g., Maine, with mostly very clear lakes, allows no more than a 1 ppb increase in P concentration), but there may be no clear basis for such a standard in Florida.

To apply this approach, some data are needed and several assumptions must be made:

- Initial P load: The models allow the load to be predicted from in-lake concentrations, a readily acquired measure that may already be available for many lakes, given Florida's extensive LakeWatch program. These data are not in the possession of the Panel at this time, however, so we will assume several hypothetical in-lake levels for example purposes.
- Initial hydraulic load: The flushing rate is an important variable in most models, and the quantity of incoming water can be estimated from the watershed area multiplied by a water yield coefficient. We will assume a yield of 1 cubic foot per second per square mile of watershed (1 csm) for example purposes.
- Mean depth: This can be derived from the available bathymetric data for each lake, simply expressed as volume divided by area.
- Future P load: Although load may change with altered inflow, it will be assumed that the P load is constant. This may be a very weak assumption for lakes for which the source of water and nutrients is the same.
- Future hydraulic load: If the water level declines as a function of direct withdrawal, the hydraulic load may not be altered. However, it is assumed that water level will decline as a function of withdrawals from outside the lake, leading to decreased inflow. That decrease in inflow will be estimated as the percentage decrease in lake volume.

A spreadsheet model was applied to test this approach. The process proceeded as follows:

- The needed data for the Historic P50 condition (P concentration, watershed area, lake area and volume) were entered into Part 1 of the model (which applies two separate empirical models), resulting in a calculation of the initial P load (in Part 2 of the model) necessary to achieve the observed in-lake P concentration.
- The estimated load was entered into Part 1 of the model to yield an estimate of the P concentration in Part 2 of the model. The actual and predicted P concentrations should be the same, but rounding error can result in small differences.
- The area and volume for the new (reduced) water level were entered into Part 3 of the model, yielding an estimate of the new P concentration.
- Initial and new P concentrations were compared.

Examples have been run for the Historic P50 vs. the Current P50 and the Current P90 for selected lakes (Table A3-5, including all test lakes for which sufficient data were provided).

Table A3-5. Predicted change in phosphorous concentration with water level change

Lake	Elev. Difference (Historic-Current P50)	% P Change	Elev. Difference (Hist. P50-Curr. P90)	% P Change
Big Fish	1.36	9.1	5.84	518
Calm	0.89	15.8	3.38	37
Church/Echo	0.91	10.0	3.82	30
Crenshaw	1.02	0.0	3.83	30
Cypress	1.20	0.0	3.52	5
Helen/Ellen/Barb	0.96	10.5	2.55	26
Starvation	0.22	10.0	6.06	65

Over the range of Current P50 to Current P90, the change in phosphorous concentration and associated trophic status is substantial for most lakes. Not all are affected in the same manner, as changing depth, area and volume vary among these lakes, but this approach is sensitive enough to detect potentially significant changes in trophic status over the range of water levels likely to be observed.

Choosing a significant change standard would be less subjective if a target value was selected, such as a P concentration of no larger than 20 ppb, or water clarity of 2 m as measured by Secchi disk. The model has an accompanying set of calculations that evaluate average and maximum chlorophyll and Secchi transparency as well as estimating P concentration. If the lake P concentration is already >20 ppb, perhaps no change from the actual P concentration or that calculated for the Historic P50 should be allowed. This would be especially true if the lake was listed on the Section 303D list. Using an actual or calculated Secchi transparency could be useful, as it ties lake condition to lake uses (a contact recreation standard for water clarity in Florida would be helpful).

Alternatively, setting some reasonable percent change in P concentration that will be allowed as a function of declining water level could work, if such a limit can be agreed upon. It is generally suggested that a 20 percent change in loading will result in an observable change in lake condition, while some changes may be detectable with a 10 percent shift.

This method has merit, but does rely on assumptions that have not been tested thoroughly or even sufficiently. The assumption that the load of phosphorus will remain constant with a decreased water load is especially troublesome. Inspection of several of the target Category 3 lakes at very low water levels suggested no algal blooms in August 2001, and water clarity was quite high in virtually all cases. If reduced water input translates into reduced load, there may not be a major trophic state impact from changing water level due to reduced water inputs.

Additionally, the starting values in the model are important to the outcome. Assumption of a proportional outcome with a proportional change in any variable was not upheld when the starting phosphorous concentration was changed from 20 ppb to 40 ppb (Table A3-6). Consequently, this approach would appear to have validity only if used with accurate, system-specific data. This would require a major effort for each lake, as not all necessary data are readily available. While this may be a useful avenue for future research and application, it is not a realistic addition to the multi-parameter method at this time.

Table A3-6. Predicted change in phosphorous concentration with water level change under different initial phosphorous concentrations

Lake	Elev. Difference (Historic-Current P50)	% P change at initial P = 20 ppb	% P change at initial P = 40 ppb
Big Fish	1.36	9.1	20.0
Calm	0.89	15.8	5.0
Church/Echo	0.91	10.0	8.0
Crenshaw	1.02	0.0	0.0
Cypress	1.20	0.0	3.0
Helen/Ellen/Barb	0.96	10.5	2.0
Starvation	0.22	10.0	10.0

3.3.e. Development of a significant change standard for stratified lakes

There appears to be a lack of a metric for developing a change standard for those lakes where the dynamic ratio is less than 0.8 between the HGL and LGL (indicating insignificant resuspension), but do produce stable patterns of thermal stratification as evident from depth profiles of water column temperature and dissolved oxygen concentration during summer months (see p5-10 in Leeper et al., 2001). Under such a regimen, direct resuspension of nutrient-enriched sediments and porewaters into the water column is not likely to be significant. However, there still exists the potential for release of nutrients from sediments into anaerobic hypolimnetic bottom waters, which would readily be entrained in the water column during destratification.

There are several published indexes that should be explored by the District staff as possibly being suitable to incorporate as part of their multi-parameter assessment. One of these "anoxic" indexes could be used individually, or more appropriately, in combination with the dynamic ratio. The first index (Osgood 1988) is simply the reciprocol (the mean depth in meters divided by the square root of the lake surface area in km^2) of the dynamic ratio. Osgood (1988) found that this ratio was closely correlated with the fraction of lake volume involved in mixis and the duration of summertime mixis. More polymictic lakes ($z/A_o^{0.5} \approx 5$ and less) had a summertime increase in total P if internal P supplies are important compared to dimictic lakes ($z/A_o^{0.5} \approx 7$ and higher). It is interesting to compare the ratio proposed by Osgood (1988) with the dynamic ratio, both expressed in the dynamic ratio form ($A_o^{0.5}/z$). Whereas Bachmann et al. (2000) reported a dynamic ratio of greater than 0.8 as indicative of sediment resuspension, the reciprocal of the Osgood ratio for polymictic lakes is 0.2 or less. Thus, the standard derived by Bachmann et al. (2000), which is required for sediment resuspension, is nearly four times higher than the criterion set forth by Osgood (1984) for lakes that mix frequently from thermal destratification or less intensive wind energies.

Another index to seriously consider is the anoxic factor (AF), which quantitatively summarizes the extent and duration of anoxia in stratified lakes (Nürnberg 1995). It is a ratio that represents the number of days in a year or season that a sediment area equal to the lake surface area is anoxic (units of days/year or days/season):

$$AF = \frac{\sum_{i=1}^{n} t_i \cdot a_i}{A_o}$$

This index has several important features (Nürnberg 1995):

- Gives a quantitative measure of hypolimnetic anoxia in stratified lakes that is comparable across lakes of different sizes since it is corrected for lake surface area.
- It is a useful indicator of sediment-related trophic processes besides anoxia, such as processes like P and Fe release that require reduced sediment surfaces.
- Sensitive to small, but deep lakes that are oligotrophic to mesotrophic where anoxia would not be expected to be extensive or frequent.
- It has been reported to be significantly negatively correlated with the number of fish species in small Canadian lakes.

Since the guidelines presented in Leeper et al. (2001) state in the event that the dynamic ratio does not change or changes from ≥0.8 to <0.8 with a change in elevation bounded by the Current P10 and P90 elevations, dissolved oxygen and temperature profiles will be gathered. Such an action guideline would yield the necessary data to construct AF, and no additional field costs or monitoring would be required. Choosing a significant change standard for AF could be done by regressing the AF against the lake area for those lakes within the District's boundaries that were included in the monitoring program.

3.3.f. Development of a significant change standard for the maximum depth of colonization (MDC) for submerged aquatic vegetation (SAV)

We consider this parameter to be a very important one in the eight-member suite of parameters used to set MLL because SAV:

- Provides a critical habitat for fish
- Serves as a food source for waterfowl
- Is important in nutrient recycling, sediment stability and water turbidity
- Is sensitive to water quality changes

Although all of the four above reasons are important in themselves, it is the sensitivity of SAV to water quality changes that is perhaps the most important because, in addition to the sediment resuspension/stratification parameter previously discussed, this is the only other parameter that encompasses trophic state. Whereas the sediment resuspension/stratification parameter captures the direct cause of nutrient enrichment (i.e., increase in trophic state) through internal loading, the SAV coverage parameter describes more of the effects of nutrient enrichment on a key community. As a lake becomes more eutrophic, higher phytoplankton populations reduce the depth to which light penetrates. This causes the SAV community to become more limited to shallower depths than before, which results in less SAV biomass and coverage in the lake.

The significant change standard for this parameter is based on a study of 26 Florida lakes by Canfield et al. (1985). Canfield et al. performed a regression of the maximum depth of macrophyte colonization (MDC) vs. the Secchi disc depth (SD), which produced the following empirical model:

$$\log(MDC) = 0.42\log(SD) + 0.41 \qquad r^2 = 0.71$$

where MDC and SD are expressed in meters. Note that this equation is incorrectly given on p4-21 in the Draft Report (Leeper et al., 2001).

The high coefficient of determination for the regression suggests that the model should be robust for other Florida lakes. However, there are some drawbacks in using that database that we feel should be examined and redressed for minimum effort and cost. Canfield et al. (1985) included emergent and floating vegetation in their 26-lake data set, which we feel are not nearly as physiological-dependent on underwater light penetration as is the submersed aquatic vegetation community. If you subtract the number of lakes with floating or emergent vegetation, then the data set is reduced from 26 to 18 lakes. Furthermore, of those 18 lakes, 11 of them were dominated by hydrilla (*Hydrilla verticillata*), which biases the regression coefficients toward this exotic species that is known for growing in low light environments.

Given the importance of this parameter, we recommend that the District staff initiate a site-specific study on as many lakes as feasible with the purpose of developing a regression relationship between MDC and SD for SAV. Such a study could be done quickly (within a growing season) and at only a small cost. District staff has essentially performed a similar type of exercise when it used its own database of 295 lakes to compile a mean depth of 3.9 ft for the emergent and floating macrophytes when it developed the significant change standard for the herbaceous wetland area parameter.

At a minimum, Secchi disk depth could be correlated with the MDC for each lake and a regression performed between the two variables. Only slightly more effort would be required to relate the MDC and the attenuation coefficient, which could be done by employing a conversion factor (Giesen et al. 1990). If this is done, then the minimal light requirement expressed as a percentage of the surface insolation could be reported for each major SAV taxon according to the Lambert-Beer equation:

$$I_z/I_o = e^{-K_d \cdot Z}$$

Where I_z is the photosynthetic active radiation (PAR) at depth z, I_o is the PAR just below the water surface, K_d is the light attenuation coefficient (m^{-1}), and z is the water depth (m).

By knowing the percentage transmittance of light at the MDC for each species, differences between SAV species could be accounted for and incorporated into the significant change standard. In other words, a species-specific MDC would be known and could be applied to the significant change standard, depending on which species dominated a lake.

The suggested additional effort is substantial, and probably could not be accomplished within the time constraints for establishment of MLLs for the targeted lakes. It may provide future improvement in the application of the multi-parameter method, however, and is worth investigating.

3.3.g. Development of a significant change standard for herbaceous wetland area (HWA)

The Draft Report (Leeper et al., 2001) alludes to possibly calculating the significant change standards for herbaceous wetlands relative to the their occupation areas at the Historic P50 elevation. That is, some percentage change of the surface areas occupied by emergent plant communities at the Historic P50 should be determined to represent a pivotal point (i.e., a critical area) above which a significant change would occur in the plant community or related lake features. The elevations corresponding to this percentage would constitute the significant change standards that would then be compared to the other standards calculated. The elevation corresponding to the critical percentage change (say 20 to 25 percent) in the acreage of HWA from its coverage at the Historic P50 would be equal to the HWA significant change standard. This would be compared to the standards for the other six parameters to add another quantitative measure to the multi-parameter approach to setting minimum lake levels.

The challenge is arriving at scientifically defensible critical minimum areas as the cutoff percentages. These percentages may be determined from a literature review as to what constitutes an "ideal" percentage of HWA habitat for lakes, or interviewing lake managers or user groups (fishermen, boaters, lake residents) as to their perceptions of appropriate coverage for herbaceous wetlands within lakes. This survey approach may overlap with the aesthetic standard setting process suggested later, but could still be applicable.

3.3.h. Recreation/ski significant change standard enhancement

While the proposed significant change standard preserves a lake use, it could allow much less of that use on some lakes. Rather than evaluating water level based on the minimum that will support safe skiing, why not consider the change in usable lake area for water-skiing or any other motor-dependent activity of interest (e.g., fishing or just cruising). For example, boatable acreage could reasonably be defined as the area with some minimum depth (5 ft) at some minimum distance from shoreline and structures (100 ft), divided by the desired acres per boat (10–25). The impact induced by water level changes can then be assessed, and some reasonable reduction in boatable acres (20 to 25 percent) can be established as the significant change standard.

This approach might be facilitated by user surveys to identify levels of boatable area loss that are unacceptable to boaters, and would require substantial effort. At issue is defining a defensible percentage loss in boatable area.

Alternatively, the currently proposed approach of simply maintaining water-skiing as a use might be modified in several ways. The significant change standard could be made more stringent by requiring less loss of water-skiing paths in terms of the number of circular units of appropriate size (radius = 418 ft) available at a lake. This would be similar to the boatable area approach. The significant change standard could be made more lenient by consideration of alternative paths that provide for safe water-skiing; paths need not be circular to be safe, and the area encompassed by a circle with a radius of 418 ft may well be available as a rectangle or other functional shape in some lakes.

Any alternative approach with regard to the recreation/water-ski significant change standard will require substantial effort to develop and implement, and may not be suitable for inclusion in the multi-parameter approach within the time constraints for its approval. The current approach of using a minimum area suitable for maintaining water-skiing as a lake use is acceptable, it just may not be optimal.

3.3.i. Aesthetic significant change standard enhancement

The current significant change standard for lake aesthetics is reasonable as a first cut attempt to preserve a use, but could be substantially improved and more quantitatively supported by user surveys aimed at quantifying user perceptions of lake condition at various water levels. This is a common technique for quantifying acceptable change where subjectivity is a major factor. Recreation science deals with the associated uncertainty and statistical evaluation of results, and has been a great aid in settling disputes over minimum flows in rivers for aesthetic or other recreational uses, wilderness preservation and scenic features maintenance.

The effort necessary to generate a more quantitative assessment of water level aesthetics is substantial, and it may take several years to generate the necessary data. Undertaking such a survey is advised, however, to strengthen the aesthetic significant change standard.

3.3.j. Possible benthic invertebrate significant change standard

The potential use of invertebrates as indicators of undesirable changes induced by water level decline was focused on zooplankton species and justifiably abandoned. However, where aquatic mollusk populations exist, size and age distributions at different depths often reflect the impact of drawdown over periods up to several decades long. By examining the spatial distribution of any given species of mollusk, and the age distribution for any given water depth, the zone of drawdown impact can be defined fairly clearly. It may very well correspond to the P10-P90 zone, in which case it could then be compared to the RLWR for the area. Otherwise, some index of impact zone change would have to be developed. Mollusk population features should correlate well with long-term water levels in lakes with suitable water chemistry (adequate calcium and pH >6.0) and substrate, providing acceptable precision and accuracy.

Considerable field work would be involved (possibly several thousand hours), but studies of this type (e.g., Normandaeu 1996, Fugro 1998) have been conducted elsewhere and the results have been used in setting the water level regime over annual and decadal cycles. If there are endangered or otherwise protected species of mollusks in the area, the District may actually have some obligation to evaluate this approach. The current problem is that the low water levels of the last decade have apparently decimated the mollusk populations of many lakes, and it may be a long time before populations recover sufficiently to make such an investigation worthwhile. This may be more valuable as an indicator of restoration success than as a significant change standard for setting MLLs.

3.3.k. Consideration of septic system influences

During the public meeting of August 2001, the issue of high water levels impacting septic system function was explored briefly. Current statutes in Florida require that there be only two feet of non-saturated soil (at the wettest time of year) between the bottom of the leach field and the groundwater table (Henigar and Ray, 1990). Practices in many other states reference a distance of four to six feet between the bottom of the leach field and the groundwater table for proper function of a conventional septic system. This suggests that many on-site disposal systems have been built in Florida in a manner that is sub-optimal for the protection of water quality, and that a decrease in adjacent lake level might actually provide some water quality benefits.

Much site-specific work would be necessary to document such a benefit for any lake where the established MLL was high enough to potentially impact septic system function, and it is not recommended that this be a primary consideration in setting MLLs, but it should be noted that not every aspect of raising water levels back toward historic levels is beneficial.

3.3.1. Adjustment of the Reference Lake Water Regime (RLWR)

During the public meeting on August 6, 2001, it was suggested that some of the Category 3 lakes are more flow-through systems, while others are more hydraulically unconnected to nearby lakes as far as their surface waters are concerned. Category 3 lakes that are considered to be more "isolated" with respect to their surface water hydrology are shown by double asterisks in Table 2. We could not detect any differences between the two types of lakes based on differences in the NP and HGL (column **A**), Historic P50 minus the District MLL (columns **B** and **C**), or the District MLL minus the mean of all applicable parameters (column **E**). However, the sample size of just four hydraulically "isolated" lakes is probably not large enough to detect any differences between the two hydrologic types of lakes if they should indeed exist.

The suggestion that development in recent years has increased the variability in hydrology and therefore in water level has merit, but it will take considerable effort to sort out the influences of recent development, drought between 1989 and 2001, and water withdrawals from area wells, if indeed these influences can be separated. It seems worthwhile to examine the available data sets to see if this can be done, but application of results to a new RLWR requires assumptions additional to those applied in the construction of the existing RLWRs and is not clearly justifiable. Expenditure of perhaps a week of staff time should be adequate to determine if such separation of influences is feasible with existing data, if it has not already been done.

It has also been suggested that each lake could have its own RLWR based on current data that would reflect recent variability. This approach suffers from both a need for considerable additional effort and violation of the intended purpose of the RLWR (to assess variability in the absence of well withdrawals). However, in light of recent watershed development and drought conditions, it would be worthwhile to evaluate the available data to see how much more variable water levels are now than for the time period in which RLWRs were created, using data from the same lakes used to construct RLWRs. This might require just a few days of staff time, and may shed some light on changes in variability in response to recent events, even if the causes for any increased variability are not differentiable.

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Appendix 4
Public Supply Permitted Quantities and 2002 Withdrawals in the SWUCA

2002 Public Supply Use vs. Permitted Quantities (mgd)

Public Supply Permitted Quantities and 2002 Withdrawals in the SWUCA

Column Source:	RDB		RDB	EWU,A1	E*F	EWU,A3	EWU,A1	EWU,A1	I-K	EWU
ALL WUPS AFFECTING THE LISTED COUNTY	**WUP #**	**SOURCE TYPE**	**Permitted Daily Avg.[1]** (mgd)	**Treatment Efficiency [2]** Decimal Portion	**Available Supply** (mgd)	**Available Supply in County[3]** (mgd)	**2002 Avg. Daily W/D for Service in County[4]** (mgd)	**2002 Avg. Daily Use for Service in County[5]** (mgd)	**Avg. Day Reserve for Service in County[6]** (mgd)	**Persons Using 2002 Unadjusted Gross gpcd[7]** (No. persons)
CHARLOTTE COUNTY										
CHARLOTTE PR/MWSA (Initial Capacity)[8]	10420	SW	10.750	0.94 [A]	10.105	10.105	8.497	8.497	1.608	49,059
CHARLOTTE PR/MWSA (Peace River Option)[8]	10420	SW	2.000	0.94 [E]	1.880	1.880			1.880	9,127
CHARLOTTE PR/MWSA (Future Expansions)[8]	10420	SW	3.000	0.94 [E]	2.820	2.820			2.820	13,691
CITY OF PUNTA GORDA UTILITY DEPT	871	SW	5.358	0.98 [E]	5.251	5.251	4.198	3.543	1.708	27,514
ENGLEWOOD WATER DISTRICT (GW/RO) Assumed 50%	4866	GW I	5.360	0.60 [E]	3.216	1.608	2.138	2.138	-0.530	17799
GASPARILLA ISLAND WATER ASSOC (GW/RO)	718	GW S,I	1.538	0.82 [A]	1.261	1.297	1.105	0.938	0.359	3,744
FLORIDA WATER SERVICES INC (GW/RO)	3522	GW I	0.914	0.87 [A]	0.794	0.794	0.319	0.319	0.475	4,375
CHARLOTTE HARBOR WATER ASSOC (GW/RO)	1512	GW I	0.712	0.60 [E]	0.427	0.528	0.433	0.346	0.182	4,866
Small Utiliities (<0.1 mgd permitted)			0.341	0.50	0.170	0.170		0.085	0.085	1,385
Charlotte County Total			**29.972**		**25.924**	**24.453**		**15.866**	**8.587**	**131,560**
Ground Water Total			**8.864**					**3.826**	**0.571**	
Floridan Ground Water Total			**0.000**					**0.000**	**0.000**	
Surface Water Total			**21.108**					**12.040**	**8.016**	
2020 Projected PS Needs (2001 RWSP)[14]									7.5	85,481
2020 Projected PS Needs (2001 RWSP) Total[15]									9.8	
DESOTO COUNTY										
ARCADIA, CITY OF (GW)	4725	GW I	1.117	0.98 [E]	1.095	1.095	1.090	1.090	0.005	7,371
PR/MRWSA / LAKE SUZY (Initial Capacity) (SW)[8]	10420	SW	0.067	0.94 [A]	0.063	0.063	0.063	0.063	0.000	1,289
PR/MWSA (Peace River Option) (SW)[8]	10420	SW	0.375	0.94 [E]	0.353	0.353			0.353	365
PR/MWSA (Future Expansions) (SW)[8]	10420	SW	1.000	0.94 [E]	0.940	0.940			0.940	973
Small Utiliities (<0.1 mgd permitted)			0.057	0.98 [E]	0.056	0.056		0.028	0.028	420
DeSoto County Total			**2.616**		**2.506**	**2.506**		**1.181**	**1.325**	**10,418**
Ground Water Total			**1.174**					**1.118**	**0.033**	
Floridan Ground Water Total			**0.000**					**0.000**	**0.000**	
Surface Water Total			**1.442**					**0.063**	**1.293**	
2020 Projected PS Needs (2001 RWSP)[14]									0.4	9,990
2020 Projected PS Needs (2001 RWSP) Total[15]									1.1	
MANATEE COUNTY										
MANATEE COUNTY	5387	SW	34.900	1.00 [A]	34.760	35.736	28.874	28.846	6.890	226,483
MANATEE COUNTY / EAST COUNTY	7470	GW F	13.816	0.98 [E]	13.540	0.405	13.135	0.000	0.405	0
IMC FERTILIZER & MANATEE COUNTY	7345	GW F	1.960	0.98 [E]	1.921	0.618	1.303	0.000	0.618	0
CITY OF BRADENTON	6392	SW	6.950	0.98 [A]	6.804	6.962	5.539	5.673	1.289	49,958
LONGBOAT KEY*	10963	SW	0.000			2.358	0.000	2.358	0.000	15,997
CITY OF PALMETTO*	12443	GW F	0.000			1.438	0.000	1.438	0.000	11,608
Small Utiliities (<0.1 mgd permitted)			0.008	0.98 [E]	0.007	0.007		0.004	0.004	58
Manatee County			**57.634**		**57.032**	**47.524**		**38.319**	**9.206**	**304,104**
Ground Water Total			**15.784**					**1.442**	**1.026**	
Floridan Ground Water Total			**15.784**					**1.442**	**1.026**	
Surface Water Total			**41.850**					**36.877**	**8.179**	
2020 Projected PS Needs (2001 RWSP)[14]									11.6	92,063
2020 Projected PS Needs (2001 RWSP) Total[15]									12.8	
SARASOTA COUNTY										
NORTHPORT[8]	2923/10420	SW	3.280	0.98 [E]	3.214	3.865	1.303	1.954	1.911	18,863
NORTHPORT PR/MRWSA (Peace River Option)[8]	10420	SW	0.000	0.94 [E]						
NORTHPORT PR/MRWSA (Future Expansions)[8]	10420	SW	1.000	0.94 [E]						
CITY OF SARASOTA	4318	GW F	6.000	0.91 [A]	5.453	10.185	5.036	7.187	2.998	70,569
SIESTA KEY UTILITIES*	4709	GW F	0.000		0.000	1.674	0.000	1.674	0.000	16,473
ENGLEWOOD WATER DISTRICT Assumed 50%[9]	4866	GW I	5.360	0.75 [E]	4.020	2.010	2.138	2.138	-0.128	17,799
CITY OF VENICE	5393	GW I	6.864	0.52 [A]	3.561	3.561	4.311	2.246	1.315	22,090

2002 Public Supply Use vs. Permitted Quantities (mgd)

ALL WUPS AFFECTING THE LISTED COUNTY	WUP #	SOURCE TYPE	Permitted Daily Avg.[1] (mgd)	Treatment Efficiency [2] Decimal Portion	Available Supply (mgd)	Available Supply in County[3] (mgd)	2002 Avg. Daily W/D for Service in County[4] (mgd)	2002 Avg. Daily Use for Service in County[5] (mgd)	Avg. Day Reserve for Service in County[6] (mgd)	Persons Using 2002 Unadjusted Gross gpcd[7] (No. persons)
Column Source:	RDB		RDB	EWU,A1	E*F	EWU,A3	EWU,A1	EWU,A1	I-K	EWU
ELL-CAP 66 / CAMELOT LAKES (GW/RO)	5807	GW I	0.385	0.75 [A]	0.288	0.288	0.165	0.125	0.163	1,976
SARASOTA CO. / UNIVERSITY PARKWAY[17]	7411	GW F	15.226	0.98 [E]	14.922	24.478	6.253	15.809	8.669	186,265
ROYALTY RESORTS / SUN N FUN RV. (GW/RO)	7448	GW I	0.205	0.50 [E]	0.103	0.103	0.104	0.104	-0.001	2,600
SARASOTA COUNTY MABRY CARLTON16	8836	GW F	7.303	0.80	5.842					
CITY OF SARASOTA - DOWNTOWN (GW/RO)	10224	GW F	6.000	0.58 [A]	3.488	0.000	4.732	0.000	0.000	0
SARASOTA CO PR/MRWSA (Initial Capacity)[8]	10420	SW	0.000	0.94 [E]	0.000	0.000			0.000	-
SARASOTA CO PR/MRWSA (Peace River Option)[8]	10420	SW	3.625	0.94 [E]	3.408	3.408			3.408	-
SARASOTA CO PR/MRWSA (Future Expansions)[8]	10420	SW	10.000	0.94 [E]	9.400	9.400			9.400	-
Small Utiliities (<0.1 mgd permitted)			0.395	0.98 [E]	0.387	0.387		0.193	0.193	4,344
Sarasota County Totals			**65.643**		**54.085**	**59.358**		**31.430**	**27.928**	**340,979**
Ground Water Total			**47.738**					**29.476**	**13.209**	
Floridan Ground Water Total			**34.529**					**24.670**	**11.667**	
Surface Water Total			**17.905**					**1.954**	**14.719**	
2020 Projected PS Needs (2001 RWSP)[14]									12.8	143,820
2020 Projected PS Needs (2001 RWSP) Total[15]									23.1	
FOUR-COUNTY AREA (CHARLOTTE, DESOTO, MANATEE, AND SARASOTA COUNTIES) TOTAL										
Four-County Area Totals			**155.865**		**139.547**	**133.842**		**86.796**	**47.045**	**787,061**
Ground Water Total			**73.560**					**35.862**	**14.839**	
Floridan Ground Water Total			**50.313**					**26.112**	**12.693**	
Surface Water Total			**82.305**					**50.934**	**32.207**	
2020 Projected PS Needs (2001 RWSP)[14]									32.3	362,921
2020 Projected PS Needs (2001 RWSP) Total[15]									46.8	
HARDEE COUNTY										
BOWLING GREEN, CITY OF (GW)	30	GW F	0.386	0.97 [E]	0.374	0.374	0.271	0.271	0.103	2,191
WAUCHULA, CITY OF (GW)	4461	GW F	1.110	0.97 [E]	1.077	1.077	0.827	0.827	0.250	4,377
ZOLFO SPRINGS, TOWN OF (GW)	7658	GW F	0.229	0.97 [E]	0.222	0.222	0.195	0.195	0.027	1,560
Small Utiliities (<0.1 mgd permitted)			0.176	0.97 [E]	0.171	0.171		0.085	0.085	1,074
Hardee County			**1.901**		**1.844**	**1.844**		**1.378**	**0.466**	**9,202**
Ground Water Total			**1.901**					**1.378**	**0.466**	
Floridan Ground Water Total			**1.804**					**1.331**	**0.418**	
Surface Water Total			**0.000**					**0.000**	**0.000**	
2020 Projected PS Needs (2001 RWSP)[14]									0.3	4,540
2020 Projected PS Needs (2001 RWSP) Total[15]									0.6	
HIGHLANDS COUNTY										
LAKE JOSEPHINE HEIGHTS WATER	4167	GW F	0.308	0.97 [E]	0.299	0.299	0.096	0.096	0.203	1,135
CITY OF SEBRING	4492	GW F	5.699	0.97 [E]	5.528	5.528	3.448	3.448	2.080	30,529
SUN N LAKE OF SEBRING IMPROV DIS	4708	GW F	1.006	0.97 [E]	0.976	0.976	0.511	0.511	0.465	5,338
LAKE PLACID HOLDING CO	4980	GW F	0.401	0.97 [E]	0.389	0.389	0.264	0.264	0.125	2,572
TOWN OF LAKE PLACID	5270	GW F	0.754	0.97 [E]	0.731	0.731	0.489	0.489	0.242	3,087
SEBRING RIDGE UTILITIES INC	5786	GW F	0.232	0.97 [E]	0.225	0.225	0.164	0.164	0.061	2,029
CITY OF AVON PARK	6029	GW F	2.428	0.97 [E]	2.355	2.355	2.324	2.319	0.036	14,150
HIGHLANDS CO / TOMOKA HEIGHTS	6326	GW F	0.366	0.97 [E]	0.355	0.355	0.165	0.165	0.190	1,846
BUTTONWOOD BAY UTILITIES	7139	GW F	0.245	0.97 [E]	0.237	0.237	0.176	0.176	0.061	1,936
COUNTRY CLUB OF SEBRING, INC	7704	GW F	0.106	0.97 [E]	0.103	0.103	0.246	0.243	-0.140	653
CRYSTAL LAKE CLUB	7811	GW F	0.288	0.97 [E]	0.279	0.279	0.154	0.154	0.125	878
WOODLANDS OF LAKE PLACID	9490	GW F	0.175	0.97 [E]	0.170	0.170	0.081	0.081	0.089	575
HIGHLANDS RIDGE ASSOCIATES	9516	GW F	0.224	0.97 [E]	0.217	0.217	0.183	0.183	0.034	969
Small Utiliities (<0.1 mgd permitted)			0.338	0.97 [E]	0.328	0.328		0.171	0.157	2,604
Highlands County			**12.570**		**12.193**	**12.193**		**8.464**	**3.729**	**68,301**
Ground Water Total			**12.570**					**8.464**	**3.744**	
Floridan Ground Water Total			**12.570**					**8.464**	**3.744**	

2002 Public Supply Use vs. Permitted Quantities (mgd)

Column Source:	RDB		RDB	EWU,A1	E*F	EWU,A3	EWU,A1	EWU,A1	I-K	EWU
ALL WUPS AFFECTING THE LISTED COUNTY	**WUP #**	**SOURCE TYPE**	**Permitted Daily Avg.[1]** (mgd)	**Treatment Efficiency [2]** Decimal Portion	**Available Supply** (mgd)	**Available Supply in County[3]** (mgd)	**2002 Avg. Daily W/D for Service in County[4]** (mgd)	**2002 Avg. Daily Use for Service in County[5]** (mgd)	**Avg. Day Reserve for Service in County[6]** (mgd)	**Persons Using 2002 Unadjusted Gross gpcd[7]** (No. persons)
Surface Water Total			**0.000**					**0.000**	**0.000**	
2020 Projected PS Needs (2001 RWSP)[14]									3.9	31,319
2020 Projected PS Needs (2001 RWSP) Total[15]									4.7	
HILLSBOROUGH COUNTY										
FLORIDA WATER SERVICES INC (Seaboard)	2840	GW F	0.396	0.96 [A]	0.380	0.708	0.308	0.636	0.072	8,452
FLORIDA WATER SERVICES INC (Valrico Hills)	3704	GW F	0.156	0.96 [A]	0.150	0.150	0.090	0.090	0.060	876
TAMPA BAY WATER (S-C Hillsborough)	4352	GW F	24.100	0.94 [A]	22.654	24.431	22.612	24.389	0.042	208,307
WILDER MOBILE HOMES INC	4757	GW I	0.124	0.98 [E]	0.122	0.122	0.041	0.041	0.081	325
CAX RIVERSIDE LLC	7637	GW F	0.730	0.97 [E]	0.708	0.708	0.068	0.068	0.640	680
TAMPA BAY WATER (BUD Well Field)[10]	11732	GW F	6.000	0.98 [E]	5.880	2.678	3.274	0.000	2.678	
TAMPA BAY WATER (Alafia River)[11]	11794	SW	17.510	0.98 [E]	17.160	17.160	0.000	0.000	17.160	
TAMPA BAY WATER (Desal Plant)[12]	n/a	SW	44.000	0.57 [A]	25.080	0.000	0.000	0.000	0.000	
Small Utiliities (<0.1 mgd permitted)[11,13]			0.143	0.97 [E]	0.139	0.139	0.543	0.069	0.069	1,147
Hillsborough County			**93.159**		**72.272**	**46.096**	**26.936**	**25.293**	**20.803**	**219,787**
Ground Water Total			**31.649**					**25.293**	**3.643**	
Floridan Ground Water Total			**31.517**					**25.248**	**3.558**	
Surface Water Total			**61.510**					**0.000**	**17.160**	
2020 Projected PS Needs (2001 RWSP)[14]									30.3	202,903
2020 Projected PS Needs-(2001 RWSP) Total[15]									33.1	
POLK COUNTY										
MOUNTAIN LAKE CORP.	143	GW F	3.710	0.95 [A]	3.525	3.525	0.092	0.092	3.433	376
BARTOW, CITY OF	341	GW F	4.463	0.97 [E]	4.329	4.329	3.277	3.227	1.102	15,896
FORT MEADE, CITY OF	645	GW F	1.014	0.97 [E]	0.984	0.984	0.722	0.722	0.262	7,476
LAKE REGION MOBILE HOME OWNERS	1616	GW F	0.163	0.94 [A]	0.153	0.153	0.086	0.086	0.067	1,026
FOUR LAKES GOLF CLUB	1625	GW F	0.424	0.97 [E]	0.411	0.411	0.620	0.620	-0.209	1,881
LAKE HAMILTON, TOWN OF	2332	GW F	0.484	0.97 [E]	0.469	0.469	0.321	0.321	0.148	2,400
ORCHID SPRINGS DEVELOP. CORP	3415	GW F	0.115	0.97 [E]	0.112	0.112	0.083	0.083	0.029	710
CROOKED LAKE PARK WATER CO INC.	4005	GW F	0.304	0.97 [AE]	0.295	0.295	0.288	0.288	0.007	1,927
WINTER HAVEN, CITY OF	4607	GW F	10.565	0.97 [E]	10.248	10.248	9.412	9.410	0.838	60,653
LAKE WALES, CITY OF	4658	GW F	3.696	0.97 [E]	3.585	3.585	2.659	2.659	0.926	19,493
LAKELAND, CITY OF	4912	GW F	28.033	0.97 [E]	27.192	27.156	24.658	23.982	3.174	155,143
SPORTS SHINKO (FLA) / GRENELEFE	5251	GW F	1.278	0.97 [E]	1.240	0.408	0.988	0.938	-0.530	2,355
FROSTPROOF, CITY OF	5870	GW F	1.338	0.97 [E]	1.298	1.299	1.125	1.125	0.174	4,100
DUNDEE, TOWN OF	5893	GW F	1.003	0.97 [E]	0.973	0.466	0.494	0.494	-0.028	3,289
MULBERRY, CITY OF	6124	GW F	1.120	0.97 [E]	1.086	0.582	0.463	0.463	0.119	3,325
POLK CO. / NORTHWEST REGIONAL SA	6505	GW F	5.480	0.97 [E]	5.316	5.716	3.094	2.833	2.883	20,373
POLK CO. / SOUTHWEST REGIONAL SA	6506	GW F	4.948	0.97 [E]	4.800	4.812	3.266	3.264	1.548	24,127
POLK CO. / CENTRAL REGIONAL SA	6507	GW F	1.916	0.97 [E]	1.859	1.859	1.616	1.596	0.263	11,451
POLK CO. / SOUTHEAST REGIONAL SA	6508	GW F	0.929	0.97 [E]	0.901	0.901	0.559	0.551	0.350	4,567
LAKE ALFRED, CITY OF	6624	GW F	1.015	0.97 [E]	0.985	0.985	0.730	0.730	0.255	5,962
EAGLE LAKE, CITY OF	6920	GW F	0.380	0.97 [E]	0.369	0.369	0.276	0.276	0.093	2,040
AUBURNDALE, CITY OF	7119	GW F	5.029	0.97 [E]	4.878	4.878	3.098	3.098	1.780	21,125
CENTURY REALTY FUND - CHC VII	7187	GW F	0.461	0.97 [E]	0.447	0.447	0.525	0.525	-0.078	1,907
POLK CO. / EAST REGIONAL SA	8054	GW F	1.065	0.97 [E]	1.033	1.033	0.741	0.723	0.310	5,133
CENTURY REALTY FUNDS / SWISS VILL.	8344	GW F	0.234	0.97 [E]	0.227	0.227	0.229	0.229	-0.002	1,557
CYPRES LAKES VENTURE	8472	GW F	0.453	0.97 [E]	0.439	0.439	0.143	0.143	0.296	1,388
HAINES CITY, CITY OF	8522	GW F	3.734	0.97 [E]	3.622	3.622	2.768	2.768	0.854	15,454
PLANTATION LANDINGS LTD.	8753	GW F	0.111	0.97 [E]	0.108	0.108	0.084	0.084	0.024	847
SWEETWATER COOP, INC.	8967	GW F	0.149	0.97 [E]	0.145	0.145	0.101	0.101	0.044	692
VILLAGE OF HIGHLAND PARK	9807	GW F	0.175	0.97 [E]	0.170	0.170	0.102	0.102	0.068	185
CYPRESS LAKES UTILITIES, INC	11531	GW F	0.396	0.97 [E]	0.384	0.384	0.202	0.201	0.183	2,352
Small Utiliities (<0.1 mgd permitted)			2.421	0.97 [E]	2.431	2.431		2.431	0.000	15,289

2002 Public Supply Use vs. Permitted Quantities (mgd)

ALL WUPS AFFECTING THE LISTED COUNTY	WUP #	SOURCE TYPE	Permitted Daily Avg.[1] (mgd)	Treatment Efficiency[2] Decimal Portion	Available Supply (mgd)	Available Supply in County[3] (mgd)	2002 Avg. Daily W/D for Service in County[4] (mgd)	2002 Avg. Daily Use for Service in County[5] (mgd)	Avg. Day Reserve for Service in County[6] (mgd)	Persons Using 2002 Unadjusted Gross gpcd[7] (No. persons)
Column Source:			RDB	EWU,A1	E*F	EWU,A3	EWU,A1	EWU,A1	I-K	EWU
POLK COUNTY			86.606		84.014	82.548		64.165	20.383	414,499
GROUND WATER TOTAL			86.606					64.165	20.383	
FLORIDAN GROUND WATER TOTAL			86.606					64.165	20.383	
SURFACE WATER TOTAL			0.000					0.000	0.000	
2020 PROJECTED PS NEEDS (2001 RWSP) [14]									27.1	708,926
2020 PROJECTED PS NEEDS (2001 RWSP) TOTAL [15]									30.0	
SWUCA										
SWUCA TOTALS			350.101		309.870	276.522		186.096	92.427	
GROUND WATER TOTAL			206.286					135.162	43.075	
FLORIDAN GROUND WATER TOTAL			182.810					125.320	40.796	
SURFACE WATER TOTAL			143.815					50.934	49.367	
2020 PROJECTED PS NEEDS (2001 RWSP) [14]									93.9	
2020 PROJECTED PS NEEDS (2001 RWSP) TOTAL [15]									115.2	

Appendix 4 Notes:

mgd - million gallons per day
gpcd - gallons per capita daily
GW - ground water,
SW - surface water
PR/MRWSA - Peace River/Manasota Regional Water Supply Authority (Authority)

* Indicates utilities that either have been issued a wholesale permit or that have not been issued a permit, and receive 100 percent of its water supply from an outside source

1 Permitted average annual quantities
2 Treatment efficiency accounts for water loss incurred during the treatment process, such as water contained in slurries, sludges, brines, and other water-containing waste products. Where utilities provided actual, reasonable treatment efficiencies, they are identified by a superscript "A" and included in the table. Where utilities provided unreasonable treatment efficiencies or no treatment efficiency, a water treatment efficiency estimate, as determined by District staff and identified by a superscript "E," is provided.
3 Includes all quantities identified in "Available Supply" plus imported quantities minus exported quantities.
4 Includes "Withdrawal" as provided in the District's 2002 Estimated Water Use report; this is basically metered pumpage.
5 Includes "Gross Use" as provided in the District's 2002 Estimated Water Use report; Gross Use - imports + exports - treatment loss.
6 "Available Supply In County" - "Daily Use For Service In County"; represents the unutilized permitted quantity
7 Calculated as the "Avg. Day Reserve For Service In County"/the permittee's per capita water use rate, according to the District's 2002 Estimated Water Use report. For small utilities, the county average per capita use rate was applied.
8 The Authority's Peace River Facility, located in DeSoto County, is permitted for 32.7 mgd. It's delivery capacity and corresponding allocable quantities are being developed in three stages: the initial capacity of 12 mgd is that which existed prior the Peace River Option; the Peace River Option capacity of 6 mgd is that provided by construction of the Peace River Option; the future expansion capacity of 15 mgd is that provided by the Peace River Facility Expansion and the Regional Reservoir Expansion. The allocated quantities in each expansion phase are broken out separately in the table, as indicated in the WUPS column.
9 It was assumed that all attributes of Englewood Water District's service area, which lies in both Sarasota and Charlotte counties, would be applied to the respective counties in equal proportions.
10 The BUD and S/C wellfields constitute the potable supply for the SWUCA portion of Hillsborough County.
11 Per capita use was derived from the reported per capita use reported for S/C Hillsborough Wellfield.
12 Current production is delivered to Pinellas County for distribution with no use currently occurring in Hillsborough County.
13 Daily use for Service in County is based on 16.3% of Hillsborough County population in S/C area (Alafia 2001 5-year plan) and Table 1, page 10 in the EWU Report.
14 Estimated as (2020 public supply demand) - (2000 public supply demand), not including domestic self supply and irrigation wells, provided in the District's 2001 Regional Water Supply Plan.
15 Estimated as (2020 public supply demand) - (2000 public supply demand), including domestic self supply and irrigation wells, provided in the District's 2001 Regional Water Supply Plan.

Appendix 5
District's Messaging and Outreach

1.0 Outreach
For the SWUCA Recovery Strategy to be fully successful, information will need to be communicated to various audiences. Components of the outreach strategy include determining the message, the audience, the messenger and the method of delivery. In addition to the messages listed below, all audiences will need a basic briefing on the water issues being addressed — saltwater intrusion in the Floridan aquifer, lowered lake levels in portions of Highlands and Polk counties, and lowered flows in the upper Peace River.

1.1 Messages
The Recovery Strategy will:
- Help the resources recover
- Protect the investments of existing water use permittees
- Allow for economic expansion and new economic activities

Approximately $785 million is estimated to be needed to develop additional water supply and provide for recovery (only those projects proposed to date) of the SWUCA.

The District, federal, state, regional and local governments and the private sector will be called upon to provide financial assistance to help pay for these projects.

1.2 Audiences
The following are the primary audiences to receive District messages:
- District Governing and Basin Boards/Advisory Committees
- Department of Environmental Protection
- District staff
- Elected officials (local, state and federal)
- Local government senior staff
- Public utilities/water supply authorities
- Permit holders
- Agricultural community
- Business community
- Environmental organizations
- Media/general public

1.3 Messengers
A variety of messengers will be needed to successfully communicate the District's recovery strategy, including:
- Governing Board members
- Basin Board members
- Senior staff
- Communications staff
- Community and Legislative Affairs staff
- Regulatory staff
- Planning staff

1.4 Methods of Delivery

Many methods of delivering the District's message are available. The key will be selecting the appropriate method for the particular audience. Potential methods of delivery include:

- Personal briefings
- Presentations to District Governing and Basin Boards/Advisory Committees, editorial board/organizational/association meetings, and local, state and federal elected officials
- Emails
- Web site
- Direct mail
- Tours
- Media interviews
- News releases
- Guest columns/letters to the editor
- Newsletters
- "Town hall" workshops

1.5 Outreach Efforts to Date

The District has conducted significant outreach activities for the Draft SWUCA Recovery Strategy using printed materials, in-person contacts and the District's web site.

- Printed materials: The District has widely distributed the Draft SWUCA Recovery Strategy for review and comment. The document is also available on the District's web site, www.WaterMatters.org.
- In-person contacts: District staff and Board members have met with a wide variety of audiences through meetings involving, among others, the District Governing and Basin Boards, SWUCA Workgroup, District advisory committees, county and city elected officials, Department of Environmental Protection staff, water supply authorities, newspaper editorial boards and the public. A complete list of outreach activities is available on the District's web site, www.WaterMatters.org.
- Web site: the District has created a SWUCA web page on its home site, www.WaterMatters.org. Click on the SWUCA icon. The SWUCA page includes a map of the SWUCA, background information, upcoming meetings and links to the Draft SWUCA Recovery Strategy, Draft SWUCA Rules, a summary of comments and responses regarding the SWUCA proposals and a summary of the District's outreach efforts.

Appendix 6

SWUCA Work Group Members and Alternates

As of last meeting held on September 19, 2005

Member	Alternate
Charlotte County Commission Commissioner Sara Devos Commissioner Adam Cummings	**Charlotte County** David Schlobohm
Dept. of Agriculture & Consumer Services Bill Bartnick	Nate Jameson
DeSoto County Commission Commissioner Jerry Hill	**DeSoto County** Craig Coffey and Mandy Hines
ECOSWF Becky Ayech	No assigned alternate
Florida Citrus Mutual Jay Clark, III, Clark Farms, Inc.	Andy LaVigne
Florida Electric Power Coordinating Group Jim Frauen, Seminole Electric Cooperative	Tanya Portillo
Florida Farm Bureau Federation Cara Martin	John Eubanks
Florida Fruit and Vegetable Association Butch Calhoun	Alan Peirce
Florida Turfgrass Growers Association Mac Carraway	No assigned alternate
Hardee County Commission Commissioner Bobby Ray Smith	**Hardee County** Lex Albritton
Highlands County Commission Commissioner Bob Bullard	**Highlands County** Carl Cool
Hillsborough County Commission Commissioner Kathy Castor	**Water Resources Associates** Peter Hubbell **Hillsborough Co. Water Resources Team** Bart Weiss, Pamela Marlowe-Greene, Mario Cabana

Member	Alternate
Homebuilders Assoc. of Sarasota County L. Dickson Clements	No assigned alternate
Mosaic Fertilizer, LLC Jeff Stewart	Melody Foley
John Cannon Homes John Cannon	No assigned alternate
Lakeland Water Utilities Charles Garing	Gary Ross
Manatee County Commission Commissioner Pat Glass	**Manatee County** John Zimmerman
PR/MRWSA Pat Lehman	Ray Pilon
Polk County Commission Commissioner Bob English	**Polk County** Jeffrey Spence
Sarasota Audubon Sarasota County Commissioner Jon Thaxton	No assigned alternate
Sarasota County Commission Commissioner Shannon Staub	**Sarasota County** Rob Patten, Theresa Connor, Steve Suau
City of Sarasota Javier Vargos	Doug Taylor
Tampa Bay Wholesale Growers Hugh Gramling	No assigned alternate

Appendix 7
SWUCA Work Group Meeting Summaries

The Southern Water Use Caution Area (SWUCA) Work Group was first convened in October 1998 and met on an as-needed basis through September 2005. The input and advise of the Work Group was invaluable to the District in the formulation of this Recovery Strategy and the associated rule revisions. Included in this appendix are summaries of the Work Group meetings starting with the November 17, 2003 meeting where the first draft of the Recovery Strategy was discussed, through the last meeting held on September 19, 2005. In all, the Work Group and its original subcommittees (the Water Resource Development and Regulation Focus Groups) met a total of 30 times over this eight-year period. Copies of all Work Group meeting summaries are available from the District upon request.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SOUTHERN WATER USE CAUTION AREA (SWUCA) WORK GROUP
MEETING SUMMARY
NOVEMBER 17, 2003
(REVISED)

The SWUCA Work Group met at 9:10 a.m. November 17, 2003, in the District's Bartow Service Office. A copy of the meeting agenda and the sign-in sheets (reflecting members of the public, staff, and the Work Group) are attached. Copies of presentation materials are available upon request. Proceedings of the meeting were recorded and are on file at the District's headquarters in Brooksville, Florida.

Richard Owen, Planning Director, called the meeting to order and introductions were made. He provided a brief overview of the information we would be reviewing regarding the draft Management Plan. Mr. Moore, Executive Director, also made introductory remarks. He emphasized that the draft Recovery Strategy represents a significant milestone and the District hopes to engage this group and others in its review and finalization. Mr. Moore also emphasized this is "a" Management Plan, not "the" management Plan and anticipates potential revisions before it is finalized. Mr. Moore said there have been issues regarding the boundaries of the southern water use caution area and where they are drawn, and said we will review the history of how and why these boundaries were drawn using graphical presentations. He said staff is prepared to answer any questions regarding minimum flows and levels or any section of the Plan, but the main focus today is the water supply planning component, and the regulatory enhancements. He said much of the Plan can be implemented under existing rules, but there will be some enhancements required, and we will be also be reviewing those components. Mr. Moore said that today, we hope to provide an introduction to the Plan and want the work group members to take the opportunity to review the Plan within the next 45-60 days, and provide any input they may have and then we will meet again mid-January. Mr. Moore said the Plan will go back to the March Governing Board meeting for finalization. Mr. Moore expressed his appreciation for the staff and their efforts in putting this draft Plan together.

I. Review of the draft SWUCA Management Plan

Mr. Owen began by giving background on how the boundaries were determined. He showed a graphic depicting the Lake Wales Ridge which showed the District boundaries and how this boundary captured the Ridge region. It also captured the citrus activity and citrus land uses that predominate that area and how those withdrawals are concentrated up and down the Ridge, and within the South Florida and St. Johns River boundaries, there are no significant withdrawals. He said the issues we are dealing with is how these withdrawals contribute to the resource concerns, including impacts on lake levels and the ground water system as a whole. He said another concern is the impacts on the Peace River. Mr. Owen said the Governing Board, last year, confirmed three principles to guide staff in preparing the Plan, they included: actions taken need to contribute to resource management and recovery; the protection of existing reasonable beneficial uses; and allowing for economic changes and expansion to occur as land uses change and the water uses must also change. He said during this process, other guiding principles became evident that are reflected in the Plan. He said we want to base our management actions on the best available information and science. We need to minimize the need for additional rules and rule revisions and use existing rules to the maximum extent. Staff is confident that the methodologies for establishing minimum flows and levels (MFLs) and the application of the methodologies to water bodies in the SWUCA are adequately scientifically founded. We want to ensure the components of the recovery strategy are, to

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the maximum extent possible, consistent with similar types of recovery actions and plans of the other water management districts and the DEP.

At this time Mark Barcelo provided an overview of the SWUCA physical conditions. Mr. Barcelo said the boundaries are delineated based on persistent ground water flow within the Floridan aquifer. He said in 1987 there was a follow-up study regarding the cause of declining water levels on the Ridge, and it was concluded it was because of ground water withdrawals within and outside the Highlands Ridge area. He said in the northern Tampa Bay area, the impacts were associated with the lowering of lakes and wetlands. He said in 1989 the Governing Board declared three water use caution areas: Northern Tampa Bay, Eastern Tampa Bay and Highlands Ridge. He said a short-term strategy was to form citizens advisory groups in each of those areas to develop mid- and long-term solutions, and implement any best management practices that were possible. He said the staff would then return to the Governing Board with recommendations made by these groups on management strategies in the different areas. A significant recommendation from one of the groups was the establishment of most impacted areas in the Eastern Tampa Bay area. The purpose for this was to stabilized the ground water level declines within that area that was contributing to or causing the increase movement of the saltwater interface. Since 1990 there has not been any increases in permitted ground water withdrawals from the Floridan aquifer in that area – this is a significant result of that work group process. Mr. Barcelo said when we try to delineate the boundaries within the southern water use caution area, we approximate the boundaries of the southern ground water basin and they were set at the District boundary. In the eastern boundary, the ground water basin boundary generally goes down the center of the Lake Wales Ridge or the Highlands Ridge water use caution area. In Hillsborough County, I-4 is a reasonable approximation for the northern extent of the ground water basin. We used the northern boundary to the Eastern Tampa Bay water use caution area as the SWUCA boundary.

> Jeff Spence asked if this would be a good opportunity to change the eastern boundary to the watershed boundary? Mr. Barcelo said we still deal with the same problem to try to divide a distinct water use group. Mr. Spence asked if we would still allow ground water withdrawals in that area? Mr. Barcelo said yes, as long as they meet rule criteria.
>
> Dave Moore said when issues are brought up from work group members, staff will formulate a response and provide that information at, or prior to the next meeting for consideration. We will ask for a consensus of the work group as to what changes are recommended for Governing Board consideration. In response to a question from the work group, Richard Owen stated he will be the clearinghouse for any type of correspondence by the work group and will coordinate the responses.

Mr. Barcelo referred to a graphic depicting the general north-south and east-west hydrogeologic cross section of the region, the areas of recharge to and discharge from the Floridan aquifer within the SWUCA, monthly and 12 month moving average water levels in the upper Floridan aquifer and water levels in the Sarasota 9 Deep well located east of the City of Sarasota. Mr. Barcelo referred to the 12 month moving average water levels from long-term monitor wells in the SWUCA and noted the fact that the patterns are very similar even though they are spread several miles apart. He said the underlying signature is a basin-wide response – a collection and effect of all the withdrawals in the basin. Water fluctuations are the result of pumping occurring in the Floridian aquifer. He said 60-70 percent of the water being used is for agricultural purposes and is also dependent on rainfall.

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Commissioner Bullard said when we talk about a basin-wide response, you are really not talking about, for example, Highlands County in that portion of the Ridge, because you don't have any of the specific key wells there and that period of time of monitoring. Mr. Barcelo clarified that it extends into Highlands County as well, they are in the upper end and it isn't at the magnitude of fluctuation that we have seen in other areas, but you do still see the basin signature out there. Commissioner Bullard asked if this holds true for Charlotte also? Mr. Barcelo said it does, but they are at the lower end of the flow path and the water quality in the Floridan is not as good in Charlotte County and there is not as much groundwater use.

Mr. Barcelo showed a graphic regarding the relative, long-term changes in the potentiometric surface of the Floridan aquifer, which showed predevelopment to the years of 1975 and 2000. Mr. Barcelo said that there are 6000 permittees within the SWUCA area, and of that 60-70 percent of the use is for agriculture and 20 percent is for public supply, those are the two major ground water users. Mr. Barcelo said there is very little withdrawals occurring adjacent to and outside our District's boundary.

Becky Ayech asked if there were opportunities for using surface water for irrigation purposes, similar to that occurring in the SFWMD? Mr. Barcelo said yes, it's just a question of the availability of surface waters on a site-specific basis. He noted there is a big difference between the surface water in South Florida, such as they have the Kissimmee River which has a fairly large drainage basin which provides more available surface water, and our District does not have that along the Ridge.

Mr. Barcelo covered the resource concerns which included: saltwater intrusion in the coastal area; lake levels in the Highlands Ridge area, and; low flows in the Upper Peace River (Zolfo Springs north). He said in order to stop or halt saltwater intrusion, if we were to rely solely on reducing aquifer withdrawals, it would require a cutback from 650 mgd to approximately 200 mgd, which is a significant amount to cutback and would cause significant economic impacts, which has led the District to investigate other options in our management strategy.

Becky Ayech asked what analysis was done to determine the economic impacts of the ground water reductions? Mr. Barcelo said that if you go from 650 to 400 mgd, that results in 250 mgd of water supply to find, and through the regional water supply planning process we are finding that we are growing in excess of 100 mgd in that area and having difficulty in finding sources to meet growth.

Commissioner Thaxton said when we make a statement that the cutbacks will be too dramatic, we need to quantify the effects associated with these reductions. He said we are simply reducing the permits that we have – not offsetting them. Have we really described in terms of how much it would cost if we were to go to a sustainable yield in this aquifer? Mr. Barcelo said we do understand the cost, based on experience with other alternative sources. We will be taking a phased approach and will continually be reassessing and reevaluating these approaches, through the regional water supply planning process.

Becky Ayech asked what analysis has the District done to look at the impacts of wells experiencing saltwater intrusion; specifically, the impacts on surface water quality of waterbodies receiving this poor quality groundwater as runoff? Gregg Jones said we are dealing with these problems, rather than doing an environmental study, by backplugging these wells so that they are now accessing high quality water, as well as the FARMS program.

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> John Zimmerman said we should encourage some withdrawals along the coast to stabilize saltwater intrusion and there may be some users that are willing to use that brackish. Beverley Sidenstick stated that injecting into the aquifer is an alternative way to create a saltwater intrusion barrier. Gene Heath said if you are going to withdraw in that area, you are actually creating more salt water intrusion, to put injection in that area you are bringing the potentiometric surface back up.

Mr. Barcelo said another resource concern is impacts on the flows in the upper Peace River. The low flow in the River is a concern, and there are times when there is no flow at all. Mr. Barcelo referred to a cross-section graphic showing the potentiometric surface of the Floridan aquifer along the Peace River – predevelopment and the recent annual average. He also showed a comparison of the five-year moving average river flows of the Peace and Withlacoochee Rivers, which have very different land uses but how their fluctuations are similar – this underscores the rainfall contribution. Mr. Barcelo showed a graphic depicting an aerial view of Highlands and Polk counties with locations of water use permits – most of the agricultural use is for irrigation of citrus. This underscores the problem of managing withdrawals so lakes are not impacted within that area. Mr. Barcelo stated that the Governing Board has determined there is significant harm occurring in this area, and staff is in the process of establishing minimum flows and levels for the past few years, which have undergone an independent peer review process.

> A question was asked regarding the next step of this process as far as rulemaking. Mr. Owen said the rulemaking component of our recovery strategy is going concurrent with the finalization of this Plan. We anticipate going to the Governing Board in March to ask for approval of the Plan, and approval of the proposed rule. During the January timeframe we should have draft rule language for review.

At this time, Gregg Jones began his presentation of projected water demands in the SWUCA through 2025 and the strategies on how we plan to meet those demands. Mr. Jones summarized the use types and associated demand amounts and said the total demand through the year 2025 is up to 234 mgd, which includes cutbacks in groundwater withdrawals. Mr. Jones discussed additional water needs and potential sources for Charlotte, DeSoto, Manatee and Sarasota counties. Mr. Jones said these counties were grouped together because they are within the Peace River/Manasota Regional Water Supply Authority. He said the additional water demands over and above current needs is almost 50 mgd. Mr. Jones discussed the existing permitted surplus of surface water and ground water, as well as funded new surface water supplies. Mr. Jones said a 10 percent reduction through conservation, when the use of reclaimed water is included, could be achieved and noted that a number of surface waterbodies were identified (in the RWSP) where 10 percent of the highest flows could be captured and stored which would provide a significant surplus of water.

> Becky Ayech said at a Public Supply Advisory Committee, Pinellas County representatives gave a presentation on a survey they conducted on their water conservation efforts and their findings showed there was a high percentage of the public not using conservation methods. Ms. Ayech asked how the District plans to overcome this and achieve 10 percent in conservation? Mr. Owen said the study was conducted by Pinellas County in order to target where conservation efforts should be more focused. Mr. Heath also noted that 20 years ago, Pinellas County's per capita demands were at least 10 percent greater than they are today. Mr. Jones gave examples of conservation efforts in the cooperative funding program in working with local governments that include: toilet rebate projects, low flow plumbing fixtures, Florida friendly landscaping, and residential reclaimed water projects, which is a

> tremendous effort, not only for public supply but also for the agricultural industry and golf courses. We are providing the incentives and are aggressively pursuing these efforts.

Mr. Jones summarized the additional water needs and potential sources for Hillsborough, Polk, Highlands and Hardee counties. Mr. Jones noted that there are public lands which the District is looking to acquire eventually and there are ground water permits associated with those areas which would be retired, and that ground water could be used to offset the 50 mgd to meet the saltwater intrusion minimum aquifer level.

> Becky Ayech asked if the District would not purchase lands unless the water use permit can be retired? Mr. Jones said, if we purchase it, we would retire the permit. Mr. Moore said the goal of this plan is to maximize the retirement of actual ground water use associated with publicly owned lands. He said we would make it an objective to try to retire actual use where we could.

Mr. Jones said the additional water needed through 2025 is up to 235 mgd, and summarized the potential sources, demand management and resource restoration options, which include: public supply conservation – 35 mgd; existing permitted and not fully used alternative supplies – 15 mgd; alternative supplies under construction or design – 27 mgd; surficial and intermediate aquifers – 35 mgd; non-residential reclaimed water offset – 40 mgd; non-public supply conservation (including FARMS projects) – 45 mgd; water use changes when land use changes – 50 mgd. Mr. Jones explained each of these potential sources.

> Beverly Sidenstick asked if the District had evaluated the impacts on recharge by the land use conversions we are seeing in that this conversion often results in more impervious surface and a lot of the northeast Polk development is on lands with very high recharge rates? Mr. Jones said we will take a look at that and provide an answer at the next meeting.

Mr. Jones said the next source is the retiring water use when public lands acquired – projected at 10 mgd. This provides a cumulative total of 255 mgd from those sources. He noted there were also additional net benefit activities to help the resource, which are things the local governments, industry, agriculture, etc., can look at to meet their demands. He said this is a viable plan that will get us to where we need to be in terms of the ground water cutbacks and in meeting the demands for all the new users.

> Becky Ayech asked why the intermediate aquifer was identified as potential new source of water when it is difficult to set a minimum level for it and how can you monitor it to determine how much water is capable of being withdrawn from there without any impacts? Mr. Jones said the immediate aquifer encompasses approximately 4,000 square miles in the SWUCA, which is very large and the potential for getting water out of the intermediate aquifer is significant, which would be monitored by wells across the aquifer system. Ms. Ayech asked if we would be willing to hold off identifying the intermediate aquifer as a potential source until we establish a minimum level. Mr. Jones said our Governing Board has not made a decision yet on whether to establish a minimum level in the intermediate, and it's going to be extremely difficult to do, that's why monitor wells would need to be used. Steve Suau the best approach is to have monitor wells, and Sarasota County has a cooperative funding grant from the District to enhance monitoring of the intermediate within the County. Mr. Moore said there are activities we could undertake that could produce substantially more water. When you look at 35 mgd over a 5,000 mile area (the

entire SWUCA) from the surficial and intermediate, golf courses and power plants have done a better job in taking advantage of the surficial aquifer in capturing rain water, so more than 50 percent of the 35 mgd may well become surficial aquifer deposits and keep in mind it is a ballpark figure that would be adjusted up and down as we go on. John Zimmerman said you could do a detailed modeling to show that amount is a very reasonable number.

Mr. Owen said the Plan takes two approaches to resource management – managing ground water levels and withdrawals from them, as well as a series of projects – restoration type projects for the upper Peace River and lakes. He said these are in the Plan and will not be presented in any detail today, unless there are questions. He said the next section to be covered is the Regulatory section.

John Heuer said the approach we are taking is similar to what was done in Northern Tampa Bay, to adopt minimum flows and levels, come up with a prevention and recovery strategy and use conservation and alternative supplies as the primary tool. Unlike Tampa Bay, we are not dealing with just impacts to wetlands and lakes; we are dealing with eight lakes in the Ridge, the upper Peace River and saltwater intrusion. Mr. Heuer said the regulatory component of the Recovery Strategy relies extensively on existing rule provisions, including not only the Districtwide water use permitting provisions but also the existing Eastern Tampa Bay and Highlands Ridge water use caution area rules that went into effect in 1990, and the SWUCA I rules that went into effect earlier this year. These existing rules included establishment of the 150 per capita, conservation rate structures and increased irrigation efficiency requirements. Mr. Heuer said the SWUCA I rules went into effect January 1, 2003, which included: public supply conservation rates structures; industrial, mining and recreational uses are required to have conservation plans, and a reduction in agricultural irrigation permitted quantities for many permits from being based on a 2-in-10 drought event to being based on average rainfall conditions combined with a drought credit system. The existing rules require evaluating the use of lowest quality water where available; this can be relied upon to encourage users to develop alternatives to fresh groundwater in the SWUCA. For example, a project by Pinellas County includes the use of horizontal wells. They are going to golf courses and installing horizontal wells 20 feet below the playing surface, using that as a means of irrigation. Then the golf courses are not using reclaimed water, and the reclaimed water is then moved further out to residential areas. Mr. Heuer said we continue to evaluate the use of reclaimed water, and desalination as a means to provide an additional supply under this existing rule provision. Mr. Heuer then reviewed the proposed new rules that are a part of the Recovery Strategy. He said the proposed new rules have been kept to a minimum. For public supply, the 150 per capita requirements would be extended through the remainder of the SWUCA and, due to known problems with how per capita rates are currently being calculated, a consistent methodology for computing per capita would be established. Mr. Heuer provided a summarization of the proposed net benefit provisions, which is when a proposed withdrawal, coupled with other activities or measures, will result in an improvement to a minimum flow or level waterbody that more than offsets the impact of the withdrawal. Examples of how net benefits could be obtained and when it would be necessary included: when there is a change of use type for a use impacting an MFL waterbody, the new use will be limited to historically used quantities minus at least ten percent; when relocations occur, similar provisions would apply; new uses impacting MFL waterbodies could take into account the positive effects of quantities associated with reduced, abandoned or retired permits that previously impacted that same waterbody; water withdrawal credits whereby when existing groundwater withdrawals are replaced with an alternative supply, a portion of that previously used groundwater quantity would be available for continued use; mitigation of minimum flow and level impacts that result in an improvement to the impacted MFL waterbody; use of quantities associated with District source augmentation projects; and use of quantities retired through land acquisition efforts. Mr. Heuer also described proposed provisions

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that would address how competing application would be handled in the SWUCA should someone decide to compete.

Commissioner Bullard stated that a comment was made that early on regarding the peer review process, but when reading the summary of the peer review process there are comments that could have substantial impacts on the methodology, such as "although the methodology for establishing minimum levels are generally acceptable, deficiencies in their application and consideration of additional parameters require future adjustment." All the regulatory components are based on methodologies where the peer review says deficiencies exist, is there a process in place for reviewing those methodologies? Marty Kelly said we will continually be looking at our methods for improvements and the peer review group made recommendations that were adopted by the District. Mr. Jones said we will bring back a report on the peer review group's recommendations. Doug Leeper said the process is an adaptive management approach and when the peer review report was published, presentations were made to the Governing Board and we made modifications to the methodologies based on their recommendations.

John Zimmerman said net benefit contributions need to be made by every applicant, including any new users. This should include financial contributions if nothing else is available. Mr. Heuer said there are some applicants who are limited in their ability to provide a net benefit, while some of the larger users have the availability to lend themselves to contributing to the net benefit option.

Jeff Spence asked on the issue of competing applications, have we considered having language that would look at the consumptive use of the water? In some instances an entity is using water that is lost to the system, while another may be putting water back into the system through a reuse system in a high recharge area? Mr. Heuer said yes, through an impact analysis.

Becky Ayech asked, on competing applications, would the District consider looking at noncompliance of permit conditions in order to make determinations of reasonable and beneficial use, or whether it is in the public interest, as a part of the proposed rule? She stated that there are people that are not complying with their permit conditions at all, for a period of years, and questioned whether they should be on the same level playing field as someone who has been following the rules all along? Mr. Heuer said yes, under the public interest, the District can take into account noncompliance. Ms. Ayech suggested this be stated explicitly in the proposed rule.

Becky Ayech asked if how the cumulative analysis would be conducted. Would it be done how it is currently performed (a proposed withdrawal and others within the immediate vicinity), or in a manner that would include all other drawdowns in the Floridan aquifer? Mr. Heuer said it would be a cumulative analysis of that withdrawal and others in the area to the MFLs.

A comment was made that he would like to review the rule associated with the Recovery Strategy in advance. Mr. Moore responded by stating that we hoped to have a first draft of the rule for review prior to the next work group meeting in January. We would hope to provide it in advance of that meeting so that members could come prepared to discuss the rule.

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Mr. Owen said we will summarize all the issues brought up today by the work group and, for those that are still open for further discussion and input, we will try to get a recommendation from the work group to the staff on those issues. We will be addressing the issues brought up today and willdiscuss them at the next work group meeting. Mr. Heath said to please submit any other issues in advance of the next meeting so they can also be addressed.

Mr. Moore said the development of this recovery strategy is one of the more complicated things that we have to undertake as an agency. We are looking at an eight county area where we are looking at environmental restoration (ground water and surface water systems) and the statutory requirement as to how we meet the projected growth for the next 20 years. This report is a starting point; this issue has been discussed for years and this is a significant milestone. The District will take what we have heard today and put it in writing to give an opportunity for feedback. He said the draft rule language will be brought back to this group for input as well. We would appreciate your critical thought and feedback and we will be responsive to your concerns.

II. Future Meeting Schedule

The next meeting is anticipated for January 2004. A notice will be sent out prior to this meeting.

III. Public Comment

No public comments were received at this time.

IV. Adjournment

Mr. Owen adjourned the meeting at 12:10 p.m.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SOUTHERN WATER USE CAUTION AREA (SWUCA) WORK GROUP
MEETING SUMMARY
JANUARY 12, 2004

The SWUCA Work Group met at 2:05 p.m. January 12, 2004, in the District's Bartow Service Office. Copies of presentation materials and other related meeting information is available upon request. Proceedings of the meeting were recorded and are on file at the District's headquarters in Brooksville, Florida.

I. Review of the November 17, 2003 Meeting Summary

Mr. Owen provided an opportunity for the Work Group members to comment on the last meeting summary. No changes to the summary were received.

II. Further Discussion of the draft SWUCA Recovery Strategy

a. Responses to input received to-date

Mr. Owen said an abbreviated summary of the questions and issues raised at the November 17th meeting, that were not fully resolved and needed a response from staff, has been prepared for today's meeting for review and discussion. Mr. Owen noted we have also received several written comments from Work Group members, as well as other parties on issues or concerns they have regarding the Recovery Strategy, and this information will also be provided as soon as it becomes available.

Mr. Owen briefly reviewed each question/issue from the summary in order to provide any further clarification that may be needed. The questions/issues are as follows:

1. Change SWUCA boundary to follow watershed.
2. Justification for Highlands County being in SWUCA.
3. Surface water development opportunities in the Ridge area.
4. Analysis of economic impacts if reduced pumpage from 650 to 400.
5. Impacts of poor quality groundwater runoff to streams/receiving water bodies.
6. Stabilize SWI through withdrawals or injections along the coast.
7. How will we achieve 10 percent Public Supply reduction through conservation?
8. Will the District require permits be retired when acquiring lands? Will the District prohibit transfer of permits prior to purchasing lands?
9. Impacts of land conversion, increased impervious surface on recharge.
10. How did the District determine 35 mgd from intermediate aquifer without MFLs being established and the aquifer being so discontinuous?
11. Postpone including intermediate as source until levels are set.
12. What are the changes in MFL methodologies based upon peer review recommendations?

    John Zimmerman said in the peer review regarding the minimum aquifer level, it was suggested that the District investigate pumping to the east to determine its impacts on water levels within the MIA – that has not been addressed and is a big concern on the aquifer level as proposed now. Gene Heath said one of things discussed about the MIA was whether or not we maintain the MIA as originally in place, and decided we would – in doing so, anything easterly which has an impact on the MIA line, is what we would look at closely with regard to not impacting the MIA line.

13. Everyone (all new users) should contribute to recovery (financial contributions as last resort).
14. Competing applications: consider "consumptive" nature of uses; include in rule consideration of past non-compliance.

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b. Additional discussion

Mr. Owen asked for any further comments or questions regarding the draft Recovery Strategy. Mr. Heath said there is still time to continue to submit comments or questions, and those responses will be available at the next meeting.

> Alan Peirce said in looking over the rules and the Recovery Strategy there is not much mentioned regarding mobile irrigations labs, and is asked if the language could be added pertaining to this. He said this is one of the biggest tools that agriculture could use to conserve water. Gregg Jones said it was not intended for it to not be included, but we are doing a lot with agricultural conservation, and in Section 5 of the Recovery Strategy under the non-public supply conservation the total of 45 mgd includes FARMS, mobile irrigation labs or anything at all we can do within the agricultural community to save water. Mr. Jones said the mobile irrigation labs program could certainly be included with more detail in the Recovery Strategy.

III. Review and discussion of the draft SWUCA rule revisions

Mr. Owen said within the Recovery Strategy, our regulatory approach is to rely on our existing rules to the maximum extent, and our approach to new rules is to only make changes that are essential and necessary. In regard to what the MFLs will do in terms of constraining ground water or new sources of water in the area is what is triggering the need for these rule revisions. He said the main parts of rules that will be revised to incorporate new provisions include: 40D-2 Consumptive Use Permitting; 40D-8 Water Levels and Rates of Flow; and, 40D-80 Recovery and Prevention Strategies for Minimum Flows and Levels. He said today's focus will mainly be on the revisions to 40D-2 and the associated Water Use Permitting Basis of Review.

Mr. Owen said the core of 40D-2 changes is any new quantities that would impact an MFL water body will be required to participate in the recovery strategy and a minimum of a 10 percent improvement to the affected MFL water body.

> Becky Ayech asked if this meant new quantities permitted or new quantities used? She gave an example of having a permit for ten years and not using the water, but then needed to – so is this a new use because it wasn't pumped before, but now it is. Mr. Owen said no, this does not trigger the new use. Mr. Heath said it does trigger looking at the permit when it comes up for renewal to determine the reasonable-beneficial use. He said this is under the existing rules but is something that with time will become a more focused criteria. Mr. Heuer also noted that the definition for new quantities is contained within the rule revisions. Ms. Ayech said when permittees come back to renew their permits, they should be required to justify their non-use and this could be an opportunity to free up water for other uses. Mr. Heuer said this will be reviewed at the end of the permit, or when they are requesting a modification.

Mr. Owen said, as a reminder, the guiding principles set by the Governing Board which are contained in the Recovery Strategy are for our actions, including regulatory actions, contribute significantly to resource recovery, and while trying to achieve that, attempt to protect the investment of existing legal users and allow for changes in the growth of the economy to take place.

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Mr. Owen moved on to the next revisions, which include: Reservations from use – future reservations related to District restoration projects; Modification of Permits – the permits that affect MFLs in the SWUCA. Mr. Owen reviewed the following applicable Basis of Review sections, which include:

<u>Withdrawals that impact MFL water bodies</u>

- Renewals/modifications with no increase are not affected by these revisions;
- Renewals/modifications to increase quantities and applications for new quantities – if the levels in the water body are above the minimum it can be permitted as long as it does not cause the level or flow to fall below the minimum; where the actual level or flow in the water body is below the minimum, it can be permitted only with a net benefit;
- Renewals/modifications with an increase offer the opportunity for someone to come in and compete for those "increased" quantities.

<u>Withdrawals that impact MFL water bodies – Net Benefit</u>
Definition: activities or measures that will result in an improvement to a minimum flow or level water body that more than offsets the impact of the proposed withdrawal.

> Pete Hubbell asked if there is a set of standards in the rule when the 10 percent applies. Mr. Owen said the concept of net benefit is a 10 percent minimum, there is no range.

- <u>Modification to change use type or relocate some or all quantities</u> – must meet all other conditions of issuance; undergo reasonable-beneficial review; and quantities available are limited to 90 percent of permitted/used reasonable-beneficial quantity; the remaining 10 percent permitted quantities are subject to the net benefit – both used and unused; all relocations will be looked at to ensure that they are not increasing impacts to the MFL water body; relocated quantities may be subsequently relocated, subject to net benefit.

> John Zimmerman said when we went through the reallocation concept in SWUCA I, if it was shown that they were pumping 2 mgd and reallocated 1.8, but they were permitted for 4, so they could reallocate the 1.8 which would give up 2 of their permitted and keep 2 onsite, is this still allowed? Mr. Owen clarified that in that example, the 2 that remains onsite, not historically used, is reduced to 1.8; it has to contribute 10 percent as well. Mr. Heath said you still have to do the reasonable-beneficial on that quantity at that point and time. Mr. Zimmerman said they are pumping 2 onsite and reallocating 1.8 to another site and have 2 left on their existing permit, now all of a sudden they are pumping 1.8 on the site – they're okay? He said we really haven't reduced pumpage, plus 1.8 is somewhere else pumping – that's okay? John Heuer clarified that the 1.8 remainder stays for that type of use on that site will not be able to move or change use type. So as the land use trends continue, that quantity remaining on-site should eventually go away.

> Adam Cummings asked how long it usually takes before we start looking at this permit for a reduction? Mr. Heuer said at the time of renewal, typically the first permit is issued for six years and we would address that question at the end of that term. Renewal timeframe is 10 years. Mr. Cummings said, if financial decisions are being made based upon the need of that entire permit and are putting that in for the next permit application, and we know the permitted quantities are higher than what is being used – it feels likes we are creating a financial incentive to utilize permitted unused capacities. Mr. Heath said at the time of

renewal, you have made all your financial decisions on what you are going to do with that land which requires that permitted quantity – we are saying that you have an option that if you want to eventually move that water you can do the historically used quantity, you will lose 10 percent of that quantity, the unused quantity which continues to be proved up as reasonable-beneficial will also be reduced by 10 percent and that will need to be taken into financial consideration that you are going to forego the use of that water in the future.

Becky Ayech said in the existing rules people with 10 year permits can move the entire amount of water as long as they prove up, but 10 years ago we did not know about saltwater intrusion, and now we do. District rules say we can't cause saltwater intrusion, so how can you say any of your permits out there right now that are causing saltwater intrusion can meet existing rule criteria? She asked how can I prove up if I wanted to reallocate that amount – whether there's a minimum flow or level, I'm still causing saltwater intrusion? Mr. Heath said we recognize that there are adverse impacts of saltwater intrusion and in Peace River and in the lakes, and given that this was occurring back in the 1970s before our rules were established, we have to deal with an existing situation and look at recovery – this is what we are trying to accomplish. We are taking an incremental approach to move forward with recovery efforts and alternative supplies.

Adam Cummings said he looks at this in the perspective that we will be better off than what we are right now, but he is having a hard time with the idea that we are moving in the right direction, when we are still keeping the deficit at the same level it is now. Even if we think it is unlikely to meet, the goal should be something to strive for, and to at least have a goal saying we are going to try to get to the point where we are not making it any worse than it is now. Mr. Heath said this is a recovery strategy – we are starting where we are now and working to make things better. When looking at the Recovery Strategy, the projects involved and the transition of agriculture to urban, all these things factored in – is an improvement over where we are. In ten years from now, we should be significantly better off than what we are now.

- <u>Land use change</u> – applications to modify use must include quantities for potable needs; and potable quantities may be relocated to local government providing supply.

Becky Ayech asked if this allows for individual domestic wells to meet their potable needs? Mr. Owen said the concept is that the potable needs be met out of their existing permitted quantity.

Pete Hubbell asked if a land use changes, for example water use goes from ag to recreation, are we saying that domestic wells are not allowed for the residents potable needs? Mr. Heath said no, we don't permit domestic wells. Karen Lloyd said this was contemplated, but it might be something to look at. She said it was contemplated there would be a water service area within the development.

John Zimmerman asked if the rule language could state that the permittee that is being transferred to doesn't have to be on the original permit – this would make it easier for transfers. Ken Weber said that was the intent and the language could clarify that.

- <u>Lapsed quantities</u> – previously permitted and historically used quantities that have lapsed because permits were reduced, abandoned, or retired. Use of lapsed quantities – applies to withdrawals

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that previously impacted an MFL; applies where lapsed occurred after December 31, 1999; applicant for these quantities must demonstrate compliance with all criteria except impact to MFL; no other net benefit option is feasible; and 50-90 percent of lapsed quantity available depending on: resource recovery trends, total lapsed quantity available, consumptive nature of lapsed quantity compared to applicant, previous allocation to applicant of lapsed quantities, and District funding involvement.

Alan Peirce said he noticed in the rules that the lapsed quantities was defined, but it wasn't in the definition section and it would make more sense to move it there.

Bob Bullard asked how the applicant proves the lapsed quantity and what the impact is on the MFL. Mr. Heuer said the District will inventory the location and the impacts. Mr. Bullard said we started out with the fact we are using the impact to the affected resources rather than to the aquifer because it is more scientifically defensible, but in reality we have to get to the aquifer anyway because we have to show that for the withdrawal from the aquifer precisely what its impact is on affected waterbodies. He said what he is hearing is this process will be done by the District – so the District will determine what the anticipated impact to the MFL is of various levels of withdrawals. Mr. Heath said yes. Mr. Bullard asked if someone challenges that – what is the process. Mr. Heuer said if our staff and the applicant's consultant don't agree on the scientific information, a proposed agency action for that permit would be processed and the applicant could challenge it and then go to the administrative hearing process.

Bob Viertel asked if there is a scoring or ranking mechanism for how we arrive at whether a 50 or 90 percent of the lapsed quantity would be available? Ken Weber said no, we would look at the factors that are listed and make a case-by-case determination.

- <u>Water withdrawal credits</u> – allows 50-90 percent of existing ground water use that is replaced by an alternative source to be used; and this quantity is available to the supplier, receiver, or both – it is their determination.

A question was asked on how the range was determined. Mr. Heath said where they are with respect to an MFL and what impact it would have.

A question was asked that if you replace Floridan ground water with surficial ground water wouldn't you have to qualify for this? Mr. Heath said it was designed for reclaimed water, the question is whether or not it would fit any type. Karen Lloyd said we specified reclaimed and surface water, we have to look at other sources and if they would be considered as alternative sources.

Pat Lehman asked if this could work out as a three party deal since the Authority doesn't have wastewater – if one of their members were to offset flows, and the Authority were their supplier of water, would that work into the picture? Mr. Heath said it wasn't deliberately in there, but he didn't know why it wouldn't work.

- <u>Mitigation of MFL impacts</u> – applicant may propose direct mitigation, but must more than offset the proposed impact by at least 10 percent as a net benefit.

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- Quantities created by District water resource development – water created by District projects or by retirement of permits on acquired lands; applicants must meet all conditions for issuance except impact to an MFL water body; and, can apply for up to 50 percent of created quantities. The conditions include: proposed withdrawal affects the same source; excess quantity (above MFL restoration) is available; no other feasible alternatives; and, no interference with quantities reserved for water resource development.

  John Zimmerman asked if this means what was reserved for resource development is what is needed for MFL restoration? Mr. Heath said that is correct. Karen Lloyd said it would be just for the MFLs.

  Adam Cummings said if he's gone to the cost and expense of actually buying land outright, as opposed to just paying for a conservation easement, he wants all of the preservation value of the land. Mr. Heath said when the District buys land, negotiations are made for the any wells or infrastructures on that land, and this issue is whether or not we would allow any of that water to go into the pool. Mr. Heath asked if what Mr. Cummings means is he does not agree with allowing any of that water to go into that pool. Mr. Cummings said yes, not when he's gone to the expense of buying all of +the land outright.

  A question was asked if this would qualify as a lapsed quantity? Mr. Heath said yes. Karen Lloyd said this particular one would also cover additional kinds of resource development where we have created a reservoir to hold water to release during low flow, but we also have additional capacity in the reservoir that could be used for the water resource development water supplies.

  Mr. Cummings said if you go into it with the intent of purchasing lands for the purpose of developing water supply that's one thing, if you are purchasing land for preservation to benefit the resource that's a whole different ballgame. Mr. Heath said it should be disclosed at the time of acquisition as to the disposition of any water that would come with the purchase of that land.

Competing Applications

- Can only compete with permit affecting same MFL waterbody; competitor can have no greater impact on MFL waterbody; all else equal, renewal is preferred over new use; where none are renewals, applicant who contributes to recovery is preferred; where none of the above apply, preference is given to small business/city/county; and, where none of the above apply, preference given to application with least impact on MFL.

  Becky Ayech asked if the first condition is the same as the third condition. Ken Weber explained in the first condition you have someone that is proactively doing something to help in the recovery, and the third condition, you have two applicants that are not actively doing anything, but they both have impacts projected and the one with the least amount of impact is given preference.

  John Zimmerman asked if they are impacting an area that is already below a MFL, aren't they both denied? Ken Weber said this is where you are competing against the renewal or a modification for increase and the only way you can get an increase is to provide a net benefit.

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- Competing application procedures: must be complete and meet rule criteria with exception of MFL impact; may only compete with new applications and modifications to increase, or renewal that impacts same MFL water body.

  A question was asked if the permits have to be simultaneous. Karen Lloyd said the water that is being competed for is eligible for issuance to somebody and we look at statutory requirements that we give renewals a proper preference for that water. She said we then look at another aspect of recovery, if someone would provide a net benefit to make that water available, we look at another statutory directive to consider small business/city/county and the least impact to the MFL gives us an additional net benefit.

  Adam Cummings asked if we go through and analyze all the rule criteria during a competing application? Karen Lloyd said this is for quantities of water that we have said it is okay to issue, and provides for recovery and renewals by statutes are given priority.

- Competing applications procedures: can only compete against application with sufficient quantities; only compete against one designated application at a time; and competitor may waive 90 day limit in order to compete.

  Pat Lehman asked about the timing – if a permit has gone through months of consideration and its ready to go to the Board then another competitor comes into the picture, what happens? Karen Lloyd said they have to be ready at the same time if they want to compete. Ken Weber said if you are a new user and want to compete, you have to wait until there is an application for renewal to compete with.

  A question was asked how long our permitting process allows for a complete application to wait with no action taken on it? John Heuer said a competitor has 90 days, but this can be waived to wait for an applicant to apply for a renewal.

  John Zimmerman asked if a competitor could waive the applicant's 90 day time clock. Ken Weber said no.

  Pete Hubbell said since this only applies for the southern area, are we contemplating this for Northern Tampa Bay? John Heuer said although there are things in this rule that might be applicable outside the eight county area, this rule will only affect the SWUCA. If this rule gets into place, the next step would be to look at what provisions we would want put in place for the rest of the district. Karen Lloyd said circumstances are hydrologically different in the northern Tampa Bay and the competing applications, as structured in this rule, may not work at all in other areas.

- Public Supply Use: no change is proposed for the per capita requirement of 150 gpd that has existed in the Eastern Tampa Bay and Highlands Ridge and extending that throughout SWUCA; specifying the methodology for calculating permanent and seasonal population served by the utility and collect data from that being applied throughout the SWUCA to see what the actual per capita rates are.

Mr. Owen said right now it is optional on whether or not a utility calculates its seasonal component of its population and this will now be mandatory and the methodology will be specified. Mr. Owen said the focus of this discussion would be brought to the Public Supply Advisory Committee.

John Zimmerman asked a question regarding the per capita definition itself – its going to be Eastern's definition which gave us a reuse credit and a significant use reduction, is that still going to be in the per capita definition? Richard Owen said staff will look into this and provide an answer to this question.

A question was raised on why 150 gpd – he looked at the 2000-01 Estimated Water Use and most of the utilities are less than 150 now. Mr. Owen said that in many cases the populations served component was calculated incorrectly which increased the population significantly. He said we want to specify a clear methodology to follow and track that information to see where we stand, before we consider revising the standard.

John Zimmerman asked if we recalculated all of their per capita based on our new populations? Mr. Owen said we need this data from the utilities.

Mr. Owen said there are changes proposed to the SWUCA I rule revisions and briefly reviewed those items, which include:

- Duration of permits – clarifies duration for standby permits related to replacement of traditional water sources with alternative sources.
- Permit classification – deletes standby alternative source permit.
- Water Use Caution Areas – deletes Highlands Ridge and Eastern Tampa Bay WUCAs; specifies area for Most Impacted Area; specifies SWUCA as water resource caution area/resource caution area.
- Application Forms – delete reference to Standby Alternative Source form.
- Duration of Alternative Source Permits – clarifies duration for standby permits related to replacement of traditional water sources with alternative sources; transfers existing MIA rule regarding special well construction form.
- Determining reasonable quantities – deletes Standby Alternative Source permit; simplifies alternative source standby procedures.
- Efficiency standards in the SWUCA – deletes increased efficiency requirements in 2004/2005.
- Irrigation water use – transfers existing language from deleted HR & ETB WUCAs.
- Public supply use – transfers existing language from HR & ETB WUCAs.
- Metering of alternative sources – clarifies metering threshold bases (standard average, drought average).
- Special permit conditions, flow meters – requires meters be installed prior to use of standby withdrawal points; changes meter calibration interval from every 2 years to every 5 years.
- 7.1 Highlands Ridge WUCA and 7.2 Eastern Tampa Bay WUCA – deleted.

Mr. Heath requested that written questions or issues to be sent as soon as possible so staff can have time to respond to them before the next meeting. Mr. Owen set a deadline for January 26th for submittal of these questions/issues.

IV. Future Meeting Schedule

The next meeting is anticipated for Monday, February 9, 2004 at 2:00 p.m., in the Sarasota Service Office. A Public Input meeting will follow at 6:30 p.m. A notice will be sent out prior to this meeting.

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V. Public Comment

No public comments were received at this time.

VI. Adjournment

Mr. Owen adjourned the meeting at 5:10 p.m.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SOUTHERN WATER USE CAUTION AREA (SWUCA) WORK GROUP
MEETING SUMMARY
FEBRUARY 9, 2004

The SWUCA Work Group met at 2:05 p.m. February 9, 2004, in the District's Sarasota Service Office. Copies of presentation materials and other related meeting information are available upon request. Proceedings of the meeting were recorded and are on file at the District's headquarters in Brooksville, Florida.

I. Review of the January 12, 2004 Meeting Summary

Mr. Owen provided an opportunity for the Work Group members to comment on the last meeting summary. No changes to the summary were received.

II. Further Discussion of the draft SWUCA Recovery Strategy and Rule Revisions

Mr. Owen said a question was brought up at the last meeting regarding per capita rates and if we are going with the Eastern Tampa Bay WUCAs, or SWUCA I provisions? He said what was referred to as reuse credits, or the ability of a utility that has a reuse program providing reclaimed water to users who are not potable water customers to receive a portion of that as a credit when they calculate their per capita rates – is not included in the proposed SWUCA II rule. However, the ability of the utility to deduct significant uses when calculating their per capita rate is included in the rule provisions.

Pete Hubbell asked a question regarding lapsed quantities and the idea that under law when the permits expire generally the quantity associated would go away too – it seems as though it is making the District's job harder to get out of the hole using lapsed quantities. Mr. Owen said this is a proposal to recognize the resource benefits attributable to permitted quantities that were historically used that go away – they lapse, and those permitted and used quantities were impacting on the minimum flows and levels waterbodies. He said lapsed quantities is a concept whereby we could look at the resource improvement that has occurred and take a portion of that and make it potentially available for someone who is asking for a new quantity of water that would impact that same waterbody and there were no other options available. This has been proposed as a means to find a balance between the Recovery Strategy objectives of achieving recovery while at the same time meeting growing water needs for all reasonable-beneficial uses.

Pete Hubbell asked if those quantities are subject to competition – competing applications? Karen Lloyd said if an applicant gets through all the criteria and qualifies to apply for the quantity, and another applicant in a similar situation qualifies also, then it would be into the competing application process. Mr. Owen said there will be applicants for small quantities, typically agricultural, that do not have the resources to participate in a recovery project or mitigate and their project would impact one or more of the MFL waterbodies, and under those circumstances, absent some other alternative, we would be in a denial position – and the lapsed quantities are a means to address this. In addition, competing application process is an alternative that has been proposed.

Bob Viertel asked a question regarding the lapsed quantities and if they are part of the Recovery Strategy and not a rule revision. Mr. Owen said they are part of the 40D-2 rule revision.

A comment was made regarding the restoration efforts of the lakes that do not meet minimum flows. The District shows only one demonstration project on a lake in Highlands

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County to look at augmentation. It was asked if the District anticipates coming up with a schedule or a plan for the other lakes that are not going to meet minimum flows and levels? Mr. Heath said the study that is ongoing on the lakes with regard to connectivity, drainage patterns, etc., looks at quantities of water for a numerous number of lakes in the Highlands Ridge, and we are addressing all the lakes that are under that study. He said the one project example that was used was Lake Lotela as a possible area for augmentation.

Commissioner Bullard stated in regards to the reverse of augmentation, a concern he has is when a minimum level is set, as an example Lake June in Highlands County, and there is a permit application there, and it is determined by the District that it would impact the minimum level that has been set because the lake is not achieving that level, this seems to be a tough position to defend when the District controls the major structure and determines when to allow millions of gallons to escape that lake, how then can a permit be denied. Doug Leeper said most of the lakes in our District have water management levels that have been in place for several years, we are going back and revisiting the lakes to set new levels and they are now being used in the operation of our structures. Any lakes that have structures, the structures will be operated and maintained to help achieve recovery.

Commissioner Thaxton asked if calculations have been done in terms of quantities of water that are realizable under the lapsed quantities provisions? What is the difference between 50% to 90%? Mr. Owen said the total lapsed quantities starting in January 2000 SWUCA-wide is about 22 mgd, and this is the quantity that 50-90% would potentially be available for someone to apply for. However, not all of this would be available for a particular MFL waterbody.

Commissioner Thaxton asked about the lands purchased through the Save-Our-Rivers program and if those permitted quantities are also going to be put in the lapsed quantities? Mr. Owen said they are included in the lapsed quantities. Commissioner Thaxton said we should retire those quantities. Mr. Heath said we may well do that and it is anticipated when we go into our land acquisition, and up front it is determined by the Board as to what quantity of water is going to be retired off that land – it may be the whole quantity.

Pete Hubbell said they have an issue with the fact that the lapsed quantities go back to 1999; and said it should be from the rule adoption forward. Mr. Heath said we are not going to renege on a commitment we made in an acquisition of land and then reverse ourselves and capture those lands to put in the lapsed quantities, so whatever the history is with those permits, that commitment would be followed. Mr. Owen said the reason for going back was to have a lapsed quantity available the day the rule goes into effect. Mr. Hubbell said they don't agree – it should be the date of rule adoption.

Ed Helvenston clarified it wasn't an issue for District acquired land, but if Hillsborough County acquires land a year from now, the expectation of the County Commission would be the water would be taken out of production – how would our Governing Board deal with ELLAP acquisitions – and what would happen to that water? Mr. Heath said it would already be determined when an acquisition is made what would happen to the permitted quantity.

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Mr. Owen asked if there were any questions or comments regarding the rule revisions? Hearing none, he then introduced Ken Weber to provide a brief review of an example of the relocation process.

> Commissioner Thaxton asked if it was possible that this could backfire – instead of reducing the true amount of water that is being used it could be increased because it takes water that is presently being unused and makes it immediately available. Mr. Owen said right now, they could grow into their full permitted quantity. Under the proposed rules, upon relocation, for any quantities remaining on the original site, the use type cannot be modified in the future. He said if the relocations are occurring on the lands that are transitioning and changing in land use type, eventually the quantity that remains on the site will go away.
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> Pete Hubbell said in regards to competing applications, local governments should have a role in decisions made when competing applications are being considered. He said this helps strengthen the land use/water use link. Mr. Helvenston said local governments have something to say what the public interest is and the nexus between asking the local government for an opinion within a specified timeframe on a particular issue is a legitimate consideration for the Governing Board. Mr. Heath said it would be helpful if this language could be provided to staff for clarification and consideration of this issue.

Mr. Owen said we have received several written comments on input to the Recovery Strategy and rule revisions, most of which have been responded to and this information will be posted on the District website for review.

Commissioner Thaxton said in the introduction section of the rule there needs to be a real clear concise goal statement, it's not clear what is trying to be achieved.

III. Future Meeting Schedule

The next meeting is anticipated for the April/May timeframe, a notice will be sent out prior to this meeting. Work Group members indicated they would prefer to meet again when both the revised draft Recovery Strategy and the rule revisions were available.

IV. Public Comment

No public comments were received at this time.

V. Adjournment

Mr. Owen adjourned the meeting at 3:40 p.m.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SOUTHERN WATER USE CAUTION AREA (SWUCA) WORK GROUP
MEETING SUMMARY
APRIL 5, 2004

The SWUCA Work Group met at 2:10 p.m. April 5, 2004, in the District's Bartow Service Office. Copies of presentation materials and other related meeting information are available upon request. Proceedings of the meeting were recorded and are on file at the District's headquarters in Brooksville, Florida.

I. Review of the February 9, 2004 Meeting Summary

Mr. Owen provided an opportunity for the Work Group members to comment on the last meeting summary. No changes to the summary were received.

II. Further Discussion of the draft SWUCA Recovery Strategy and Rule Revisions

Mr. Owen said the purpose of the meeting is to primarily go over the revised Recovery Strategy, which will include: substantive changes recommended, those substantive changes that were requested that we do not recommend, and substantive changes recommended that do not warrant revisions to the Strategy document, but will be incorporated into the revised rules.

Mr. Owen reviewed the current timeline for completing the Recovery Strategy and noted changes could be made depending upon today's direction. The timeline/process includes:

- Presentation to the Governing Board at their March 30th meeting;
- Today's Work Group meeting in which we are looking for input on recommended changes, or any other subject matter that needs to be discussed;
- Potential Governing Board approval of any further substantive changes and finalization of the substance of the Strategy at the April 27, 2004 meeting;
- May – review of a final document that reflects all appropriate changes.

Mr. Owen said staff is also looking at how the input received during the process may have implications for the rule revisions, which are only a part of the overall Recovery Strategy, and updates are being made to the them as well and we will also solicit further input and review. Mr. Owen said it is anticipated that we will present the Governing Board with a revised rule at their June meeting and request authorization to publish the rule in the Florida Administrative Weekly.

Mr. Owen proceeded to the proposed substantive changes. He said not all sections or appendices required changes, and will review what changes were made within those sections.

Section 3. Minimum Flows and Levels

<u>Variations in: resource conditions; strategies; and the effects of regulations</u>
This change was made based on input by Work Group members and local governments in which they asked for recognition that resource conditions vary throughout the SWUCA, and based on those variations and conditions our strategy and proposed regulatory components must also vary.

Section 4. SWUCA Recovery Strategy

<u>Monitoring and re-evaluation</u>
This change was a clarification to our intent all along to monitor trends; both resource and trends in permitted and used quantities, and will re-evaluate the recovery strategies on a regular basis, at a minimum once every five years.

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Section 5. Regional Water Supply Planning

Data updated – public supply permitted but unused quantities
It was projected through the year 2025 what the growth and water demands would be and then inventoried the various options to meet the needs, many of which are alternative sources. In areas where alternatives are limited, it is recognized that ground water will continue to serve an important role in meeting growing demands, and part of the ground water can come from permitted, not yet used ground water sources for public supply. The demand projections did not change – 235 mgd in new demands, the change was for the permitted, unused public supply component of potential sources, based on updated information from the original document. The biggest change was in Polk County, where the public supply permitted but unused increased substantially.

Agricultural use of reclaimed water
Members of the Agricultural Advisory Committee have expressed concern with the use of reclaimed water on certain agricultural commodities. This has not been validated as a concern within our District, the State, or by DEP. Staff has also contacted some of the national organizations the District belongs to and they are not aware of this concern. Text was included to recognize the concern, and through the monitoring process it can be identified if it becomes an issue, and staff would evaluate the impact on the overall recovery.

Section 7. Projects

Projects updated
All descriptions of the various water resource development/restoration projects being proposed have been updated based on more recent information and are consistent with the Federal Funding Initiative.

Lake Wales Ridge Lakes screening/restoration project expanded
Updated and expanded to more clearly show how the project will prioritize lake restoration efforts in terms of the eight MFL lakes.

Section 8. Regulatory Component

Variations in: resource conditions; strategies; and the effects of regulations
Reiterated variations in resource conditions warrant variations in strategies and that the effects of the regulatory component will vary by region based upon these differences.

Monitoring/re-evaluation
Reiterated commitment to monitoring and regular re-evaluation of the recovery strategy, including the regulatory component.

Statewide Water Conservation Initiative
Several agencies are participating in an initiative called the Joint Statement of Commitment, and as part of that they are specifically addressing public supply and how best to achieve efficiency. The outcome of this initiative could have implications for future revisions to the Recovery Strategy.

Clarified when new rules apply - New quantities impacting an MFL waterbody
Net Benefit provisions only come into consideration when applying for new quantities that impact an MFL waterbody; renewals with no changes and applications for new quantities that do not impact

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MFL waterbodies are subject to existing rules. It is anticipated the majority of all permitting activity will not be affected by the new Net Benefit requirements.

<u>Clarified what new rules are being amended and why – 40D-2 / 40D-8 / 40D-80</u>
- 40D-2 Water Use Permitting and Basis of Review – describes the effects of MFLs in WUP process, the Net Benefit provisions and competing applications
- 40D-8 Minimum Flows and Levels – actual flows and levels below minimums necessitates a recovery strategy.
- 40D-80 Recovery Strategy – by statute we are required to have a Recovery Strategy.

<u>Net Benefit provisions – Relocation: Up to 90% of the historically used, reasonable-beneficial quantity</u>
Recovery Strategy had allowed for 50-90%, it was recommended to the Governing Board to reword this to "up to 90%."

<u>Net Benefit provisions – Lapsed quantities: Up to 90%; detailed tracking system; quantities from land acquisitions – local governments and other entities, District</u>
Recovery Strategy had allowed for 50-90%, it was recommended to the Governing Board to reword this to "up to 90%." Committed to establishing a detailed tracking system in order to track lapsed quantities and resource conditions, and clarified how we will treat quantities that could potentially come from land acquisition programs. The District will not include quantities retired through the land acquisition program of local governments or other entities at their request. Quantities on lands purchased by the District in the future (in the SWUCA) will be addressed on a case-by-case basis.

> John Zimmerman said a concern to him is if we allow citrus groves that were maybe in Polk County to transfer quantities to other users and they are growing into the old unused quantities on that site, and the local governments are thinking that the quantity is there and they can convert it to public supply only to find out the quantity was previously transferred and it can't be converted from citrus to public supply – now we have a problem. Mr. Owen said one of the suggestions was to improve how we notice local governments on permitting activities and that would give that local government an opportunity to provide input into the process and work directly with an applicant. Mr. Zimmerman said you could go back to the other approach which is to relocate historically used quantities, but whatever is left has the same legal standing as the relocated quantities – and that's all that can be used is the historically used quantities – not the unused quantities. Mr. Owen said the District has significant concerns with proposing to take away all historically unused quantities on a relocation.
>
> Gene Heath asked if any representatives from the Agricultural would like to comment? Cara Martin disagreed with taking the unused quantities away.
>
> Pete Hubbell asked what was the reason for this change? Mr. Owen said we are trying to find the balance between having an exact amount versus trying to recognize that in some cases we might authorize a greater amount of historically used quantities and still achieve resource benefits. He said we will be looking at resource trends in the area, and if these trends are poor, it will go down to 0%, but if we are seeing a tremendous recovery, we might be able to go up to 90%. Mr. Hubbell asked if this type of language will be in the rule? Mr. Owen said there was significant discussion at the Governing Board regarding this and they asked for staff to look at options on both the percentage that is remaining on historically

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unused portions, and what percentage of the used portions would be available. Once finalized, the criteria will be described in the rule. Mr. Hubbell said 50% would be acceptable.

Theresa Connor said it important for the District to have coordination with the local governments, and have a clear tracking system. John Heuer said, in the past, staff conducted workshops regarding land and water linkage and local governments should think about land and rezoning issues. He said oftentimes local governments see this information well before (2-3 years) the District receives the environmental resource permit, or change in water use permit. So the local governments have a couple of years head start, and as they go through the rezoning discussions – think about where the permit is, where they are going to get their water supply. He said this land and water linkage is important to make this whole plan work. Mr. Heath said more information is going to be provided on the notifications, but we are not aware of what the local governments are currently doing with the notification information they receive at this point, and it would be beneficial if we get feedback as to what type of information local governments want to see.

<u>Net Benefit provisions: Water withdrawal credits – limited to 50%</u>
Recovery Strategy stated 50–90% of the offset withdrawal was available as a credit, it was recommended to the Governing Board to revise to 50%, which is consistent with how this was previously proposed in the SWUCA I rulemaking effort.

<u>Net Benefit provisions: Quantities associated with District augmentation projects – up to 100% of water potentially available</u>
Recovery Strategy stated 50-90% of the quantity was available. It was recommended to revise to up to 100%, since some water resource development projects may be intended solely to meet growing demands.

Mr. Owen proceeded to the other substantive input – changes not made portion.

Section 8. Regulatory Component

<u>Net Benefit relocation provisions: Achieving Net Benefit through a relocation without a 10% reduction in withdrawals</u>
A question was asked that if through relocation alone there is an improvement to MFL waterbodies, for instance an existing groundwater withdrawal that is impacting a MFL lake is relocated further away from the water body, isn't that sufficient? Should we also be required to have a 10% reduction in historically used quantities? Mr. Owen said staff's concern is that we also have identified an overall reduction in groundwater withdrawals of 50 mgd to address the minimum aquifer level and to contribute to overall recovery – a portion of this reduction is to be accomplished through these relocation provisions.

<u>Net Benefit relocation provisions: Relocation of drought credits</u>
A recommendation was made that drought credits should be transferred when a relocation is approved. Staff did not agree because if the new use receiving relocated quantities is agriculture, it will be issued an initial 2-year's of drought credit, just like a new permit. If for a non-agricultural use, drought credits do not apply.

Pete Hubbell asked if the existing permit drought quantities will be modified proportionally to the amount that was relocated? Karen Lloyd said the drought credits that stayed at the original site would be proportionally modified.

<u>Net Benefit relocation provisions: Modifications of historically unused quantities subsequent to relocation</u>
It was recommended that subsequent to a relocation, if any historically unused quantities remain at the original site from which quantities were relocated, there should be no limitation on what these quantities can be used for. Staff did not agree with this because that would allow those actual uses to grow into the permitted quantities and exacerbate resource problems.

Rule Revisions

<u>Land use changes</u>
The concept is that if someone applies to modify the use type of an existing permit, they must include the quantities necessary and available from their historically used quantities to meet the potable demands, if any, associated with the new land use. DEP expressed concerns with this portion of the rules and staff recommended to remove this from the draft rules. Staff is evaluating whether the same objective could be achieved through the lapsed quantities provisions.

<u>Duration of permits</u>
Existing rules provide that when a groundwater withdrawal is replaced with reclaimed water, a 20-year permit will be issued, and there was no clarity as to what amount of the existing withdrawal be offset. Staff recommended that a minimum of 50% or more must be replaced to qualify, but the permittee must also report pumpage to ensure compliance. This was restricted to permits 100,000 gpd or greater because these are the only permits with metering requirements. Staff has recommended these provisions be modified to allow permits for less than 100,000 gpd to also qualify if they meter and report pumpage.

<u>Permits partially in the SWUCA</u>
It will be clarified that permits that are only partially in the SWUCA, if the majority of the withdrawals are in the NTB WUCA, the NTB WUCA provisions will apply (e.g., conservation, per capita, etc.), while still protecting SWUCA MFLs. If the remainder of the permit outside the SWUCA is not in a WUCA, the SWUCA rules will apply.

<u>Crop rotation/leased lands</u>
The rules will also clarify that crop rotation on leased lands is not subject to the net benefit provisions.

III. Future Meeting Schedule
The next meeting was tentatively scheduled for May 10, 2004, a notice will be sent out prior to this meeting.

IV. Public Comment
No public comments were received at this time.

V. Adjournment
Mr. Owen adjourned the meeting at 4:05 p.m.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SOUTHERN WATER USE CAUTION AREA (SWUCA) WORK GROUP
MEETING SUMMARY
MAY 10, 2004

The SWUCA Work Group met at 2:00 p.m. May 10, 2004, in the District's Bartow Service Office. Copies of presentation materials and other related meeting information are available upon request. Proceedings of the meeting were recorded and are on file at the District's headquarters in Brooksville, Florida.

I. Review of the April 5, 2004 Meeting Summary

Mr. Owen provided an opportunity for the Work Group members to comment on the last meeting summary. No changes to the summary were received.

II. Further Discussion of the draft SWUCA Recovery Strategy

Mr. Owen said the purpose of the meeting is to open it up for any comments, questions or suggestions regarding the revised Recovery Strategy, or any other topics the Work Group members want to discuss. Mr. Owen said there are two topics for which we are seeking input from the Work Group, including the relocation provisions and the lapsed quantities provisions.

Mr. Owen provided a brief update of what the relocation provisions are; what the current draft proposal is and why; an example of a relocation provision; and available options. Mr. Owen said the relocation provisions are only one part of the proposed rule revisions and the rule revisions are only one part of the regulatory component of the Recovery Strategy. Mr. Owen said relocation provisions address any new withdrawals that impact an MFL waterbody, and must include a Net Benefit. He discussed what we are recommending for consideration of a permit renewal after the minimum flows and levels are adopted. He said we are proposing a process that would try to strike a balance between the overall recovery and how we treat existing legal users. He gave an example of a ten mgd permit renewal - based on a reported information, six mgd have been reasonably and beneficially historically used, this is one factor we look at in the renewal as to what would continue to be their reasonable and beneficial needs. The District would also look at acres planted, in the case of an agricultural permit, and if the permittee has been more efficient than required, the quantities associated with that acreage. He said another factor would be if they have a business plan in which they demonstrate reasonable and beneficial use for expansion of their operation.

> A question was asked regarding agriculture and what specific criteria would be considered. Mr. Owen said we would look at what has been done to date and if they have been logically progressing in growing into the permitted quantity.

Mr. Owen said one of the important reasons to show the proposed renewal process – a permit impacting an MFL – is that the clear majority of permitting activities are currently renewals, and these are the rules that most permits are handled by in the SWUCA. He said a relocation is where a permittee voluntarily decides, during the life of their permit, to come forward and change some aspect of their business plan. Mr. Heath said we indicated that we were looking at renewals and there are no changes that we are suggesting under the existing rules as they govern renewals, and as far as the regulatory aspect and the reasonable-beneficial, all three components (AGMOD, business plan, historical use) are intack – there are no changes. He said now we are talking about relocation and this is a new item that needs to be considered.

> John Zimmerman said we have already implemented the efficiency standards within the SWUCA on all the existing permittees – so it's not going to be a reduction due to a higher

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efficiency, it would have to be taken from something else. Mr. Heath said the permittee may not have come in during this time where they have been applied, so this may be the first time that we actually look at the basic quantities on the permit and those higher efficiencies are started at that point.

Mr. Owen said the issue before us is on how we structure a possible relocation and how it might contribute to recovery while also allowing for economic expansion. He said we have the greatest amount of certainty of recovery if we were to restrict this to just the historical use – because it is the actual use that is causing the impacts. And as currently proposed, we are saying that you could only reasonably relocate up to 90 percent. He said the least amount of certainty, that what most protects the business plans that might have been in the works, would be to base it on someone wanting a relocation that proposes a new business plan – a permittee might present a plan that they had anticipated expanding further into their full permitted quantity. This would be the most generous to the permittee, but presents the greatest uncertainty that actual use could grow into permitted quantities.

Sonny Vergara asked about the identification of the 1.8 mgd (from Mr. Owen's example) and the fact it would eventually go away and is it based upon the original pretence that of the 10 mgd permit there was 2 mgd that was not reasonably or beneficially used so it's identified as such. Mr. Owen said yes, this is the difference between the 8 and 10.

John Zimmerman said his issue is we are going to get a new use on the property, which we have hardly any uses that do not need water, if it's residential it needs water, even though it was once farms, they are going to want to irrigate their lands and they need the water in their homes. If you do not have that 1.8 available to that new use you are creating a problem. He said if the two uses, the one that is transferred and the one that remains is where you want it to be, you are better off. Mr. Owen said the District is not instigating a relocation, this is something that is brought to us, asking for relocation of quantities – the existing permittee and a new permittee are both perceiving this as to their advantage. This is why we notice local governments for them to get involved in these issues.

Jeff Spence asked if this takes into account a change in use (citrus to houses)? Mr. Owen said if you are trying to relocate quantities from an existing citrus area to new areas being developed and this is a way you are tying to meet those needs – the new development has to meet the reasonable-beneficial criteria for its needs. Mr. Spence asked what if it is the same site? The permit has to be transferred to a potable supplier, and does the District agree this can be worked out? Mr. Heath said yes, what you have is a Net Benefit, you are staying at the same site – it's not a relocation, you are changing the use. He said we still have the notification process of the use change, local governments are involved in this activity. Mr. Spence said a local government is going to need to know that quantity to be in their permit to allow the development to occur. John Heuer said local governments have a 2-3 year headstart – zoning, paperwork with developer and the County usually precedes the development – so you should be the first to know about the development and should take that into consideration in the rezoning process. Mr. Spence asked if the Department of Community Affairs has accepted this, and when they modify their comprehensive plan, and say their source of water is going away, do they have to identify permitted quantities for the next ten years? Mr. Owen said he couldn't speak for DCA, but that the District will assist the Counties in properly describing how the growing needs can be met. Mr. Spence said he would like clarification from DCA regarding this issue.

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> Dr. Griffiths asked if this was a rule that would apply equally everywhere in the SWUCA? Mr. Owen said yes, the effects might vary, depending on how much impact is on waterbodies. Dr. Griffiths said the District fails to recognize the SWUCA has three separate areas – and we need to recognize this because, if we don't, we will have a lawsuit when the rule is final. Mr. Vergara said the report indicates the District will apply this based on the judgmental factors in the different areas. Dr. Griffiths said he wants this written down on how it will be applied in each area – or the District will be taken to court – this is a fact – he has two to three Counties behind him.

Mr. Owen said the Governing Board is also debating several of these issues, and the concern is this will allow for an increase in actual withdrawals impacting MFL waterbodies. He said other considerations included: reasonable-beneficial, historically used quantities would be available for relocation. He said potentially that which could be justified of actual acres planted, by a farmer, to justify a greater quantity than historically used under our reasonable-beneficial evaluation. One other option being discussed is that the business plan would not be considered.

> Cara Martin said there are two separate issues – as an agricultural example, there's a farmer who wants to continue to farm – these rules do not apply. It is only when you start relocating water is when this happens. She asked if you can keep the 1.8 mgd amount (or grow into it) what would happen to other existing legal users in the SWUCA? Mr. Owen said the combination of the two – what you relocated and hanging on to has exacerbated problems, at least on a temporary basis.

Mr. Owen asked the Work Group members for input on several specific issues that had received significant discussion at the April Governing Board meeting. These issues included aspects of the relocation and lapsed quantities provisions of the revised draft SWUCA Recovery Strategy.

Relocation Provisions
Regarding the relocation provisions, the Work Group Members were asked to specifically address when a permittee applies to relocate quantities with a change in use-type and/or ownership, whether the District should limit its review to (1) the reasonable-beneficial historically used quantities; or should the District also include consideration of (2) reasonable-beneficial quantities that would be permitted under the AGMOD irrigation model based upon acres planted; or (3) the reasonable-beneficial quantities based upon a business plan that would argue for further growth into historically unused quantities. It was emphasized that this does not include renewals or a relocation with no changes in use-type or owner. The discussion then focused on whether to allow for consideration of reasonable-beneficial quantities described in number (3).

<u>Chuck Walters, Sarasota County</u>
Did not express a position on the issues as presented. Mr. Walters expressed concern that the relocation provisions, as currently described, do not seem to take into account reuse of reclaimed water that reduces the historically used quantities. Recommended clarification as to how this would be considered in a relocation.

<u>Cara Martin, Florida Farm Bureau Federation</u>
Stated the original option, as currently written in the draft Recovery Strategy, allows for the greatest amount of economic activity and is not as restrictive. Preferred the business plan option. However, both options protect production agriculture in that if you want to continue what you have been doing, or even expand an operation, you can do so under each of the options.

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Alan Peirce, Florida Fruit and Vegetable Association
Stated the Recovery Strategy protects production agriculture by the way in which it proposes to handle renewals. The relocation provisions, addressing when someone wants to "sell" quantities to another use, are not really an agricultural production issue. This is more of a water management issue that is the responsibility of the District. But, supports the current proposal to allow for consideration of the business plan if the District determines it can meet it objectives under this proposal in a timely manner.

Bob Viertel, Department of Agriculture and Consumers Services
Prefers the version that allows the business plan to be considered. There are many reasons why a grower might not have used all of the permitted quantities and these growers should not be penalized by the proposed rules.

Jeffrey Spence, Polk County
Mr. Spence stated that under the existing rules we have not seen signs of recovery. He stated he would recommend Plan B (e.g., the reasonable-beneficial quantities associated with acres planted), not allowing further growth into unused quantities associated with relocations.

Mandy Hines, DeSoto County
New representative for the County, declined to comment due to being new to the Work Group and unfamiliar with the issues.

John Zimmerman, Manatee County
If the District is really trying to protect the resource, total quantities should be limited to 90% of the historic use upon relocation. However, speaking for Manatee County, the business plan provides for the greatest amount of potential economic growth and that is what the County would support.

Peter Hubbell, Hillsborough County
Hillsborough's concern has always been the ability to grow into unused quantities, so the County supports getting rid of the business plan. Even if in the relocation provisions quantities are held to the historically used amount, there is still concern regarding growth into historically unused quantities.

Jay Clark, Citrus Mutual
Citrus Mutual's position is to accept the option to protect the permit holder best – to keep the business plan as a consideration.

Charles Garing, City of Lakeland
Keep the business plan. The District has the ability to question the validity of the business plan and can remove any fictitious requests. This maintains the greatest amount of flexibility.

Tanya Portillo, Florida Electric Power Coordinating Group
Not available during discussions.

Lapsed Quantities Provisions
As currently written, the draft Recovery Strategy provides that the District will not include, in the Lapsed Quantities, quantities that are retired through the land acquisition programs of local governments or other entities in the SWUCA if so requested by that local government or other entity. In addition, the draft Recovery Strategy provides that quantities associated with future

District acquisitions will be handled on a case-by-case basis as to whether some or all of the quantities should be included in the Lapsed Quantities. At the April Governing Board meeting, concern was expressed that the District should retain the ability to consider the quantities associated with future land acquisitions of local governments or other entities based on the merits and circumstances of each particular permit affected by an acquisition. In addition, the Board discussed the option that quantities associated with future District land acquisitions should be directed toward resource recovery, or that more specific criteria should be developed as to determining quantities that will be retired or placed in the Lapsed Quantities pool. The Work Group was asked for input on these specific aspects of the Lapsed Quantities provisions. The following input was received:

Peter Hubbell, Hillsborough County
Hillsborough County appreciates the language contained in the revised draft Recovery Strategy, honoring requests from local governments to not include quantities associated with local government land acquisitions. The County also understands from the District staff that no quantities from the County's land acquisition program are included in the 22 MGD originally estimated by District staff to be available as Lapsed Quantities from January 2000 to present. However, the County is still concerned that the Lapsed Quantities provisions will "make the hole bigger" (e.g., exacerbate resource problems). If, as discussed in previous meetings, the Lapsed Quantities provisions are proposed by the District to address the needs of small users with no other available source options, then the District should define a "small user" or otherwise develop criteria for allocation of the Lapsed Quantities so that they are not all consumed by one or two large users.

John Zimmerman, Manatee County
The Lapsed Quantities provisions, in combination with the Relocation provisions, as currently proposed allow for a great amount of flexibility. As currently proposed, the District can accommodate the needs of a local government such as Hillsborough County that may want to restrict use of Lapsed Quantities. However, at the same time the provisions could allow a local government to relocate quantities from a property that it is working to purchase. This allows a great amount of flexibility.

Water Withdrawal Credits
Chuck Garing, Lakeland, asked what the status was of a previous recommendation from the Work Group members that the Water Withdrawal Credit be structured as "up to 90%," similar to the Relocation and Lapsed Quantities provisions. District staff responded that in the revised Recovery Strategy, the Water Withdrawal Credit is still structured as 50% of the previous groundwater withdrawal. Staff will bring this recommendation to the Governing Board for direction.

At this time, Mr. Owen asked if there were any other topics that needed to be discussed, hearing none, he proceeded to the future meeting schedule.

III. Future Meeting Schedule
The next meeting was tentatively scheduled for July 12, 2004, a notice will be sent out prior to this meeting.

IV. Public Comment
No public comments were received at this time.

V. Adjournment
Mr. Owen adjourned the meeting at 4:05 p.m.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SOUTHERN WATER USE CAUTION AREA (SWUCA) WORK GROUP
MEETING SUMMARY
JULY 15, 2004

The SWUCA Work Group met at 2:00 p.m. July 15, 2004, in the District's Bartow Service Office. Copies of presentation materials and other related meeting information are available upon request. Proceedings of the meeting were recorded and are on file at the District's headquarters in Brooksville, Florida.

I. Review of the May 10, 2004 Meeting Summary

Mr. Owen provided an opportunity for the Work Group members to comment on the last meeting summary. No changes to the summary were received.

II. Further Discussion of the draft SWUCA Recovery Strategy, including the updated draft Rule Revisions

Mr. Owen said the purpose of the meeting is to focus on the relocation provisions in our Recovery Strategy, and discuss the purpose of those provisions. He said he will review the current draft Recovery Strategy (March 2004) proposal; the May Governing Board direction, which is reflected in the draft rules; the June Governing Board discussion; and a letter we just recently received from the Department of Environmental Protection (DEP) regarding their input on the draft rule.

Mr. Owen said staff have been working on the overall Recovery Strategy for more than a year, and the regulatory component is only one part of it, and the relocation provisions are only one part of the regulatory component. He said the most significant components of the Strategy have been completed and have had a consensus of support. He noted that portions of it are already being pursued and implemented, particularly the project components, and the financial support continues in this year's budget and next year's proposed budget. Mr. Owen reviewed the major elements of the Recovery Strategy, some of which include: future water use demands; inventorying potential sources to meet the growing demands; alternative sources to replace ground water withdrawals; existing rules and enhancements to existing rules; water resource development projects; and financial incentives. He said we are now focused on the enhancements to the rules and part of the net benefit options. Mr. Owen reviewed the regulatory component, which includes the SWUCA 1 rules, adoption of minimum flows and levels, not allowing new impacts to the minimum flows and levels, and net benefit options for new withdrawals. He said a net benefit is an action that will not only offset a projected impact to an MFL waterbody but will also result in a net improvement to that waterbody. He reviewed the net benefit options, which include: mitigation; resource development projects; water withdrawal credit; lapsed quantities, and relocation. He said we are seeking the Work Group's input on the relocation provisions. Mr. Owen said an applicant that wants to receive relocated water has to show there is no feasible alternative supplies to meet their demands; and it is important to note that this is not being initiated by the water management district – this is two or more willing parties coming to the District asking to relocate a quantity and they perceive this as a benefit for themselves. He said the issue is how to address historically unused quantities upon a relocation. He explained why we need to address this. Mr. Owen said there is approximately 950 mgd permitted ground water quantity and the long term average annual use of ground water is approximately 650 mgd – on a regional basis, we do not want to allow actual use to grow into permitted quantities, and the Recovery Strategy actually sets a goal of reducing withdrawals from the upper Floridan aquifer by 50 mgd to contribute to recovery. Mr. Owen said the trends for permitted quantities in the Floridan Aquifer shows decreases while the actual use remains relatively stable, the reasons being the application of the reasonable-beneficial rules, lapsed quantities, and others, while growth is still occurring in certain sectors (public supply, recreation).

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Mr. Owen said we will focus in on how we treat relocations and the historically unused quantities. He said we have characterized this as a "certainty of recovery" issue looking just at relocation activities and how they might meet the principles set by the Board. He said the greatest amount of certainty that these transactions would contribute toward the Recovery Strategy is if we restrict what can be relocated from an existing permit to the historically used quantity. He said the least amount of certainty is to allow consideration of a business plan by which a permittee could justify growing into historically unused quantities subsequent to a relocation. He said the greatest likelihood for a relocation would be from existing agricultural operations to some other land use type – so we could look at the actual acreage planted, in addition to the historical use. Mr. Owen described an example of a relocation with a change in use type/owner that was reflected in the March 2004 draft Recovery Strategy. He said both used and unused are reduced by 10%, only 90% of the historically used could be relocated with a change, and any remaining unused is prohibited from being relocated or changing use type in the future. Eventually, these quantities – historically unused – would go away.

Mr. Owen said that at the May Governing Board, staff were directed to remove all unused quantities; but did not include the 10% reduction in used quantities. Karen Lloyd also noted this change was reflected in the current revised draft rules. Mr. Owen said the net benefit (10% reduction) provisions have been removed.

Mr. Owen said at the June Governing meeting, as a discussion item under the Chair's agenda, one option discussed regarding a relocation with a change in use type was to still remove all unused quantities, but reintroduce the 10% reduction in used quantities. He said as a reminder, this was just a discussion item and no action was taken. He said this is with a change in use type – but without a change in use type or a change in owner – this is called a self-relocation, and there is no restriction as currently proposed. Mr. Owen said the concept of self relocation has been in the draft Recovery Strategy and draft rules for months, which is when an existing use/existing owner changes their location, all the reasonable beneficial used and unused would be available for relocation. He said this was not discussed at the May Governing Board meeting, but at the June Governing Board discussion, both the used and unused quantities would potentially be available, but there was a concept of adding a 10% reduction. He said a modification to change use type, where the site stays the same but an existing use changes, was discussed, and where a portion of an existing permitted site is sold and the use type is changed – this would be a partial transfer with a change in use type. He said within the March Recovery Strategy this was considered analogous to a relocation with a change in use type – we would have restricted this to historically used quantities minus 10% and unused would be reduced by 10% and restricted to that site and use type. He said at the June Board meeting, used and unused quantities would be available but reduced by 10%. Mr. Owen said we are seeking Work Group input on are these various alternatives of how we address the relocation and historically unused quantities.

Mr. Owen also referred to a letter that we received from DEP (copies were provided to attendees) on their comments on the draft rules and briefly reviewed them. He said for the competing applications, they have issue with giving a preference to renewals – and that is one of our fundamental principles for trying to protect the investments of existing legal users. He said their recommendation for lapsed quantities was to remove this provision entirely from our rules. He said the relocation provisions – they concurred with removing the historically unused quantities upon approval of a relocation – and recommended it be extended to a self relocation as well.

John Zimmerman asked for clarification regarding competing applications and if DEP's not wanting preference given to a renewal – doesn't this exist in the Legislature or under 373?

Karen Lloyd said it is our position that this is within the discretion of the Governing Board to grant that preference, and DEP wants to see that out of our rule. Mr. Owen said their argument was what if a proposed new applicant wants to compete against a renewal and is offering to contribute more to recovery – or have a more reasonable beneficial use, we should be able to consider this. Ms. Lloyd explained that DEP has an issue before this point, which is if we have said you meet our rule criteria, you are all equal, then we start looking at the applicants' contributions to recovery and other criteria. DEP's position is that the District should look at those things before deciding that everyone is equal.

Mr. Owen referred back to the relocation provisions issue and asked for input.

Pete Hubbell said he looks at this as a balancing act between achieving recovery and meeting new needs, and relocation is a good idea.

Cara Martin asked if you let unused quantities grow into the permit, what would happen – has the District done any modeling in what would happen to the resource? Gene Heath said if we use the past as a history of what you could expect in the future – what has happened where there has been relocation, we have averaged from 1994 to this point less than 1 mgd a year of relocation, small portions are moving out, and also in the past, there has not been an inclining use pattern. Mr. Owen said another part of our Recovery Strategy is to put a comprehensive monitoring program in place.

Pete Hubbell asked if this would be in the rule? The rule is based on a lot of assumptions (land use changes, etc), and the tracking system makes sense, but we would like to see that in the rule. Mr. Owen said we are committing to the periodic evaluation in the rule. Ms. Lloyd noted that during the SWUCA I rulemaking, we adopted the trigger mechanism provision, where we look at use segments (ag, recreation, etc.) and look to see if the use has increased over a certain three-year period – if it has we look to see what is causing the increase and what we need to do about it.

Alan Peirce said we may want to inquire from the Work Group members of who is in favor of going back to the original (March) proposal. There is enough of a disincentive in there that he thinks we will reach our recovery goals with that. He said there would probably be more of a consensus here that this would be more of an appropriate position for the District to take – in light of the DEP letter.

Mr. Owen asked for a show of hands of how many Work Group members support the March 2004 proposal. (Note: 12 Members and Alternates present). **For: 10 – Opposed: 2**.

Pete Hubbell said he would like staff to report back to the Governing Board on if there is a consensus that relocation makes sense for the SWUCA, and if that is the case, will we see recovery happen as quickly as it should based on the March 2004 draft. He does not want to see relocation go away, but says there should be a better way to look at it. He said Hillsborough County is concerned with the permitted unused quantities. Mr. Owen said how we structure relocation is not going to have that big of an influence on achieving recovery, it's a relatively small component of the permitting actions. Mr. Hubbell said the alternative would be an intermediate type of recommendation to look at what percentage of recovery is being achieved. Alan Peirce said it sounds like we are already reaching these goals with the way the rule is now. Mr. Owen said the impact of relocation on withdrawals

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will not even be measurable in terms of achieving recovery – this is an issue of a policy standpoint on how we want to structure this so relocation transactions contribute to recovery.

Pete Hubbell suggested the District look at other percentages, in addition to the 10% reduction. Sonny Vergara suggested that when the District revisits this issue on a periodic basis, and there is not a satisfactory recovery occurring, then the District should go back and adjust the percentages. He said implementing these rules to accomplish what we need to accomplish in the recovery efforts is difficult and the District has come along way from where it was 10 years ago. He would be cautious about changing the percentages that have been in the rules all along.

Mr. Owen asked for a show of hands of how many Work Group members support the May Governing Board alternative that directed 100% of the historically used quantities be available for relocation, and all historically unused quantities be removed. **For: 0 – Opposed: 12.**

Mr. Owen asked for a show of hands of how many Work Group members support the June Governing Board option that was discussed that all unused quantities be removed and that the historically used quantities be reduced by 10%. **For: 1 – Opposed: 11.**

Mr. Heath said we will provide the Governing Board an update on the outcome of today's meeting. He said the Board will be making decisions regarding these issues, and the Work Group members need to engage themselves in this process.

John Zimmerman asked about the DEP letter and if the District is obligated to do what they ask. Mr. Owen said they provide general supervisory authority over the water management districts and that will give considerable weight to their input on this process, but the ultimate decision is the Governing Board's. We are hoping to resolve any differences of opinions at the staff level. Mr. Heath said the DEP letter is on the Governing Board agenda for discussion. Ms. Lloyd said ultimately, when push comes to shove they can object and put us in a position with having to challenge them on their decision about our rules, under the Statute they can tell us this rule is inconsistent with Ch. 373 and essentially we are not authorized to have such a rule. She said then we would need to challenge their determination.

Mr. Owen moved on to the June Governing Board discussion regarding self-relocation. He said this is where the use type and owner stay the same, only the withdrawal locations and site change. He said at the June meeting, it was discussed that both used and unused quantities be available, but that a 10% reduction be applied. He said this is different from where we were in March. Cara Martin said she would oppose this because sometimes in agriculture you have to move, because of development. Alan Peirce said they would also be against this option. Mr. Owen said under the March version we addressed this, the reasonable beneficial used and unused quantities could be move, without net benefit. Mr. Owen asked for a show of hands from Work Group members who support the March

Recovery Strategy provisions regarding self-relocation. **For: 12 – Opposed: 0.** Mr. Owen asked for a show of hands from Work Group members who would support the June Board discussion to apply the net benefit reduction to self-relocations. **For: 0 – Opposed: 12.**

Mr. Owen said if anyone has any comments on the draft rule revisions, we need to receive them in writing no later than July 30th. He said if the Board approves these revisions, staff will ask for authorization at the August Board meeting to publish them. He said if there are any substantial changes made in the rule, they would also reflect those changes in the Recovery Strategy.

III. Future Meeting Schedule

Mr. Owen said the SWUCA Recovery Strategy and updated draft rules will be discussed at the July and August Governing Board meetings and encouraged Work Group members to either attend these meetings, or submit any further input in writing by July 30, 2004. He said the second day of the August Board meeting is set aside to discuss the SWUCA issues as the primary topic.

IV. Public Comment

No public comments were received at this time.

V. Adjournment

Mr. Owen adjourned the meeting at 4:05 p.m.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SOUTHERN WATER USE CAUTION AREA (SWUCA) WORK GROUP
MEETING SUMMARY
NOVEMBER 8, 2004

The SWUCA Work Group met at 1:30 p.m. November 8, 2004, in the District's Bartow Service Office. Copies of presentation materials and other related meeting information are available upon request. Proceedings of the meeting were recorded and are on file at the District's headquarters in Brooksville, Florida.

I. Review of the July 15, 2004 Meeting Summary

Mr. Owen provided an opportunity for the Work Group members to comment on the last meeting summary. No changes to the summary were received.

II. Further Discussion of the draft SWUCA Recovery Strategy and associated draft Rule Revisions

Richard Owen said the purpose of the meeting is to focus on the key provisions of our SWUCA Recovery Strategy which still have not been completed, and to get the Work Group's input on those provisions. He said the four parts to this presentation will include: an introduction/overview; the cumulative impact analysis; recovery trends; and, recovery projections, including where we go from here. Mr. Owen reminded the Work Group of the Governing Board's approved principles, that include: contribute significantly to resource recovery; protect investments of existing water use permit holders; and, allow for economic expansion. He noted he will compare and contrast the regulatory component of the Recovery Strategy, and will look at what we had up until July, and then how it compares to what we are recommending today. Mr. Owen said, at the October Governing Board, staff were given conceptual approval of the recommendations for the purposes of soliciting your input, as well as the Advisory Committees and public input.

Mr. Owen began with pre-July considerations on how a new application would be considered. He said it would first ensure it was a reasonable-beneficial use – there being no changes recommended, and to rely on our existing rules. He said we would ensure the application is maximizing opportunities for conservation as well as that it employs any alternative sources that are determined to be economically, environmentally and technically feasible, meaning we are minimizing the need for new groundwater quantities in SWUCA, but recognizing there may be applicants who go through the process and still result in a reasonable-beneficial use where there are no feasible alternatives to meet all of their demands, and are requesting new Floridan aquifer quantities. Mr. Owen said if there is no impact to an MFL waterbody, the standard rule criteria would apply. He said if there is an impact, it would have to employ a net benefit, which an applicant could chose between five options to accomplish this, including: groundwater withdrawal credit; mitigation; participation in a resource recovery project; lapsed quantities (this concept is recommended to be removed from the Recovery Strategy); relocation – self relocation and other forms of relocation. He said staff is recommending that the other forms of relocation that involves any type of relocation with a change in use type or ownership be removed from the Recovery Strategy and replaced with the cumulative impact analysis. Finally, staff is recommending the competing applications provisions also be removed from the Strategy.

Mr. Griffiths asked if competing applications are removed, how will it be handled? Mr. Owen said there are existing statutory provisions that authorize people to compete for quantities, and existing rule language, those would be all the guidance that the Board would have, and would have to address these applications on a case-by-case basis. Mr. Griffiths said, in his opinion, this is the wrong thing for the District to do.

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Mr. Owen said what we are recommending now is for the reasonable-beneficial process, conservation requirements and the development of alternative sources to remain the same. He said self-relocation would also be maintained. He said any new applications that require a new Floridan aquifer quantity is being recommended to go through a cumulative impact analysis.

Mr. Owen referred to several graphics describing what a cumulative impact analysis is. The first graphic shows the SWUCA with the most impacted area (MIA), which included the wells that were used to establish the minimum aquifer level. He said that in order to achieve the minimum aquifer level, we need to bring the actual level up to the proposed minimum, so by the year 2025 there would be a 0.7 foot rise in the 10-year moving average of the Floridan aquifer level in that area. Mr. Owen said we are proposing to have a comprehensive monitoring system for every type of change in a permitted and used quantity or recovery project that is affecting the impacts on the MIA aquifer level. He provided an example of how this cumulative impact analysis would work. Mr. Owen said if the cumulative impact analysis shows there are not quantities available – the applicant would have to propose a net benefit. He said if the analysis shows we are close to having the actual reductions and impacts close to what we need, in terms of the scheduled recovery, it would be determined if we should stop issuing any new quantities.

A comment was made that if the 5-year recovery is based on measurement, then it does not really stabilized anywhere, plus there is the hydrologic cycle of either a wetter or dryer than normal cycle, so we could be deceived into thinking there is a better recovery than what we really have, and is this where the cushion is built into this analysis? Mr. Owen said we have a comprehensive monitoring evaluation of all transactions occurring from January 2000 forward and their impacts on the MFL waterbodies. Mr. Heath said when we made the proposed minimum flow level, we were in the midst of a 100-year drought – so we are looking at the yearly recovery amount, 0.028 ft/yr as a condition to go through a 100-year drought and stay at the minimum level.

A question was asked if a schedule or process would be set up to do scenario planning on different options. Mr. Owen said a significant amount of staff time is being to devoted to a system that would automate this process.

A question was asked about which model was used for our basis? Mr. Owen said staff will get back with an answer.

Mr. Owen said we will be doing a cumulative impact analysis of the changes and impacts from changes in withdrawals for other projects, and not just in the MIA, but for each one of the MFL waterbodies.

Jeff Spence asked if we are looking at the Peace River MFL, and that the District has indicated the flow could not be brought back, and it will be done by manipulating the surficial system, so why would the District do an impact analysis on the Peace River? Mr.

Owen said we do not want groundwater withdrawals to exacerbate the impacts there, and if we have a cumulative reduction in groundwater withdrawals over time, it will contribute to recovery of the Upper Peace River. Mr. Spence asked if we have a baseline level, or when we will. Mr. Owen said staff will look at a base date for impacts for the Upper Peace River and the lakes.

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Pete Hubbell referred back to an earlier comment regarding hydrologic conditions versus what is an impact due to a withdrawal, and if we are we going to be able to tease hydrologic ups and downs out of the data to be able to say this trend is true. Mr. Heath said the compliance is based on a 5-yearlevel being achieved, it's a 10-year rolling average that will tease out some of the hydrologic impacts. He said we chose a 100-year event to set the MFL associated with that, and to achieve a recovery level to take care of the next 100-year event.

Jeff Spence said he is still confused about the Upper Peace River and that it's clear what we are doing on the MIA, but somehow we are not anticipating getting groundwater back to the Peace River, but if we are going to set an arbitrary level, we are missing something. He said he urges us to think through it a little more. John Zimmerman agreed with this and said if you are going to look at the impacts on the Peace River from groundwater use, a minimum groundwater level needs to be set in the Peace basin to evaluate against. Mr. Owen said what we are proposing is to draw a date of January 1, 2000 (for example), and will model the impacts of a proposed new withdrawal on the Upper Peace River, and then monitor all the changes in permitted withdrawals that were impacting the river and for projects that are also contributing to reducing the impacts to the Peace River. He said the biggest difference is in the MIA, the impacts need to be reduced and levels improve, but for the Upper Peace River, we need to make sure it does not get any worse. He said we are not achieving recovery to the Upper Peace River through the reduction from groundwater withdrawal impacts, we are achieving it through other means.

John Zimmerman said that in SWUCA I we had the Peace River Valley, Eastern Tampa Bay and Highlands aquifer levels, and we would be having recovery in Polk County if levels had been set, and asked if it that would help solve the problem in this area to look at the aquifer levels in the different regions to determine whether we were getting recovery in a region, and therefore additional water could be pumped? John Heuer said there are may factors affecting levels, including changes in recharge taking place, quantities have gone away, conservation that is taking place and all these things fit into that model so we are going to measure that, and this measurement is what will determine causing the recovery.

Pete Hubbell said it is not clear what the target is for the Peace River. Mr. Owen said our internal discussions have been for it (groundwater levels below the river) not to get worse, we are not achieving recovery in the Upper Peace River by improving groundwater levels, we are achieving it by the projects in place.

Mr. Griffiths asked what projects, besides Lake Hancock, are we working on? Mark Barcelo said we are looking at ways to reconnect lands in the phosphate area, and there is a clay settling area we are looking at. Gregg Jones said there is also the Peace Creek Canal where we would purchase lands to re-flood them to hold water, we are looking at restoring mined lands, and there is the reservoir project along the Peace River. Mr. Owen said we will further describe these projects in the Recovery Strategy.

A question was asked about the gauging stations and if we find through USGS information that the flows are not accurate to ensure fish passage, would we go back to contemplate the flow numbers. Mr. Owen said this does not question what the minimum flows are, it calls into question our recovery strategy for achieving those, so if the Lake Hancock project as well as other projects we bring on line still do not achieve the minimum flows that we are trying to achieve, then we would go back and entertain diking off a certain amount of flow into those sink formations. Gregg Jones said we would contemplate that if we meet those cfs at the gauging stations, it will get us there, but this is something we will not know for many years.

Mr. Owen referred back to the overview and described what we are proposing under the cumulative impact analysis. He said if we show no impact on an MFL waterbody, the standard permitting rules would apply. If there is still an impact, even after the cumulative impact analysis from proposed new groundwater withdrawal, a net-benefit could be proposed, including the groundwater withdrawal credit, mitigation or participation of a recovery project as a means by which it could still be proposed to have a new groundwater withdrawal impacting an MFL waterbody that is consistent with our Recovery Strategy. In addition, the competing applications would just be the existing rule provisions.

Jeff Spence said if relocation is out, and throughout the SWUCA, the majority of the public supply in Polk County would be in grove areas and the concept was they would turn their quantities over to the public supply as they transition from a grove to single family homes, business, etc., does this mean we aren't doing this anymore? Mr. Owen said the net result could still be achieved, if there was an existing withdrawal on agricultural land and it is transitioning, then the withdrawal will go away and what would be the benefit of that reduced withdrawal on an MFL waterbody would be a reduction in impacts, versus the new withdrawal for public supply to serve this development.

Pete Hubbell said now that competing applications are out, how do we picture the permitting process administratively? Karen Lloyd said this was a good point. She said we have been focused on the technical aspects and we need to look at it administratively also.

Pete Hubbell asked about reallocation or relocation and that under the current rules you can relocate – have we been given specific instructions to prohibit relocation? Mr. Owen said the only direction we have been given is the conceptual approval of the changes discussed today for purposes of receiving input. It is yet to be decided what MIA provisions in the existing rules will be deleted or modified.

Commissioner Cummings said his understanding is self-relocation is still available. Mr. Heath said it is – same owner, same operation they can move their facility as long as they meet all the rule criteria and not further exacerbate impacts to the MFL.

A question was asked regarding the cumulative impact analysis and if it is a master model that is kept at the District – do we put in the information and we see what the impact is, or is there a responsibility from the applicant, and is it more than just the groundwater? Gene Heath said we are in the process of doing this, and there might be other models that the applicant may want to have at their own disposal, but we will have it as a District computer model and all the information will be tracked and made available to the permittees and others that are interested.

Alan Pierce asked if the cumulative impact analysis only looks at changes in groundwater? Mr. Owen said no, it also looks at groundwater withdrawal impacts on the Upper Peace River and lakes. Mr. Jones subsequently clarified that the currently proposed cumulative impact model only looks at groundwater – so it would look not only at the MIA, but also groundwater levels below the Upper Peace River and the lakes. He said an integrated ground and surface water model is under development, but is years from being completed.

Mr. Pierce said in doing this analysis, do we take into account any credits or net benefits occurring as a result of recharge projects? Mr. Owen said yes, as to how that contributes to levels at the specific waterbody. Mr. Pierce asked if we will look at any changes that might occur that are going to reduce flows in the rivers that are not a consumptive use change, such as surface water alterations? Mr. Owen said this is not a part of the cumulative impact analysis, but it doesn't mean we would not be looking at that. He said the recovery strategy for the Upper Peace River is to prevent anything that would negate the benefits of the projects we are trying to undertake.

A question regarding what is the process for getting the model developed, the timing and how does it relate to the implementation of the rules. Gregg Jones said we are working on a pilot-scale demonstration model very soon, just to see that it will work and we are going back and looking at all the permit transactions since January 1, 2000. This pilot effort will be completed in the next several months, with the full scale model done next year. Another question was if there is a process for approval of the model. Gregg Jones said there is no approval process except perhaps through any rule changes.

John Zimmerman asked if the model would be made available. Gregg Jones said yes, it would be public record.

Commissioner Cummings said on the discussion regarding the cumulative impact analysis, he has the impression the District already has obligations to do this, but it doesn't necessarily translate directly into whether or not the current rules allow or require us to do a more comprehensive analysis. Gene Heath said cumulative analysis has been around for decades, what has not been around are the MFLs. Commissioner Cummings said the District may want to look at if this could be interpreted in current rules, as opposed to going into rulemaking. Gene Heath said we have to go through rulemaking process to develop the MFLs, and we have to have a recovery strategy associated with it, so we do not have a cumulative analysis as contemplated here to address the particular items that are going forward in the rule.

Mr. Owen continued with his presentation and described what we have been observing in the trends in groundwater levels, permitted and used quantities, etc., and it is important to keep in mind as we decide how much needs to be changed, what new measures we need to have in terms of recovery. He said we are not talking about stopping saltwater intrusion, we are talking about managing the rate of saltwater intrusion. He said this has been modeled under various scenarios throughout the groundwater basin on how far the saltwater intrusion would move in an inland fashion over a 50-year time horizon, and we know what wells are at risk of saltwater intrusion. He said we are trying to manage human use of the aquifer system for various purposes, and what we are proposing is to establish a minimum aquifer level throughout the MIA based on a series of wells. He said there was a water use increase through the 1970s, but subsequent to that, it has been relatively stable. He said looking at 1997-98 timeframe compared to 2002-03 when the hydrologic conditions were similar, the use is less in more current years. Mr. Owen reviewed graphics regarding sentinel well averages, SWUCA groundwater use total, permitted vs. use, new WUPs per year and associated permitted quantities in the SWUCA, permitted quantities in the Florida aquifer in the SWUCA, SWUCA recovery trends, SWUCA recovery projections and where we go from here. Mr. Owen said we know there are certain permits where groundwater quantities that have been issued which the permittees are not using their full permitted quantities yet, and on a user-wide basis we anticipate they will grow into the permitted quantities. He said there are areas in the SWUCA that have limited alternative sources, and that there will be reasonable-beneficial needs presented to us for new groundwater withdrawals that would impact the MFL waterbodies. He said the challenge is greater if we want to achieve a net reduction of 50 mgd, we have to have a compensating reduction for the growth in permitted but unused and compensating reductions for any new quantities beyond our recovery requirements, this process will be monitored and tracked on a case by case basis throughout the entire region to see if we are staying on track. Mr. Owen said the overall Recovery Strategy is concurred with by most parties, and the major components are completed and underway, including alternative sources development; restoration projects; existing rules; and financial incentives. He said the resource trends are positive, the permitted quantities are decreasing; there is no trend that actual use is growing into permitted quantities; actual use is returned to, or below pre-drought levels; and groundwater levels are improving. He said the reason we need to do rulemaking is to adopt MFLs and portions of the Recovery Strategy. Mr. Owen said the future schedule calls for us to have a draft Rule available at the December Governing Board meeting, and with their concurrence, distribute it to the Work Group, Advisory Committees and any other interested parties, and if necessary any further Work Group or Advisory Committee meetings held in the December/January timeframe. He said staff will go before the Governing Board for authorization to publish the draft Rules in the Florida Administrative Weekly in January or February.

Jeff Spence said if the cumulative impact model will not be finished for another year and potentially if the rules aren't challenged, then there will be a rule in place before the model, does this mean permits will not be issued during that time, or what will be do. Mr. Owen said it was discussed internally to have the effective date of the new rule coincide with the availability of the cumulative impact analysis modeling capability. Mr. Heath said we anticipate the model early next year.

Bob Viertel asked if applications that would be affected by the new rule when it goes into effect will be based on the receipt date of the application or the complete date? Karen Lloyd said right now we are looking at the date that they applied. If someone applied before the new rule goes into effect, you would be subject to existing rules, after, subject to new rules. She said this is subject to more internal review.

John Zimmerman asked if an economic impact analysis on the Recovery Strategy will be done? Karen Lloyd said a Statement of Estimated Regulatory Costs will be prepared during the rulemaking process.

Commissioner Cummings said he has a hard time seeing a value that exceeds recovery when we are admitting that we are trying to not make it worse, and it's just too hard to get recovery at this point, so we are going to have surficial projects that are basically buying time until we can get to the recovery period. Mr. Heath said the only possible thing we can do over time is to go to surficial systems, we are attempting to try to fix what we can.

Mr. Owen said the November Governing Board meeting is on the 16th in Arcadia, and this subject will be on the agenda primarily to report on the input received, and this will be another opportunity to provide input directly to them. The Governing Board is meeting in that area because that is the area that will be affected by the decisions they will make, and they would like to see interest from people in that area to give their direct input. Gene Heath said this is a chance for the Work Group members to express to the Board directly any issues they may have. Mr. Owen said a draft of the revised Rule will be presented at the December Governing Board meeting, and with their

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concurrence on the draft Rule, it will be sent out and a meeting will be scheduled for any further input.

III. Future Meeting Schedule

At the Group's concurrence, they did not want to meet until the draft revised Rules were available, therefore, the next meeting would potentially be January 19, 2005, in the Bartow Service Office.

IV. Public Comment

No public comments were received at this time.

V. Adjournment

Mr. Owen adjourned the meeting at 3:45 p.m.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SOUTHERN WATER USE CAUTION AREA (SWUCA) WORK GROUP
MEETING SUMMARY
JANUARY 19, 2005

The SWUCA Work Group met at 1:30 p.m. January 19, 2005, in the District's Bartow Service Office. Copies of presentation materials and other related meeting information are available upon request. Proceedings of the meeting were recorded and are on file at the District's headquarters in Brooksville, Florida.

I. Review of the November 8, 2004 Meeting Summary

Mr. Owen provided an opportunity for the Work Group members to comment on the last meeting summary. No changes to the summary were received.

II. Further Discussion of the draft SWUCA Recovery Strategy and associated draft Rule Revisions

Richard Owen said the purpose of the meeting is to review the revisions being proposed to the draft SWUCA Recovery Strategy and the associated revisions to the rules. Mr. Owen reviewed staff recommendations that were made in the "pre-July 2004" timeframe as well as the current recommendations. He said all applications for new quantities in the SWUCA will go through the reasonable-beneficial test, including an emphasis on conservation, and trying to minimize the need for new quantities and then minimize the need for those sources that are limited – primarily the upper Floridan aquifer quantities, and emphasize the development of alternative sources. He said we do recognize there will be needs in certain areas where applicants have met all the previous tests but are still asking for new Floridan aquifer quantities. All such applications will undergo a cumulative impact analysis addressing saltwater intrusion. If the new quantity does not impact an MFL waterbody, then the standard 40D-2 rule would apply – it if does impact an MFL waterbody, a net-benefit would then need to be proposed. These could include: groundwater credit; mitigation; and participation in a water resource development project. Lapsed quantities and relocation, with the exception of self-relocation (no change in use type or owner) are being removed from the Strategy.

Commissioner Thaxton said in regard to self relocation, after reading the original DEP concerns, they asked for the removal of the unused quantities in order to maintain consistency with the rule, so how can the District leave that in and still suggest it is consistent with the rule? Mr. Owen said his recollection is the issue on the unused quantities was associated with a relocation with a change in use type or owner. Gene Heath said this was not identified as a concern in their last set of questions, but this issue goes back to a time when we were talking about relocation of all types of uses, and have since deleted the "all types" and are only recommending self relocation. Mr. Owen stated that he is referencing the comments that were recently received from DEP, which have been provided at today's meeting.

Mr. Heath clarified that a self relocation is without change of ownership or change of use type. Commissioner Thaxton asked if it is a change in use, are all of the unused quantities to be removed from the permit? Mr. Owen said there is no relocation with a change in use.

Commissioner Thaxton asked if it then would be a new permit or a modified permit? Mr. Owen said an applicant could apply for a new permit, as well as to modify their permit to have a change in use. These applications would be subject to the new provisions.

Mr. Owen said we also had previously introduced a process of competing applications, but due to concerns of inconsistency with Chapter 373 provisions, this was also removed. Mr. Owen reviewed

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the cumulative impact analysis provisions. He said the minimum aquifer level that has been recommended (in the peer review report accepted by the Governing Board) is 13.1 feet above mean sea level. He said recent conditions are below that minimum and it is estimated that approximately 0.7 feet improvement in the minimum aquifer level needs to accomplished through 2025 on a cumulative net increase in order to achieve the minimum aquifer level – on an annualized basis, a net cumulative improvement of .028 feet per year needs to be achieved.

Commissioner Thaxton said there are two possibilities – you are going to exceed your annual goal, or not reach the annual goal. If you have a good year, with a surplus, are you going to allow that to be credited to the next year, so the next year the achievement would be less? Mr. Owen said possibly. Commissioner Thaxton suggested that if you have a good year and achieve greater than your goal – that should be a new point of where you go up, so the recovery happens in less than 25 years. He said if you go into the negative – it should be made up, but if you go into the positive you should not allow it to lapse back and should shoot for an earlier recovery goal. Mr. Owen said this has been discussed – and if we do go into a negative it will have to be made up, it is cumulative. He said if there were no anticipation of a need for new groundwater quantities in the area, we would probably be allocating it to recovery, but it is anticipated that in certain areas, groundwater use will be needed and we will determine if we can meet this need versus how fast we achieve recovery, and this mechanism is one way in which we might achieve these goals. Mr. Heath said we have to start somewhere and move forward, and every five years, under the recovery strategy, there is a time for us to review where we stand, which would be done in conjunction with the update to the Regional Water Supply Plan.

Becky Ayech said, in regard to alternative supplies, in the past when she has reviewed permit applications or renewals, the investigation of alternative supplies simply meant that someone put a letter in the file that said there are no alternative supplies – there was no sort of analysis done. She asked if staff is going to require more than just this simple statement, or will there be any analysis, criteria, or guidance done to see that there are not any alternatives available. Ken Weber said there is an evaluation done in every case, and if there is an alternative source found, the file would contain that information. Ms. Ayech asked if we have a list that identifies alternative sources and that if an applicant says that there wasn't an alternative source available in their proximity, the District would see that there was? Mr. Weber said this happens frequently that the applicant is not aware of available alternative sources in their area and staff have that information. Mr. Heath said we intend to expand our evaluations of alternative supplies when reviewing applications.

Pat Lehman said that .028 feet per year is a small amount, so is it fair to say the District is not tracking year by year because you can't discern it that much and that is why we have a five-year window? Mr. Owen said we are not trying to monitor a .028 improvement every year in the actual aquifer level, we are putting into a groundwater model every change in permitted and used quantities for projects that might be adding to the aquifer through recharge projects, and the impacts on the most impacted area. He said it is an accounting system of the impacts associated with actual changes in use occurring from January 1, 2000 forward. We are also enhancing our monitoring program, and will concurrently monitor actual trends to ensure our modeled trends are consistent with actual trends.

Dr. Griffiths asked if the 50 mgd reduction is just for the MIA or for the entire SWUCA? Mr. Owen said it is for the entire SWUCA. He said we anticipate the greatest reductions in the coastal areas where we get the greatest benefit. Dr. Griffiths asked how the 13.1 feet minimum aquifer level compared historically in that area – do we go back to the 1960, 1980 or when for the data? Mr. Heath stated that we didn't have the monitor wells in that area during that time, and this level is comparable to the decade of the 1990s data.

Mr. Hubbell said the rule states the District will go back and evaluate our progress every five years and is the intent to keep the model updated on a monthly basis so it is known how far above or below the lines that you can allocate? Mr. Heath said we are working on this now to make this determination should it be monthly, annually or how frequently.

Pete Hubbell said currently when we come in for a WUP, generally the applicant does the impact analysis, now the District is coming up with a model that decisions will be based on, so the burden is on the District and not the applicant to determine whether or not the impacts are acceptable. Mr. Hubbell asked how they would interface with the model itself, if it will be changing weekly, monthly, and it seems like the model code needs to be adopted in the rule for the applicants to know what they need to meet in order to get a permit. Mr. Weber said the rule specifies all the elements involved in the model, but he doesn't think the modeling codes need to be included in the rule. Mr. Hubbell said that in order for a water use permit to be considered it has to pass the first test, and we have a model that will tell us whether or not we are far enough above the line to even apply, so this needs to be public domain in some form or fashion. Mr. Heath said we are in the process of developing the model and hoping to have it done by the February Governing Board. He said we are going back through the year 2000 and taking each permit file and all the associated changes and the model will monitor the changes with each of these permits. Commissioner Thaxton agrees that this should be in the public domain to enable the applicants and the District to be looking at the same analysis.

Mr. Hubbell said going back to comments from Hillsborough County, is the need for competing applications language, which is more important than ever when we look at this new mechanism for allocating water, as water becomes available, there will be a lot of people that will want that water. The actual need to clarify how the District would evaluate competing applications is important. Commissioner Thaxton referred to comments by DEP on competing applications, and supported those recommendations. He said as currently written it basically says it is at the Governing Board's discretion. Mr. Heath said we are only one District out of five, and competing applications can occur at any one of those districts. At first, we decided we were going to have additional language on competing applications in addition to the language that is already in the statute, but have since decided against this. If there is to be rulemaking on competing applications, it needs to be at the statewide level. Mr. Hubbell said at some point the District will have to make decisions regarding competing applications, and this may lead back into rulemaking. Mr. Heath said we don't have a history of competing applications to make any determinations at this point.

Commissioner Thaxton referred to past suggestions made by DEP in regards to competing applications and the degree of environmental benefit in addition to the continuing recovery of the MFL to be used as criteria for competing applications and agreed with their comments. He said their language is clear and directional and why couldn't we just simply state in the rule that we are looking for things that increase the degree of contribution to the recovery of the minimum flows and levels and the degree of environmental benefit, and in his opinion would be beneficial to the whole program.

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Bill Bartnick asked when you carve out the MIA, the Upper Peace and the eight priority lakes, does the saltwater intrusion aquifer level become the default standard in the rest of the SWUCA? Mr. Heath said all the cumulative impact analysis will be directed at the saltwater areas, and the 50 mgd reduction is over the entire SWUCA.

Commissioner Thaxton asked for clarification on mitigation, if it refers to use change, is that mitigation credit available for properties that were acquired for conservation initiatives. Mr. Owen said the reductions in actual use quantities that are attributable to land being acquired for conservation purposes, those reductions are being proposed to be included in the cumulative impact analysis, as a benefit. Commissioner Thaxton said he doesn't think this should be done either. Mr. Heath said this is a decision that the Governing Board has yet to make – if a piece of land is acquired with express purpose of utilizing those back into the recovery program – they may want to do that.

John Zimmerman said the District has established a minimum flow on the Peace River, and what is shown in the Recovery Strategy is the upper Peace River is dried up because the Floridan aquifer potentiometric surface had dropped below the base of the River – how are we going to evaluate increased withdrawals adjacent to the River is we don't look at the impact on the Floridan aquifer? Mr. Owen said we want to make sure the actual levels in the upper Floridan Aquifer do not fall below what we have recommended.

Jeff Spence asked if before staff goes to the Governing Board and asks permission to publish the rule, will the Work Group have an opportunity to see the numbers and graphs? Mr. Owen said yes.

Becky Ayech agreed with Commissioner Thaxton regarding using DEP's previous comments on competing applications and asked how this language could be put back in the rule? Mr. Owen said it would be a recommendation of the staff or a directive from the Governing Board.

Bill Bartnick said this is an evolving policy realm and the District is not done with the model yet, and when it is finished and published, with the real time information levels, this may then put us inadvertently in a competition scenario. He said to date the District has not had to deal with this situation, so he suggests we wait one year to see how the model does. John Zimmerman supported this suggestion.

Mr. Owen said staff is developing and recommending a number of changes to the Recovery Strategy, some of which were based on input we received since distributing updated drafts of the Strategy and associated rules. He said staff met with DEP recently and based on their comments we will be making changes to further clarify and better reflect our intentions. Mr. Owen said at the January Governing Board meeting staff will provide an update of the comments we received, as well as our proposed additional revisions, and there will be an opportunity for public input. At the February Governing Board meeting, staff will describe where we stand on applying the cumulative impact analysis, and public input is also encouraged. He said the March Governing Board, we are asking for conceptual approval of the revisions for further input. We are looking for Governing Board approval of the revisions, and authorization to publish the rule at the April meeting, at the earliest.

Pete Hubbell said in regard to the competing applications, based on comments from Hillsborough County Commissioners regarding the Governing Board being the ultimate

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determiner of public interest – they would like a local government component stated in the rule for them to assist in those deliberations. Mr. Owen said this notification process will be in the Recovery Strategy. Ed Helvenston said if it is not in the rule, it's not binding, and the Hillsborough County Commission would still continue to have concerns with this.

John Zimmerman said Manatee County is very interested in the economic impact evaluation of the Recovery Strategy and the rule. Mr. Owen said staff is still recommending that we proceed forward with the required statement of estimated regulatory costs consistent with the statutory requirements and not expand the scope of that.

Pete Hubbell said Hillsborough County is interested in mitigation language for wells that they know will have problems in the future based on the rate of saltwater intrusion. Gene Heath said we are not in dispute with that; we are currently doing so.

Bill Bartnick said in the rule regarding duration of permits, specifically the 20-year permit, he doesn't understand the rational to discriminate users of less than 100,000 or greater than, and if it is a good thing there should be a reward-based system. Mr. Owen said it pertained to those permittees that received reclaimed water as an alternative source, and those permits that are 100,000 or greater are metering their use, so we have confirmation they are not using their groundwater quantities. Permits for less than 100,000 gpd can request 20-year permits based on offsetting 50% or more of their use if they agree to meter. Bill Bartnick disagreed and said if someone is saving 50% whether they have a meter or not, they should be entitled to a 20-year permit. Becky Ayech said she still would like to see the proof of those savings.

III. Future Meeting Schedule

The next meeting will be scheduled in April to be held in the Bartow Service Office. A notice will be sent out when a date has been established.

IV. Public Comment

Mr. Gore said something needs to be included in the Recovery Strategy regarding the continuing development and their associated impacts on the water resources.

V. Adjournment

Mr. Owen adjourned the meeting at 3:25 p.m.

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SOUTHERN WATER USE CAUTION AREA (SWUCA) WORK GROUP
MEETING SUMMARY
SEPTEMBER 19, 2005

The SWUCA Work Group met at 1:30 p.m. September 19, 2005, in the District's Bartow Service Office. Copies of presentation materials and other related meeting information are available upon request. Proceedings of the meeting were recorded and are on file at the District's headquarters in Brooksville, Florida.

I. Review of the January 19, 2005 Meeting Summary

Mr. Owen provided an opportunity for the Work Group members to comment on the last meeting summary. No changes to the summary were received.

II. Discussion of the Proposed Changes to the draft SWUCA Recovery Strategy and associated draft Rule Revisions

Richard Owen said the purpose of the meeting is to review the proposed changes to the draft SWUCA Recovery Strategy and the associated revisions to the rules. He briefly reviewed the resource concerns and contrasted it with the situation in northern Tampa Bay. Mr. Owen noted the much of the water use that exists today existed before we started regulating water use the early to mid-1970s, and that significant parts of the SWUCA did not come into this district until the later part of 1970 or early 1980s. Mr. Owen reviewed a graphic depicting the permitted quantities from the Floridan Aquifer.

A question was asked that we are measuring permitted quantities - how does this relate to actual withdrawal? Mr. Heath said it is approximately 68 percent of the permitted quantity that is actually used, and this seems to be remaining relatively constant over time.

Mr. Owen said, if the aquifer's actual flows and levels are below the minimum, a recovery strategy is required by Florida Statute. He said we are required to achieve a recovery as soon as practicable, ensure there is sufficient water supplies for all existing and projected reasonable-beneficial uses, emphasis the development of alternative water supplies and conservation and implement this with the greatest extent practical concurrent with reductions in permitted withdrawals. Mr. Owen briefly reviewed the Governing Board guiding principles and the five major elements of the SWUCA Recovery Strategy.

Mark Barcelo provided a review of the development of the cumulative impact analysis. He said this includes data on activities in the SWUCA that affect groundwater levels. He said there are numerous permits that are being reduced over time, others that are growing into their quantities, all of which are taken into account, as well as projects such as the Lake Hancock project, which will affect groundwater levels. He said once these changes are identified the District's regional groundwater flow model is used to calculate the water level changes. He said this process provides an accounting of the effects of activities in the SWUCA on groundwater levels and enables tracking of effects of redistribution of groundwater use in the SWUCA. Mr. Barcelo explained the minimum flow and level recovery in the SWUCA. He said for the period beginning January 1, 2000, staff identified changes in WUPs in renewal cycle, determined changes in actual groundwater use, identified and quantified effects of project activities, assigned changes to wells and calculated changes in average groundwater levels. He explained the activities that were not included in current the analysis, which included: SWUCA 1 conservation; WUPs outside the renewal cycle; pasture; well back-plugging; and enhanced use of alternative sources.

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Mr. Owen said we are moving forward in recovery and all the trends we are seeing, so far, are positive. He said the cumulative impact analysis tool enhances our ability analyze and monitor data. Mr. Owen said the major components of the Recovery Strategy that are completed and underway include: development of alternative sources, restoration projects, financial incentives, existing rules, and the comprehensive monitoring program in place. He said the items that need to be completed include: adopt MFLs, adopt Recovery Strategy, amend permitting rules consistent with recovery, and continue to achieve recovery through restoration projects, reducing groundwater withdrawals, and development of alternative sources. He said we are in the process of revising the Recovery Strategy and rules. He noted that we have hired a consultant to assist us with the preparation of the Statement of Estimated Regulatory Costs, but will not be started until the rules are relatively finalized. He said this information would be discussed at the upcoming Agricultural, Environmental, Green Industry, Industrial and Public Supply advisory committees. Mr. Owen said, at the earliest, staff will go before the Governing Board in November/December to discuss any input received, and early next year staff will request approval to publish the rules and accept the Recovery Strategy.

Jeff Spence said the District is developing the Regional Water Supply Plan while finalizing the Recovery Strategy and rules, will the databases be the same – or come together at the same time, how will this work? Mr. Owen said what is in the existing Regional Water Supply Plan is reflected in the current draft Recovery Strategy, with modifications primarily to the agricultural projections, and there will not be a significant change in the source options.

Mr. Spence asked how the Lake Hancock project increases groundwater levels? Mr. Owen said it would be the enhanced recharge components of that – a portion of the water that is released in the upper Peace River, in addition to what would traditionally gone in there, absent of this project, will go into the aquifer.

Mr. Weiss asked how the District would handle a permit application that proposed a recharge to offset impacts when the recharge was not in proximity to the withdrawal and the withdrawal was adjacent to one of the monitoring wells. Mr. Heath replied that we are proposing a means by which the levels in the wells could be "normalized" where overall trends are still positive.

Pat Lehman said if you were coming in for a permit and the model went from regulatory to monitoring – is the District going to run the model to see if the permit can be issued? Staff responded that the "cumulative assessment" model currently used would continue to be used. This is not the SWUCA-wide cumulative impact analysis model discussed today, but rather the existing permitting model used when cumulative impacts are suspected.

Mr. Heath noted that questions were received from Becky Ayech at the August Governing Board meeting, and staff indicated our response to these questions would be provided at this meeting. Her questions included:

How will results of Faulkner Farms be incorporated into the SWUCA rules? Mr. Heath stated Faulkner Farms was a cooperative effort that resulted in less groundwater being used. Any FARMS project such as this will be accounted for in the cumulative impact analysis. Will the District consider stopping saltwater intrusion? Mr. Heath responded stated yes, although the current effort is intended to slow the rate of saltwater intrusion, we would anticipate that once the currently proposed minimum level is achieved, a further reduction and potential stopping would be considered at that time.

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How as ASR handled? Water that is not recovered from ASR operations is included in the cumulative impact analysis model.
How often will the model be run? Staff responded that the model could be run as frequently as necessary. We are committing to report to the Board on the results of the model at least on an annual basis and every five years as a part of the regional water supply plan update.

Jeff Spence asked if the model just looks at the Floridan Aquifer or does it look at surface water also? Mr. Barcelo said it is a groundwater model. Jeff asked if the model looks at why the level of Lake Hancock has risen so much over the past year. Staff responded that the watershed has received significant rainfall in the recent past. An integrated surface water and ground water model is under development.

Mr. Weiss asked what will be in the rules regarding how the District will respond to wells impacted by saltwater intrusion, estimated at 5 mgd of current quantities? Staff responded that the District's programs that address this issue will be described in the Recovery Strategy document, which will be referenced in the rule.

Alan Pierce asked if there were a worst-case scenario where an existing legal user could come in for renewal and be told no – or could not be renewed at the current level? Mr. Heath said there is no rule change which would impact in that manner, however, there is a reasonable-beneficial factor, which every time a renewal comes forward, we reassess this use.

Mr. Heath noted the rule language is being updated to reflect the Senate Bill 444 language.

Commissioner Bullard asked if the cumulative impact analysis model would be a tool and not a part of the regulatory process? Mr. Heath said that is correct. You will see the cumulative impact analysis reflected in the Recovery Strategy portion of the rules (40D-80), but it is not a part of the permitting process. So there will be language, but it is not part of the regulatory side.

Commissioner English suggested the District should work with Polk County to dredge Lake Hancock to not only restore the lake, but to allow the dredge material to be used in conjunction with expansion of the adjacent Polk County landfill. District staff responded by committing to have appropriate staff, which were not in attendance, contact the Commissioner and Polk County staff to further discuss this suggestion.

III. Future Meeting Schedule

Mr. Owen said staff is in the process of updating the draft Recovery Strategy and rules and will distribute this information when it becomes available to garner further input from any interested parties. He noted that staff would also be glad to meet one-on-one with anyone interested. Mr. Owen said, at this point in time, this would be the last Work Group meeting, unless the members' feel is it important to continue meeting as a group. Bart Weiss noted there may be value to having a Work Group meeting after the revised rules have been distributed. Mr. Heath said there would still be an opportunity to provide input and it would be helpful to provide this input in writing in order for staff to provide feedback. Mr. Owen said this information would continue to be posted on the District's web site, and will include any comments/questions received and staff responses.

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IV. Public Comment

At this time, Mr. Gore was provided an opportunity to express his concerns regarding resource problems and solutions in the SWUCA.

V. Adjournment

Mr. Owen adjourned the meeting at 3:15 p.m.