Lake Panasoffkee Restoration Council

Report to the Legislature

November 25, 1998

LAKE PANASOFFKEE RESTORATION COUNCIL
REPORT TO THE LEGISLATURE
NOVEMBER 25, 1998

Council Members

John W. Springstead (Chairman)
Jim Wade (Vice-Chairman)
Billy Merritt (Secretary)
George L. Buhmeyer
William W. Davis
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EXECUTIVE SUMMARY

Freshwater fishing contributes more than $1.4 billion to the Florida economy, generating $37.4 million in taxes annually and 18,873 jobs. Lake Panasoffkee in Sumter County is an Outstanding Florida Water and the third largest of the approximately 1,800 lakes in west central Florida. Throughout the late eighteen hundreds and the first half of this century, the lake played an important role in the regional economy as a shipping port for timber, citrus and other regional goods. More recently, the lake serves as a vital recreational freshwater fishing resource, not only for the county but the entire region. With a national reputation, especially for its redear fishery, Lake Panasoffkee is a significant sport fishery resource and an important contributor to the local and regional economy. Fifteen percent of the anglers on Lake Panasoffkee come from out of state, and the majority of Florida residents who use the lake travel more than 25 miles to get there. However, while fishing remains popular at Panasoffkee, the lake's future as a significant recreational resource is threatened. The fisheries there have declined considerably over the last 30 to 40 years. In the mid-1950s, when the lake's fishery was first being studied, no less than 15 fish camps operated there. Today, only three remain.

Unlike many threatened Florida lakes, water quality is good at Lake Panasoffkee, thanks mostly to substantial groundwater flows into the lake from the Floridan aquifer. The threat to Lake Panasoffkee is the loss of desirable habitat for fisheries. Since the 1940s, almost 800 acres, or 22 percent of the lake's area, has been lost. Low water conditions can make the lake unnavigable. Ironically, the groundwater inflow which keeps the lake's water quality high is also the major contributor to the sedimentation which is filling in the lake. The groundwater carries large amounts of dissolved calcium carbonate. When the groundwater mixes with the lake water, the calcium carbonate solidifies, producing sediments which settle on the lake bottom, filling in fish spawning areas. These factors have combined to negatively affect the lake's fishery, promoting increased shoreline vegetation and tussock formations, which impact recreation and navigation.

Concerned for the health of Lake Panasoffkee, the Legislature passed Chapter 98-69, Laws of Florida, creating the Lake Panasoffkee Restoration Council (Council). The Legislature charged the Council with identifying strategies to restore the lake. Specifically, the Council is to look at sport fish population recovery strategies, shoreline restoration, sediment control and removal, exotic species management, floating tussock management and removal, navigation, water quality, and fisheries habitat improvement. The law also requires that the Council "report to the Legislature before November 25 of each year on the progress of the Lake Panasoffkee restoration plan and any recommendations for the next fiscal year." This report represents the plan and recommendations of the Council.

The Council has met every other week since June 15, 1998. Previous studies and reports done on Lake Panasoffkee, particularly related to lake water quality, sediment quality and quantity, and fisheries have been reviewed. Based on this review, presentations by agency experts, and the knowledge and life-long experience of members of the Council, the Council has determined that the following restoration goals should be addressed in priority order: fisheries habitat improvement, shoreline restoration, and improved navigation. Maintaining the overall good water quality within the lake and opportunities for cleaning up existing sources of pollution to the lake are high priorities of the Council and are a consideration in all recommendations.

Extensive buildup of inorganic sediments and the shallowing of the lake have destroyed fish spawning areas, and promoted woody/shrubby vegetation that has encroached markedly along the east-southeast shoreline and substantial bands of emergent vegetation in the lake. This plan proposes several steps to improve the fisheries habitat, restore the shoreline, and facilitate navigation. Six specific steps, formally adopted by the Council, have been identified and associated budgets developed (Table E-1). All of these steps involve a substantial element of sediment removal. Certain data needs are identified as well. Complete implementation of these steps will restore historic spawning areas, remove areas of dense emergent vegetation thus increasing submersed plant development and restoring the lake's shoreline, and create submersed and emergent vegetative zones in woody-shrubby areas. Total implementation of the plan will cost approximately $26,000,000. The six steps outlined in this report are numbered and presented in priority order.

Without any action, the sedimentation, or filling in, of Lake Panasoffkee will continue — The fisheries habitats will continue to be reduced, the lake will continue to get smaller, navigability problems will worsen, and the lake's environmental, aesthetic and economic benefits to the state and its residents will diminish. As the magnitude of the damage increases, so will the costs for restoring the lake.

This plan and its accompanying budget is consistent with the Legislature's commitment when it created the Council to find and implement solutions to the problems facing Lake Panasoffkee.

Table E-1. Restoration steps in priority order showing acerages, sediment volumes, and associated costs.

RESTORATION STEPS	Area Acres	% Lake Area	Sediment Volume Cubic Yards	Dredging Costs	Disposal Site Prep	Disposal Area Costs	Engineering Costs	Harvesting & Other Costs	Total Project Costs
Step One - Coleman Landing Pilot Project*			140,000	$277,600	$50,000		$22,400		$350,000
Step Two - Dredging to Hard Bottom	1010	30%	4,888,889	$4,988,889	$833,383	$270,000	$150,000		$6,242,272
Step Three - East Side Emergent Removal	784	23%	3,229,166	$3,329,166	$548,835	$270,000	$150,000	$291,000	$4,589,001
Step Four - Canals	34	0.30%	162,000						$0
Step Five - Woody/Shrubby	781	22%	1,231,481	$1,331,481	$403,326	$202,500	$150,000	$7,810,000	$9,897,307
Step Six - Dredge to 34' Contour**	2716	78%	3,600,000	$3,700,000	$598,344	$270,000	$150,000		$4,718,344
Totals				$13,627,136	$2,433,888	$1,012,500	$622,400	$8,101,000	$25,796,924

* The FGFWFC has budgeted $150,000 for this project
** Although dredging from the 34' contour would involve removal of 11.5 million cubic yards of sediment, considerable amounts of sediment are removed in Steps Two and Three

LAKE PANASOFFKEE RESTORATION COUNCIL

Enacting Legislation

During the 1998 Florida Legislative Session, Chapter 98-69, Laws of Florida was passed creating the Lake Panasoffkee Restoration Council within the Southwest Florida Water Management District (SWFWMD). The Legislature, through the Act required the following:

Representation

The Act required the establishment of the Lake Panasoffkee Restoration Council. The Council consists of seven voting members: two representatives of lakefront property owners, one environmental engineer, one person with training in biology, one person with training as an attorney, one person with training as an engineer, and one representative of the sport fishing industry. All members were appointed by the Sumter County Commission. In addition a Council Advisory Group to the Council was formed. The Advisory Group is composed of one representative each from the SWFWMD, the Florida Department of Environmental Protection (DEP), the Florida Department of Transportation (FDOT), the Florida Game and Fresh Water Fish Commission (FGFWFC), and the United States Army Corps of Engineers (ACOE) all with training in biology or other scientific discipline.

Table 1. Lake Panasoffkee Restoration Council Members and Advisory Group

Restoration Council Members

John W. Springstead (Chairman)	William W. Davis
Jim Wade (Vice-Chairman)	David C. Hanson
Billy Merritt (Secretary)	Jim W. Veal, Sr.
George L. Buhmeyer	

Advisory Group

Fred Birnie (FDOT)	Martin Kelly (SWFWMD)
Vern Gwin (ACOE)	Sam McKinney (FGFWFC)
Ken Huntington (DEP)	

Duties and Responsibilities

Chapter 98-69, Laws of Florida specifically charged the Lake Panasoffkee Restoration Council with the following responsibilities:

1. **Restoration Issues:** Review audits and all data specifically related to lake restoration techniques and sport fish population recovery strategies, including data and strategies for shoreline restoration, sediment control and removal, exotic species management, floating tussock management or removal, navigation, water quality, and fisheries habitat improvement, particularly as they may apply to Lake Panasoffkee;

2. **Evaluate Existing Studies:** Evaluate whether additional studies are needed;

3. **Funding:** Explore all possible sources of funding to conduct the restoration activities;

4. **Recommendations:** Advise the governing board of the SWFWMD regarding the best approach to restoring Lake Panasoffkee, and make recommendations as to which techniques should be part of the restoration program (the governing board of the SWFWMD shall respond in writing to the council if any recommendations from the council require re-evaluation. The response shall detail reasons for re-evaluation.); and

5. **Report to Legislature:** Report to the Legislature before November 25 of each year on the progress of the Lake Panasoffkee Restoration Plan and any recommendations for the next fiscal year.

A complete copy of the enacting legislation is provided in Appendix B and a brief chronological summary of all Council meetings to date is provided in Appendix C.

Conclusions

The Council established that of the seven restoration issues identified in the enacting legislation, its primary objectives in priority order are: fisheries habitat improvement, shoreline restoration, and navigation.

- **Fisheries:** Based on the studies reviewed, presentations by agency experts and the knowledge and life long experience of members of the Council, it was concluded that the primary cause of adverse impacts to the water resources of the lake was due to the accumulation of sediments causing a reduction in the fisheries habitat, shoreline degradation and impediments to navigation. Accumulated sediment had silted in hard bottom areas which served as fish bedding areas, and in other areas emergent vegetation had become extremely dense due to shallowing. In addition, the growth of vegetation has progressed to such an extent that almost 800 acres of

historic lake bottom are now covered with a mix of woody/shrubby vegetation. In order to reclaim these areas it was determined that substantial amounts of chiefly inorganic sediments would have to be removed form the lake bottom and that hydraulic dredging would likely be a major element of any restoration plan.

- **Water Quality:** Maintaining the overall good water quality within the lake and opportunities for cleaning up existing sources of pollution to the lake are high priorities of the Council and are a consideration in all recommendations. Concerns have been raised regarding the pollution potential of untreated stormwater draining from approximately two miles of Interstate Highway 75 that crosses Shady Brook at the south end of the lake. The Council proposes to investigate this issue further during the next reporting period.

- **Recreation and Boat Access:** Currently the only public boat access directly on the lake is on the eastern shore at Coleman Landing. However, due to sediment buildup and plant growth, it is un-navigable and unused by the public. The Florida Game and Fresh Water Fish Commission, prior to the convening of the Council, had begun work in support of a boater access improvement project at Coleman Landing on Lake Panasoffkee. By the mid 1970's boater use of the landing dwindled to zero. Low water levels, sedimentation and tussock growth made boat launching and passage through the basin and canal impossible. An additional hindrance to boaters and anglers is that the lake's shoreline has filled in with sediments allowing tussock growth to occur, essentially closing access to and from the boat ramp. To address public access, the FGFWFC submitted to DEP, by transmittal letter dated July 9, 1998, a *Joint Application for a Dredge and Fill Project at Coleman Landing.* "The goal of the Coleman Landing Boater Access Improvement Project will be to provide boaters and anglers public access." This effort is also designed to serve as a pilot project to provide insight into a number of questions certain to be raised if more extensive dredging activities are to be permitted. Since Lake Panasoffkee is designated an "Outstanding Florida Waterbody" (OFW), it is subject to more stringent permitting standards. The turbidity criteria for an OFW, for example, does not allow for any exceedance above background; this is certain to be an issue and a variance or mixing zone would be required to conduct any dredging activities. Due to the proposed design, the project will provide valuable information regarding recolonization of dredged areas by desirable submersed vegetation (e.g., eelgrass) and use of such areas by fish and macroinvertebrates. This information will be necessary to offer "reasonable assurances" regarding the likelihood of natural revegetation when dredging in currently vegetated zones. Issues regarding handling, compaction and dewatering of dredged material could be addressed by the project, and questions regarding water quality changes likely to occur in dredged areas and sloughing of dredged material could be answered. The FGFWFC has budgeted $150,000 for the project;

however, total project costs are estimated at $350,000. Assuming the FGFWFC will provide $150,000, an additional $200,000 is required to fund the project.

- **Additional Data Needs:** The Advisory Group identified particular data needs or gaps that must be filled to more accurately develop estimates of restoration costs, insure ecologically sound decision making, or to answer unresolved questions regarding the ecology of the lake. Specifically identified was the need for detailed bathymetric and vegetative maps and data on macroinvertebrates (a primary source of fish food) and fish abundance. The need and rationale for each is discussed briefly below.

  Bathymetric Map - To make accurate estimates of the amount of material to be removed, an updated bathymetric map (i.e., contour map of the lake bottom) of the lake is needed. Estimates of sediment volumes used to compute dredging and other costs presented in this report were based on a bathymetric map prepared by Greiner (1978). Their map was developed using data collected in 1955 and spot checked with soundings made in 1973. The lake's bottom contours have changed due to the accumulation of sediment that has occurred during the nearly twenty-five years that have elapsed since the bathymetric map was made. Although sediments accumulate at a relatively low rate in Lake Panasoffkee, neither the map prepared by Greiner (1978) nor the sediment thickness map prepared by Belanger et al. (1993) were constructed with sediment dredging in mind. Although sufficient for estimation purposes, bidding and budgeting of projects requiring sediment removal will require more accurate estimates of the volumes of sediment involved. It will also be necessary to know the depth of sediment overlying hard bottom. While this type of information was gathered by Belanger et al. (1993), coverage is not as detailed as needed, particularly for work proposed in Step Two.

  Vegetation Map - Lake Panasoffkee is a lake dominated by aquatic vegetation with the dominant submersed plants a mix of eelgrass, coontail and pondweed. Submersed plants cover 70-80% of the lake and extend upward in the water column often to the surface. While dense submersed plant populations can pose a navigation problem, particularly under low water level conditions, these plant beds maintain the generally good water clarity and quality characteristic of Lake Panasoffkee. It was recognized by the agencies represented on the Advisory Group and acknowledged by the Council that maintenance of desirable submersed vegetation is important for sustaining the ecological health and character of Lake Panasoffkee, and that dredging and other restoration techniques that might be employed should not cause submersed plant coverage to go below 60%. To insure that adequate submersed plant coverage is maintained an accurate vegetative map of the lake needs to be constructed so that equally accurate estimates can be made of areas likely to be impacted by dredging or other activities. In addition, revegetation will need to be monitored since expansion of restoration activities into

vegetated areas can occur while maintaining a minimum desirable coverage (>60%).

- ***Fish Food Survey:*** *Macroinvertebrate Diversity, Abundance and Distribution* - the Advisory Group has noted what appears to be a scarcity of macroinvertebrates (a group of animals without backbones that includes snails, clams and aquatic insects and worms) in lake sediments and on much of the submersed vegetation. It is possible that macroinvertebrate abundance should be low given the generally inorganic nature of the sediments and the fact that submersed vegetation is typically encrusted or covered with precipitated calcium carbonate. However, the lake is known or was known to produce a quality redear sunfish fishery. Redear sunfish are specially adapted to feeding on snails and mussels. It is also known that extensive deposits of unbroken snail shells can be found in certain areas of the lake and, in fact, serve as bedding areas for these sunfish. The occurrence of these snail shell deposits and the fact that these shells are unbroken are evidence that snail production was high in Lake Panasoffkee. Only cursory examinations have been made of the lake's macroinvertebrates; there is a need to quantify the abundance, diversity and distribution of macroinvertebrates in the lake since macroinvertebrates are a significant source of food for fish.

- ***Fish Community Survey:*** *Analysis of Fish Community Structure* - Although creel censuses have been conducted on the lake a number of times (a creel census is currently ongoing), such data do not give complete insight into fish populations in the lake, especially non-game species. Electrofishing does provide additional information; however, other techniques could provide more complete information relative to fish abundance (such as number of fish per surface acre). Unfortunately techniques such as block netting are not often nor routinely applied due to the considerable man power and other resources required. Given that much of the restoration effort is directed at fish habitat improvement and given the economic resources requested, it will be incumbent upon the agencies involved to demonstrate the expected improvement in the lake's sport fishery and overall fish community structure that result from the proposed restoration activities. It is expected that such data would include not only standing crop estimates (e.g., pounds per acre), but data on the age structure.

RECOMMENDATIONS

The Council, in consideration of the recommendations of its Advisory Group voted at its October 12, 1998 to include in this 1998 report to the Legislature the following recommendations and requests.

1. Design and seek regulatory approval for removal of sediments following a systematic six step approach to insure maximum benefit to the restoration of the lake while insuring all necessary environmental safeguards are implemented.

Step One - Pilot Project: Request funding from the Legislature for the completion of the Coleman Landing Boater Access Improvement Project. Initiate the dredging upon receipt of funding in order to provide public boat access and to provide necessary technical information vital to the proposed large scale dredging. Cost: $200,000.

Step Two - Dredge to Hard Bottom from the 35-foot contour: The historic prime fish bedding areas in Lake Panasoffkee are known to have existed in areas around Grassy Point and Shell Point located on the lakes northeast side (see Figure 1). Extensive deposits of snail shells occur throughout this area, and sport fish, particularly redear ("shell cracker") and other sunfish ("bream"), are known to have spawned there. Hard bottom can be reached with the least sediment removal in the Grassy / Shell Point areas and in a narrow band bordering much of the western shoreline. It is documented that in areas where accumulated sediment deposits are five feet or less, the lakeward most edge of the area could be fairly well defined by the 35-foot contour. For this reason, it is proposed that many historical bedding areas could be restored by dredging in two areas from the 35-foot contour

Figure 1. Step Two - Dredge to Hard Bottom from 35' Contour - entails dredging on east side of lake in vicinity of Shell and Grassy Points, along most of western shoreline. Although sediment deposits are deep, the north end is dredged to prevent material from this area being transported into hard bottom areas.

towards shore while removing sufficient material to expose the hard bottom (e.g., shell deposits, sand, etc.). These areas are shown in Figure 1. It was also recognized that there are substantial sediment deposits (i.e., >20 feet deep) in the north end of the lake, that two major inflows, Little Jones and Big Jones Creeks, enter the lake in this area, and that it is highly likely that sediments in this area would be carried into the two cleared spawning zones if not lowered to the 35-foot contour as well. For this reason, it is recommended that sediments in this area be dredged even though hard bottom would not be reached. It should be noted that very little submersed vegetation occurs in this area, that fish usage appears low perhaps due to lack of cover, and that there is probably more organic sediment deposited here than in most areas of the lake.

To accomplish Step Two, it is estimated that as much as 4.9 million cubic yards of sediment will have to be removed and that approximately 1,010 acres (30%) of the lake bottom will be affected. The actual cubic yards of material to be removed should be less; however, the actual depth of sediment covering hard bottom is not accurately known. More accurate estimates can be made once a detailed bathymetric map is made. Cost $6,242,000.

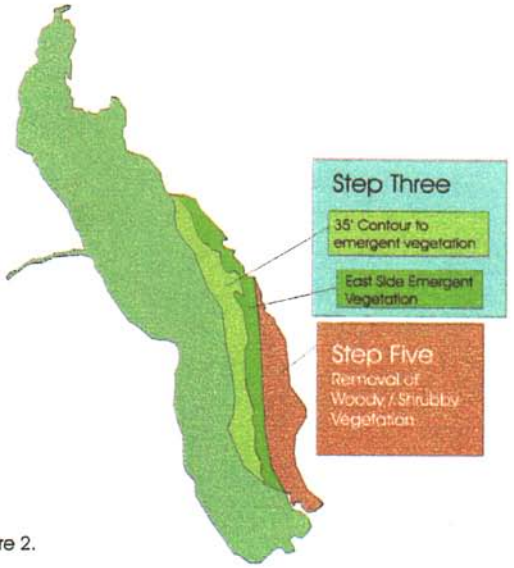

Figure 2.

Step Three - Removal of East side emergent vegetation and sediments from the 35' Contour.

Step Five - Removal of woody/shrubby vegetation and associated sediments.

Step Three - East Side Emergent Removal - Tied to 35-foot Contour: There is a broad band of emergent vegetation along the eastern shoreline of Lake Panasoffkee that runs from just south of Shell Point to the southern end of the lake (see Figure 2). This band of emergent vegetation is composed largely of pickerelweed, cattail and arrowhead. Although much of the vegetation is rooted to the lake bottom, a substantial amount could be classified as tussocks and much of the tussock problem on the lake is generated by this band of vegetation. The band is over 1,000 feet wide in some sections and is so dense and impenetrable that much of it does not provide productive fish habitat. Removal of this vegetation would improve fish habitat, restore much of the eastern shoreline and improve navigation. Dredging to a depth of two to three feet will open the area to fish and encourage the growth of submersed vegetation while discouraging emergents. It is proposed that sediment be dredged from the 35-foot contour toward the shore, and the area be sloped or stepped so that a narrow emergent zone is preserved. The entire project area is almost 800 acres, and this step would remove upwards of 3.2 million cubic yards of sediment and open up approximately 388 acres for possible colonization by submersed plants. Cost $4,589,000.

It should be noted that land bordering the entire eastern shoreline of Lake Panasoffkee is in public ownership, and the proposed dredging will enhance public access to the lake's resources. Defined as the East Lake Panasoffkee property, approximately 9,950 acres were purchased through the Save Our Rivers program. The majority of the property consists of floodplain swamp, and most of the property remains in a relatively natural, unaltered condition. Public ownership of the property will contribute directly to the long-term protection and management of the lake (SWFWMD 1996).

Step Four - Canals: The Council recognizes that should Step Two be implemented, dredging will occur in close proximity to the many existing residential canals on the lake's western shoreline. In trying to provide navigation from the canals to the lake, and realizing that dredging can be costly and that a substantial portion of the costs can be associated with sediment disposal and mobilization of equipment, the Council proposes to make project disposal areas available to residents at no cost should they choose to retain the services of the dredger. There are 37 residential canals on Lake Panasoffkee with a total surface area of approximately 34 acres. Assuming maintenance dredging would require removal of approximately three feet of sediment depth from each canal, it is estimated that there are 160,000 cubic yards of sediment in these canals. This represents a minimal amount of capacity in any disposal site prepared to handle material for Step Two. Any group living on a residential canal that would be willing to independently fund dredging in their canal and retain the services of the dredger could take advantage of the project disposal area and equipment in place (e.g., piping) provided that project implementation is not unreasonably delayed. Cost $0.

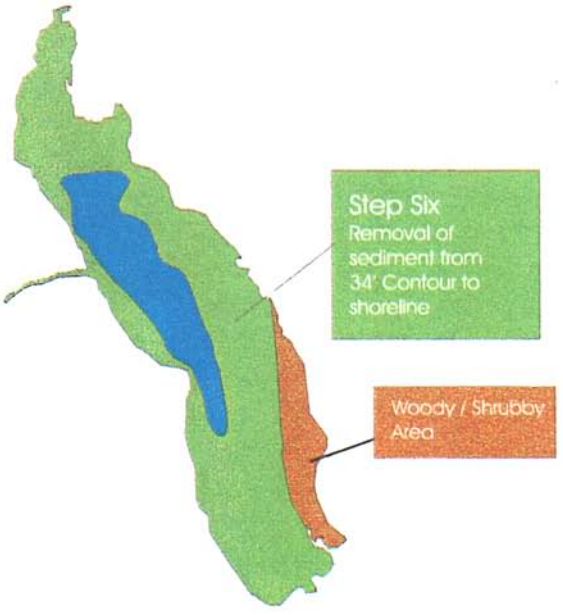

Figure 3. Step Six - Removal of sediment from 34' contour to shoreline (38.5' contour), does not include woody / shrubby area.

Step Five - Woody / Shrubby Vegetation Encroachment: Inspection of aerial photography of Lake Panasoffkee clearly indicates a historic shoreline on the lake's east side that roughly coincides with the 40-foot contour; however, it has been documented that the area between the 40- and 38.5-foot contours has been taken over by extensive stands of primrose willow, willow, button bush and other successional species. It is currently estimated that approximately 780 acres of lake area (refer to Figure 3) have been lost by this encroachment; valuable lake habitat has

yielded to fairly rapid succession. Reclamation of this area would increase the surface area of the lake by 22%. Given current regulations regarding wetlands and the OFW status of Lake Panasoffkee, reclamation of this area will present some challenges. The cost associated with dredging and disposal is high, and the Council is continuing to explore different restoration options including in-lake disposal and creation of in-lake "habitat islands". Cost $9,897,000.

Step Six - Dredging from 34-foot Contour: Dredging of the lake bottom from the 34-foot contour shoreward would deepen approximately 78% of the lake by another foot and essentially prolong the life of Lake Panasoffkee by at least 100 years (Figure 3). It should be appreciated that this option would affect most of the lake bottom and a considerable amount of submersed vegetation. Implementation of this step would remove at least 4,000,000 cubic yards of sediment in addition to that proposed in Step Two and Step Three. A demonstrated ability of desirable submersed plants to adequately recolonize dredged zones is a prerequisite for implementation of this step. Cost $4,718,000.

- Bathymetric work - estimated cost $25,000
- Vegetation map - estimated cost $25,000

Summary:

It is estimated that full implementation of the six steps and additional information needs outlined above will cost approximately $26,000,000. The estimated sediment volumes and associated sediment removal costs, disposal areas costs, engineering costs and total costs associated with each step are presented in Table 1. More exact estimates of sediment removal volumes can be made once an updated bathymetric map is constructed, then cost estimates will be adjusted accordingly.

Table 1. Restoration steps in priority order showing acerages, sediment volumes, and associated costs.

RESTORATION STEPS	Area Acres	% Lake Area	Sediment Volume Cubic Yards	Dredging Costs	Disposal Site Prep	Disposal Area Costs	Engineering Costs	Harvesting & Other Costs	Total Project Costs
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APPENDIX A

LAKE PANASOFFKEE - BACKGROUND INFORMATION / TECHNICAL ASSESSMENTS

To fully appreciate the restoration activities proposed by the LPRC some understanding of the resource is needed. This section considers much of the technical work that has been done on Lake Panasoffkee. Subjects covered include the lake's physical setting and characteristics, fishery resource, plant communities, sediment characteristics, and water quality. Although considered in some detail, much more information is contained in the technical reports referenced. These reports are available from the Southwest Florida Water Management District.

Background Information

Lake Panasoffkee is the largest lake in Sumter County, with a surface water area of approximately 4,820 acres, or 7.5 square miles (mi2) (Figure A-1). The lake is shallow with extensive communities of submersed and emergent aquatic plants. Most of the watershed and shoreline are undeveloped or rural; however, a series of residential canals exists along the west side of the lake. The major source of water to the lake is groundwater discharge and spring flow with surface water contributions from Shady Brook (also called Panasoffkee Creek), Little Jones Creek, and Big Jones Creek. The Outlet River, on the lake's west side, connects Lake Panasoffkee to the Withlacoochee River and is the lake's only surface discharge. Lake Panasoffkee has an elongated basin oriented north to south. It is six miles long and 1.5 miles wide with an average depth of seven feet and a maximum depth of ten feet at a stage of 40.95 feet (Taylor 1977). The western shore has a distinct boundary, dotted with residences and some fish camps. The eastern shore transitions from open lake surface to a shallow forested swamp and remains undeveloped.

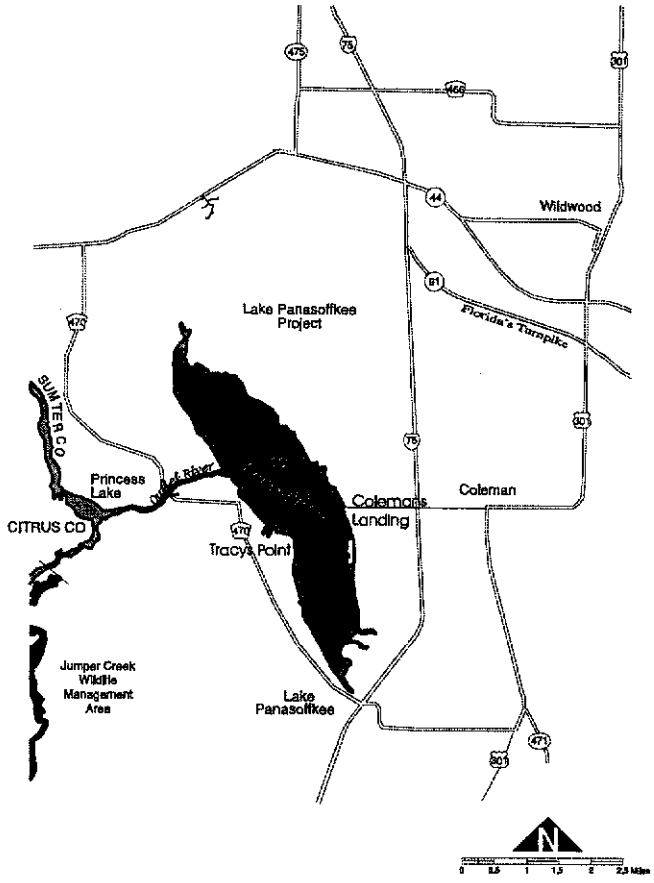

Figure A-1. Location map of Lake Panasoffkee.

A rock spillway was located in the Outlet River at the exit from Lake Panasoffkee, but no historical records of its purpose or date of construction exist. Greiner (1978) estimated that it dated from the 1830s to 1880s based on trends in regional economy, and that it was intended as a navigational improvement. A SWFWMD staff archaeologist concluded that the spillway was constructed about 1884 to maintain a permanent channel between the Withlacoochee River and Lake Panasoffkee, in conjunction with other navigational improvements implemented by the Florida Orange Canal and Transit Company (Wharton 1982).

Fisheries Data

Sport fishing is the primary recreational use of Lake Panasoffkee. It was recognized nationally as one of Florida's most productive fishing lakes for redear sunfish, and it also supported a good bass and bluegill fishery. The Florida Game and Freshwater Fish Commission (FGFWFC) has studied Lake Panasoffkee's fishery resource since the 1950s (Moody 1955, 1957), and the lake was designated a Florida Fish Management Area in 1963. Declines in fish populations were reported as early as the 1950s. Residential development had just begun along the western shoreline, and 15 fishing camps were in existence (Moody 1957). By 1978, there were over 200 residences along the lake and five fish camps in operation (Greiner 1978).

The earliest recorded creel census was conducted over 18 months during 1954 and 1955 and included interviews with 6,000 fishermen (Moody 1957). The survey results showed a total of 18,000 gamefish were caught in 13,000 hours of fishing. In 1967, the fish populations and water quality were considered excellent; however, concern was expressed for the increasing amount of aquatic vegetation, and by 1972, the FGFWFC (1972) suggested that the vegetation and muck in the lake's shallow areas needed corrective action. A study of the effects of natural water fluctuations on aquatic vegetation and fisheries was performed by the FGFWFC between October 1973 and March 1975 (FGFWFC 1975). The Wysong Dam (an inflatable dam located on the Withlacoochee River downstream of Lake Panasoffkee) was lowered at their request so the study could be performed. A creel census was taken between March and May 1973, and an excellent gamefish harvest was reported. The number of fish caught per hour per angler was high for the state as well as for the nation. Redear sunfish showed the highest catch per unit effort followed by bream. The FGFWFC recommended that the dam should continue to be lowered to allow the greatest extent of natural fluctuation, retardation of hydrilla growth, growth of desirable vegetation, and an increase the game fish population. The FGFWFC (1975) noted that a "gradual decline in total fish populations appeared to be directly related to steady recession in water level."

A documented fish kill occurred in Lake Panasoffkee in July, 1974. The FGFWFC (McKinney 1975) noted that multiple months of dry weather dropped water levels below 40 feet M.S.L. (minimum desirable lake stage). Then, heavy rains during July, 1974, raised the lake level two feet in 14 days. Tannin-stained flow from adjacent swamps turned the lake coffee-colored. Shortly after, dissolved oxygen levels dropped sharply. Prolonged cloudy weather and high color reduced light penetration and photosynthetic activity in the submersed vegetation. The combination of reduced photosynthetic oxygen production, a die-back of aquatic plants, and increased biochemical oxygen demand depressed dissolved oxygen levels in the lake and caused a fish kill. A significant amount of submersed vegetation was lost, and the lake became phytoplankton dominated. Macrophytes gradually recolonized the lake bottom, and by 1978 the lake was once again macrophyte dominated.

The FGFWFC's most recent creel survey (FGFWFC 1993) was conducted during six, two-week periods from March 11 - June 2, 1991, and March 2 - May 24, 1992. The goals of the study were to evaluate the recreational fishery, document additional recreational use of Lake Panasoffkee, and to compare the findings with historical information. A diversity of fish were present in Lake Panasoffkee, but this study concentrated on the three major species: largemouth bass, redear sunfish and bluegill. There was approximately the same amount of effort directed toward catching largemouth bass in 1991 as 1992, but the catch per unit effort (CPUE) and the harvest per unit effort (HPUE) increased in 1992. The survey years showed a trend of increasing harvest of bass (36%) over the survey period. Similarly, the redear sunfish catch and harvest rose in 1992 by 75% and 81%, respectively, from 1991, and CPUE and HPUE nearly doubled. This was supported by electrofishing data. On the other hand, declines in bluegill harvest (62%) and HPUE (29%) were recorded from 1991 to 1992, and declines were supported by electrofishing data.

Creel surveys from 1974 and 1977 were compared with surveys from 1991 and 1992. As with the later surveys, the 1974 and 1977 surveys were performed over a twelve week period. Factors affecting fishery comparisons include spring weather patterns, water levels, extent of vegetative coverage, and year class strength of target species. One of the stated goals of 1991/92 surveys was to document additional recreational use of the lake; however, other recreational users besides fishermen numbered so few in 1991 that this element of the survey was discontinued for 1992. Eight percent of the users on Lake Panasoffkee in 1991 were pleasure boating and not observed fishing during the four hour sample time. No other recreational users were observed. The charts below show some historical data by fish species for effort in hours, harvest per unit effort, and harvest. Harvest is defined as all fish retained at the completion of a fishing trip.

Table A-1. A comparison of creel survey results for several years.

	1974	1977	1991	1992
Largemouth Bass				
Effort (hours)	10265	19704	15146	14951
HPUE	0.38	0.41	0.09	0.17
Harvest	3198	8799	2105	2868
Redear				
Effort (hours)	14936	22547	13909	14904
HPUE	2.71	0.98	0.73	1.43
Harvest	38011	26263	13154	23793
Bluegill				
Effort (hours)	2824	3529	9148	5762
HPUE	1.88	1.60	0.62	0.44
Harvest	6383	5070	9977	3832

Overall, harvest estimates for largemouth bass, redear sunfish, and bluegill fishery have declined between the 1974/1977 survey and the 1991/1992 survey.

Aquatic Vegetation

Two types of vegetation have been of concern to lake managers and residents: hydrilla and tussocks. Hydrilla (*Hydrilla verticillata*), an exotic that frequently obstructs navigation in Florida lakes, is a submersed macrophyte that was introduced in Florida during the early 1950's. It is now the most severe aquatic weed problem in the southern United States and is rapidly expanding its range. Islands or mats of marsh plants, called tussocks, have been found floating in the lake for decades as reported by the FGFWFC (1974). They are typically vegetated by pickerelweed (*Pontederia cordata*), arrowhead (*Sagittaria graminea*), cattail (*Typha* sp.), pennywort (*Hydrocotyle umbellata*) and primrose willow (*Ludwigia octovalis*).

The lake contains submersed plants as well as emergent marshes and floating islands of vegetation (i.e., tussocks). Submersed vegetation has historically been dominated by eelgrass (*Vallisneria americana*), with smaller areas of coontail (*Ceratophyllum demersum*), southern naiad (*Najas guadalupensis*), parrot feather (*Myriophyllum aquaticum*), and pondweed (*Potamogeton illinoensis*).

The species composition and distribution of aquatic plants in Lake Panasoffkee has varied in response to man-made changes and natural influences (natural water level fluctuations). The first vegetative communities map was made in March 1973 and showed eelgrass (at 3-7 foot depths) to be the dominant species (57%) followed by coontail (less than 3 foot depths) and pondweed. A March 1974 vegetation map, once again, showed eelgrass, coontail and pondweed as the dominant species with increases from 47% to 342% of pure stands to combinations of species. Another map was produced for March 1975. After subsequent heavy rains in July 1974, there was a major die-back of aquatic plants which reduced the total acreage of vegetative cover from 3184 acres in 1974 to 320 acres in 1975. The percent vegetative coverage of the lake was recorded at 57% in 1973, rose to 71% in 1974 and dropped to 7% in 1975 (FGFWFC 1975). Perhaps the most dramatic change in recent years was the reduction in total coverage by aquatic plants that preceded the fish kill in July 1974. Aquatic plant coverage remained sparse through 1978, but by 1980, eelgrass was once again the dominant species.

Aquatic plant management in the Withlacoochee area has been directed largely at the control of exotic species, specifically water hyacinth, water lettuce, and hydrilla. Management of these invasive species has been for purposes of access and navigation of water bodies such as Lake Panasoffkee. The responsibility for aquatic plant management in the state rests with FDEP. Specific jurisdictional areas have been delegated to the water management districts due to manpower limitations and, Lake

Panasoffkee is one of them. The majority of aquatic plant management effort targets exotic species. Some limited tussock removal has been done when navigation channels were blocked.

Extensive communities of submersed aquatic plants in the lake provide the habitat conditions needed by gamefish populations, although the plants also restrict access to large areas of the lake during periods of low lake levels. In addition to sportfish, the lake and its relatively undeveloped shoreline support a diversity of birds, amphibians, reptiles, and mammals.

Lake Sediments

In 1957, Lake Panasoffkee sediments were reported to consist predominantly of "deep, fine yellowish inorganic silt underlain by sand, blue clay and limestone" (Moody 1957). Deep black organic muck was found over sand, silt and soft limerock near the lake shore. There is concern that the lake is becoming increasingly shallow. It had been suggested that this could be due to sediment accumulation and that this is the principal ecological problem of the lake (Greiner 1978).

Greiner, Inc. (1978) stated that lake sediments consisted principally of precipitated limestone rather than organic deposits. This report also concluded that lake depths in the south end of the lake had been decreased by sediments eroding off of uplands and carried to the lake by Shady Brook. Brenner and Binford (1988) sampled mid-lake sediments in Lake Panasoffkee and found that surface sediments had the highest carbonate content out of 97 Floridan lakes sampled which indicates that the sediments are largely inorganic; however, these were mid-lake readings, and no samples were taken from the shallower near-shore areas.

A SWIM-funded project, performed by the Florida Institute of Technology (Belanger et al. 1993), investigated sediment composition and distribution in Lake Panasoffkee. FIT determined that sediments in Lake Panasoffkee contain much more inorganic carbonate matter (72.3 %) than organic matter (17.4 %). The study focused on the possible causes of the increasing shallowness, the sources of sediment, and the extent of manmade versus natural lake degradation. Sediments were mapped by depth-to-hardpan and analyzed according to physical and chemical characteristics. FIT employed PB-210 dating, organic matter "biomarker" and paleolimnology analysis to assist the investigation.

Paleolimnological analysis was performed based on diatom identifications and trophic state index (TSI) reconstruction techniques. Based on their analysis of sediment cores, FIT concluded that very few changes have taken place in and around the lake since 1855 (Belanger 1993). In fact, analysis suggests that the trophic state of the lake was once eutrophic during this period and has moved toward a mesotrophic state since about 1970.

Patches of plant growth correspond to the various pH readings; the highest pH values, which further accelerate the formation of a calcium carbonate precipitate, were found in areas of dense vegetation. Removal of carbon dioxide due to dense macrophyte growth and photosynthesis causes precipitation of calcium carbonate ($CaCO_3$). The precipitate on eelgrass was found to be 61% carbonate and 32% organic. The eelgrass plant itself exhibited a carbonate content of 17%.

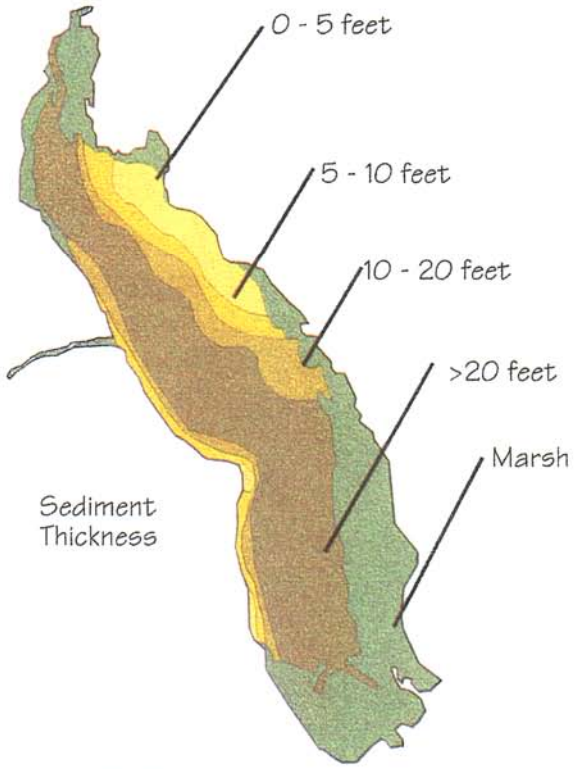

Figure A-2. Sediment thickness map after Belanger et al. 1993.

The sediment mapping effort revealed sediment depths greater than 20 feet over 75% of the lake bottom (Figure A-2). Despite deep sediment deposits, PB-210 dating (a dating method that is based on the measurement of the radioactive decay of an isotope of lead) results indicate that sedimentation rates have historically been low: 0.04 to 0.06 grams dry weight per cm2 per year (approximately equivalent to 0.06 to 0.09 inches per year). Sediments accumulate approximately 1 inch in 12 to 13 years. The rate decreases by depth exponentially over time with a 20 foot accumulation taking at least 2,880 years.

Watershed and Hydrology

The United States Geological Service (USGS) estimates Lake Panasoffkee's drainage basin to be approximately 420 square miles forming a large portion of the Withlacoochee River basin east of the Withlacoochee River (Taylor 1977). Much of this watershed drains to localized depressions that exist due to the karst geology of the region. As a result, only 62.2 square miles (39,800 acres) drain directly to the lake. The Lake Panasoffkee drainage basin makes up 27.5 % of the Withlacoochee River watershed. However, the volume of flow contributed by the lake to the river can account for 50% to 70% of the river's dry-season flow. Recorded average daily discharge from the lake to the river has ranged from 99 cfs (64 mgd) in 1992 to 288 cfs (186 mgd) in 1973.

Two aquifers lie in connection with Lake Panasoffkee; the water table which exists in the unconsolidated sediments, and the upper part of the Floridan found in the deeper limestone layer. The water table is recharged by rainfall. Losses from the lake occur mostly through outflow, evaporation, some through downward leakage into the artesian aquifer, and minor amounts through pumpage. The Floridan aquifer is recharged via water table leakage, sinkholes, and small discharges from the Green Swamp. Several springs and sinkholes are found in the vicinity of the lake and its tributaries that probably resulted from solution cavities formed along limestone fractures.

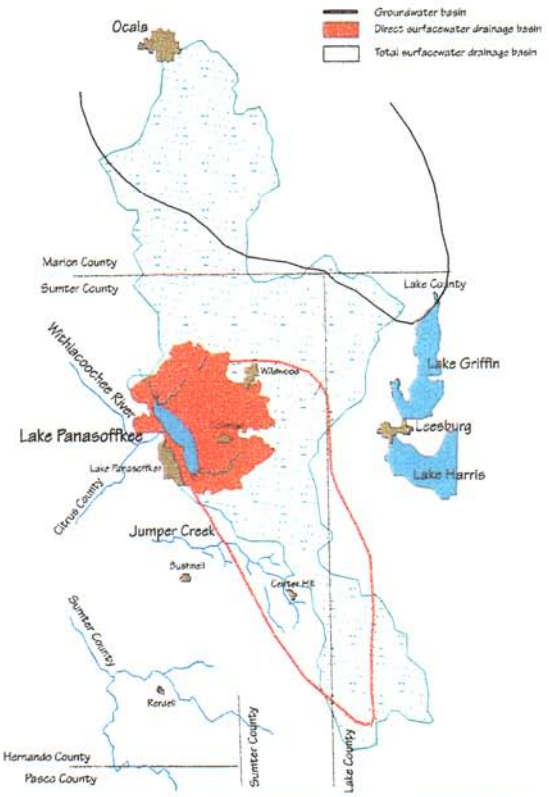

Figure A-3. Groundwater basin and watershed delineations for Lake Panasoffkee.

Figure A-3 shows the groundwater basin boundaries for the lake as compared to the surface water boundaries. The contributing groundwater basin area is approximately 300 square miles and flows in a northwesterly direction from the Green Swamp to Lake Panasoffkee. Since there is a hydraulic connection between the lake and the aquifer, water level changes in the Floridan Aquifer will directly affect water levels in the lake. Rainfall is the only recharge source to the lake's ground water supply so the amount and timing of rainfall greatly impacts the ground water table. Since rainfall patterns are erratic, the amount of rainfall on a basin can vary between points; however, in an average year, this basin receives 55 inches of rainfall and loses 48 inches through evaporation (Heath and Conover 1981) leaving an average annual surplus of seven inches.

Water Budget

Direct surface water inputs to Lake Panasoffkee include Little Jones Creek, Big Jones Creek, Shady Brook, and small ungaged streams. The subbasins associated with direct inflows to Lake Panasoffkee represent about 13,900 acres, which is 35 percent of the total contributing drainage basin. Therefore, approximately 65 percent of the 39,800 acre (62.2 mi2) watershed contributes flow to Lake Panasoffkee as sheetflow or via small ungaged

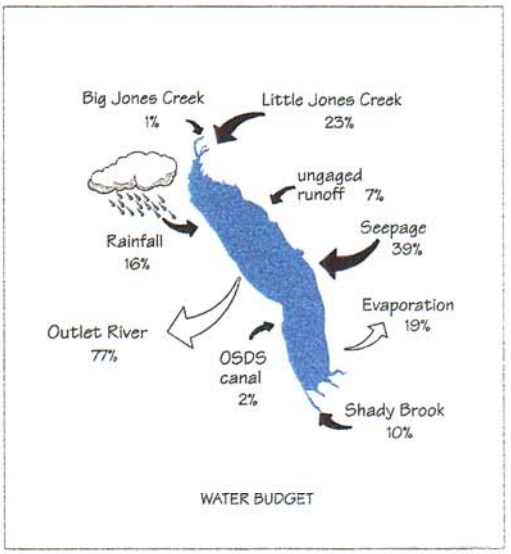

Figure A-4a. Water budget for Lake Panasoffkee.

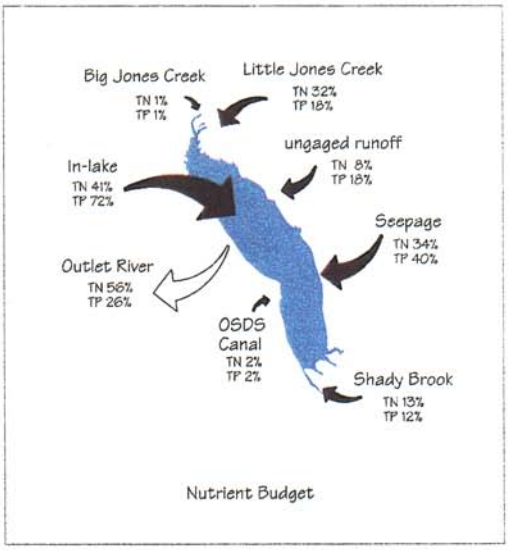

Figure A-4b. Nutrient budget for Lake Panasoffkee.

streams (CH2MHill 1995). The single output is the Outlet River, historically known as Spring Run. The Outlet River is a two mile run and joins Lake Panasoffkee to the Withlacoochee River at Princess Lake.

A water budget is the difference between flow inputs to and outputs from the lake, and that difference determines whether the lake level increases or decreases; Inputs - Outputs = Change in Storage. The input and output sources are shown in Table A-2. Input and output amounts will vary according to the rainfall amount for a given period; however, the water budget should represent relative conditions in the lake and its watershed. To illustrate, data provided by USGS indicated the 9-year average flow in Shady Brook (1982-1991) was 41.8 cfs. The 1992-1993 average of 13.2 cfs represented about 32 percent of the long-term average value which is indicative of the five year drought period that began in 1988. The annual average outflow from the Outlet River during 1992-1993 represented about 52 percent of the long-term average flow and the annual total rainfall was approximately 13 inches less than the long-term average annual rainfall with evaporation exceeding rainfall. With regards to the distribution of water sources, (Table A-2), groundwater accounted for 39 percent of the annual water input to the lake, rainfall on the lake surface contributed 16 percent, and surface runoff was 45 percent (although a good percentage of surface runoff is attributable to spring flow into the stream channels). Little Jones Creek contributes the highest gaged flow to Lake Panasoffkee (CH2MHill1995).

Water Quality

The water quality of Lake Panasoffkee is considered good; this is attributed largely to dense stands of desirable aquatic plants and a large ground water contribution. However, potential and suspected sources of water quality degradation exist. These are related to land use activities, since the ground water system is vulnerable to the transmission of

contaminants due to the unconfinement of the aquifer and surface water systems collect and convey non-point source pollutants. Fortunately, the threat of contamination has been reduced through large land purchases within the basin by the Save Our Rivers program and Preservation 2000.

The SWFWMD, through the Save Our Rivers (SOR) program and Preservation 2000, acquires lands necessary for water management, water supply, and the conservation and protection of water resources. The purchases are made through the Water Management Lands Trust Fund. About 952 acres of the Eastlake Panasoffkee tract which includes the Berry Tract was acquired by the end of 1990 and 9,553 acres, the Panasoffkee Project, along the eastern shore of Lake Panasoffkee by 1995. These sites consist of relatively undisturbed lands with mixed wetlands and uplands. The project will protect local and regional drainage features such as the two spring-fed creeks. Storage and detention of surface waters will be provided as well as important wildlife habitat. Almost the entire northern end and eastern shore of Lake Panasoffkee which accounts for 25 percent of the drainage basin of Lake Panasoffkee is now protected from development. This action alone eliminates a large area from potential water quality degradation and natural systems destruction.

The Florida Department of Environmental Protection classifies surface water bodies according to designated use. Lake Panasoffkee is a Class III surface water body, and Class III designated use is recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife. Class III waters must also meet general water quality criteria (FAC 17-302.510) and specific criteria (FAC 17-302.560). Historically, no chronic exceedances of applicable water quality standards have been documented in Lake Panasoffkee.

Water quality samples taken from May 1992 to April 1993 (CH2MHill 1995) were used to assess the current water quality of the lake and to determine whether man induced degradation of water quality was occurring. The annual water and nutrient budgets indicate that the relative importance of inputs is generally the same for water, nitrogen and phosphorus (Table A-1). Seepage (i.e., groundwater) contributed the largest volume of water (39 percent), and greatest nitrogen (34 percent), and phosphorus (40 percent) loads to the lake, followed by Little Jones Creek, which accounted for 23 percent of water inputs and 32 and 18 percent respectively for nitrogen and phosphorus. The Outlet River was the major output of water from the lake, 77 percent, but only 56 percent of nitrogen inputs and 26 percent of phosphorus were lost through the Outlet River. In-lake processes result in retention of about 41 percent of the nitrogen and 72 percent of the phosphorus input loads within Lake Panasoffkee.

During 1992-93, dissolved oxygen levels fell below the 5 milligram per liter (mg/l) standard at the north end and at the west side of the lake; however, this appears to be due to natural causes and has not been severe enough to cause problems to fish or other aquatic life.

One recorded period of low dissolved oxygen that resulted in a fish kill following a large die-off of aquatic plants in the lake occurred in July 1974 after a major rainfall event (McKinney 1975). Elevated pH levels in the lake have been recorded both historically and during the 1992-1993 study, but no adverse effects related to high pH values have been documented. Elevated pH levels are most likely attributable to high rates of photosynthesis (by the extensive macrophyte beds with associated periphytic algae) that remove carbon dioxide from the water.

Copper was the only metal concentration that exceeded Class III water quality criteria. Exceedances were only found for Shady Brook water samples. These concentrations of 0.10 mg/L and 0.22 mg/L exceeded the Class III standard of 0.0065 mg/L. The copper source is in question and may indicate a need for further investigation.

There are two major sources of historic water quality data for Lake Panasoffkee. Bays and Crisman (1981) conducted a baseline study from 1979 to 1981 to monitor various chemical, biological and physical parameters at six stations in and around the lake. Three USGS stations in or near Lake Panasoffkee have been monitored at irregular frequencies. These USGS stations correspond roughly to stations used in the Bays and Crisman (1981) study. Selected water quality data collected in 1979-1981 (Bays and Crisman 1981) were compared with results of the 1992-1993 sampling program for stations sampled in the same location during both periods. Comparisons were made of trophic state parameters such as TN, TP and chlorophyll *a* to determine if any apparent adverse long-term changes in water quality occurred. Special emphasis was placed upon a comparative analysis of nitrate-nitrite data given recent concern over increasing concentrations of this parameter in springs within the region (CH2MHill 1995).

Total phosphorus (TP) has not changed measurably in Lake Panasoffkee or its tributaries since 1980, but mean TP shows a significant decrease at the Outlet River station. Annual mean total nitrogen (TN) in the lake was not significantly different between 1992 and 1980, but mean TN had significantly decreased in Big Jones Creek and the Outlet River from the 1980 sampling to the 1992 sampling event. Similarly, TKN in Big Jones Creek, the Outlet River, the residential canal showed a significant decrease between 1992 and 1980.

Trophic State

Lakes can be classified according to many attributes, including physical, chemical, and biological characteristics. The most frequently used classification scheme for lakes is based on their degree of nutrient enrichment (i.e., trophic state); and the most widely used trophic state classification system is a modification of the Trophic State Index (TSI) proposed by Carlson (1977) as modified by Huber et al. (1982). The TSI can be calculated on the basis of chlorophyll *a* concentration, Secchi disk transparency, or limiting nutrient concentrations. The limiting nutrient is determined from the TN to TP ratio. Trophic State

classification generally used for Florida lakes begins with a determination of the ratio of TN to TP(Huber et al.). This ratio indicates whether the water body is potentially nitrogen-limited, phosphorus-limited, or nutrient-balanced. Bays and Crisman (1981) found a TN/TP ratio of 24 for Lake Panasoffkee, while 1990 USGS data yielded a value of 27. The TN/TP ratio based upon the CH2MHill study (1995) is 18.8. All three values indicate Lake Panasoffkee is nutrient-balanced, meaning that the lake will respond to increases in either nitrogen or phosphorus.

The 1991-1992 water quality data yield a TSI of 47 which places Lake Panasoffkee in the mesotrophic category. This value is essentially the same calculated by Bays and Crisman (1981), 46, and from the USGS data taken from 1977 to 1990, 45. The TSI value for Lake Panasoffkee was found to be average compared to other lakes included in a statewide study by Huber et al., 1982 (as cited by CH2MHill 1995). Since Lake Panasoffkee is a macrophyte dominated lake, the TSI value may be understated.

Nitrate-nitrogen concentrations have measurably increased in springs in west-central Florida within the past two decades. A similar increase in nitrate concentration in tributary springs to Lake Panasoffkee could be a concern to overall lake trophic state, given that the predominant hydrologic input to the lake is through groundwater seepage and spring discharge. Groundwater monitoring wells were sampled during the 1991-1992 study to determine whether nutrient loading is a problem. Groundwater appears to contribute about 34 percent of the annual total phosphorus input to the lake, and 40 percent of total nitrogen input. Nitrate-nitrite nitrogen increased significantly from 0.15 mg/L in 1980 at Big Jones Creek to 0.33 mg/L in 1992. Similarly, nitrate-nitrite increased significantly at Little Jones Creek from 0.37 mg/L in 1980 to 0.83 mg/l in 1992. Nitrate-nitrite nitrogen in a residential canal also increased to 0.71 mg/L in 1992 from 0.28 mg/L in 1980. Nitrate-nitrite nitrogen in the Outlet River was lower in 1992 (0.02 mg/L) than in 1980 (0.08 mg/L). The extremely low nitrate-nitrate concentrations within the lake, and in the Outlet River indicate that incremental increases of nitrogen inflows are completely assimilated by the lake ecosystem. This uptake is probably occurring within the macrophyte beds and their encrusting algae. The periodic measurements made by the USGS in Shady Brook show no comparable increase in nitrate-nitrite nitrogen, and concentrations measured in 1980 and 1992 were not statistically significantly different.

It was previously believed that stormwater runoff was a major source of organic sediment due to erosion and that the accumulation of sediments allowed vegetative encroachment from the shoreline waterward. It was also suspected that stormwater runoff was a source of nutrients and heavy metals to the lake (SWFWMD 1989). To validate these concerns, a limited stormwater monitoring program was used to identify differences in levels of pollutants contributed by two major drainage areas to the lake; Shady Brook on the southeastern side and Big Jones Creek on the northwestern side. Three storm events were sampled during the 1992-1993 study to provide information indicating possible non-point pollution sources stemming from man-made impacts. Two storm event samples

were taken at Shady Brook and a third at Big Jones Creek. Samples were analyzed for a number of constituents including nutrients and various heavy metals.

Data indicated that baseflow contributes most of the nutrient loading in Big Jones Creek. The data from the two storm event samples from Shady Brook show a much higher flow rate during the March storm but lower values for the measured parameters. Surface inflow contributes about 56 percent of the TN load and 51 percent of the TP load to the lake. However, surface inflow appears to be derived largely from groundwater discharge through springs and not runoff. In consideration of this fact and the fact that the basin is relatively undeveloped, stormwater runoff does not appear to be a critical pollutant contributor.

Residential On-Site Disposal Systems, or OSDS, located on properties adjacent to canals were previously suspected of contributing to the overgrowth of vegetation in the lake by increasing the nutrient load. An OSDS consists of a septic tank and the recipient drain field. A potential for septage leaching into Lake Panasoffkee exists with the usage of residential septic systems along the lake shore and canals. In order to determine the potential nutrient loading due to possible septic system leaching, a residential canal-front was sampled. A properly sited, maintained, and efficient OSDS can treat wastewater to the same degree as a secondary wastewater treatment plant. The degree of potential contamination from an OSDS is predicated on the age, efficiency, and maintenance of a system. The impacts to a water body due to an improperly functioning OSDS are predicated on the volume of septic discharge in relation to the volume of the water body with respect to dilution, and the flushing ability of the water body. Lake Panasoffkee receives a relatively small volume of septic system discharge and receives a large volume of continuous groundwater inflow. Sampling results indicate that the relatively small nutrient load from the residential canal and shore systems is quickly diluted as this discharge volume enters the lake proper; therefore, OSDS are presently not considered a significant nutrient source.

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APPENDIX B

ENACTING LEGISLATION

Approved by the Governor May 21, 1998.

Filed in Office Secretary of State May 21, 1998.

CHAPTER 98-69

Committee Substitute for Senate Bill No. 592

An act relating to water management; creating the Lake Panasoffkee Restoration Council; providing for its membership, powers, and duties; requiring the Southwest Florida Water Management District to provide staff for the council and to award contracts subject to an appropriation of funds; providing an appropriation; providing an effective date.

WHEREAS, Lake Panasoffkee is a waterbody of historic, hydrologic, and ecological significance, and

WHEREAS, Lake Panasoffkee is a major tributary to the Withlacoochee River, and

WHEREAS, Lake Panasoffkee is plagued by fluctuating water levels and sedimentation and excessive growth of aquatic plants, which are degrading its water quality and recreational values and adversely affecting the Withlacoochee River, and

WHEREAS, Lake Panasoffkee continues to provide wildlife habitat for fish, birds, and game, and offers recreational opportunities for the residents of Sumter County and Central Florida and visitors to the area, despite its current problems, and

WHEREAS, the economic potential of Lake Panasoffkee has yet to be tapped, and

WHEREAS, the Southwest Water Management District, in cooperation with several state, regional, and local entities, has developed proposals to restore Lake Panasoffkee, NOW, THEREFORE,

Be It Enacted by the Legislature of the State of Florida:

Section 1. Lake Panasoffkee Restoration Council—There is created within the Southwest Florida Water Management District the Lake Panasoffkee Restoration Council.

(1)(a) The council shall consist of seven voting members: two representatives of lakefront property owners, one environmental engineer, one person with training in biology or another scientific discipline, one person with training as an attorney, one person with training as an engineer, and one representative of the sport fishing industry, all to be appointed by the Sumter County Commission. No person serving on the council may be appointed

to any of the council advisory group agencies' councils, board, or commission. The council members shall serve as advisors to the governing board of the Southwest Florida Water Management District. The council is subject to the provisions of chapter 119 and chapter 120, Florida Statutes.

(b) The council advisory group to the council shall consist of: one representative each from the Southwest Florida Water Management District, the Florida Department of Environmental Protection, the Florida Department of Transportation, the Florida Game and Fresh Water Fish Commission, the Withlacoochee River Basin Board, and the United States Army Corps of Engineers, to be appointed by their respective agencies, all of whom must have training in biology or another scientific discipline.

(2) Immediately after their appointment, the council shall meet and organize by electing a chair, a vice chair, and a secretary, whose terms shall be for 2 years each. Council officers shall not serve consecutive terms. Each council member shall be a voting member.

(3) The council shall meet at the call of its chair, at the request of six of its members, or at the request of the chair of the governing board of the Southwest Florida Water Management District.

(4) The council shall have the powers and duties to:

(a) Review audits and all data specifically related to lake restoration techniques and sport fish population recovery strategies, including data and strategies for shoreline restoration, sediment control and removal, exotic species management, floating tussock management or removal, navigation, water quality, and fisheries habitat improvement, particularly as they may apply to Lake Panasoffkee.

(b) Evaluate whether additional studies are needed.

(c) Explore all possible sources of funding to conduct the restoration activities.

(d) Advise the governing board of the Southwest Florida Water management District regarding the best approach to restoring Lake Panasoffkee, and make a recommendation as to which techniques should be part of the restoration program. The governing board of the Southwest Florida Water Management District shall respond in writing to the council if any recommendations from the council require re-evaluation. The response shall detail reasons for re-evaluation.

(e) Report to the Legislature before November 25 of each year on the progress of the Lake Panasoffkee restoration plan and any recommendations for the next fiscal year.

(5) The Southwest Florida Water Management District shall provide staff to assist the council in carrying out the provisions of this act.

(6) Members of the council shall receive no compensation for their services, but are entitled to be reimbursed for per diem and travel expenses

incurred during execution of their official duties, as provided in section 112.061, Florida Statutes. State and federal agencies shall be responsible for the per diem and travel expenses of their respective appointees to the council and the Southwest Florida Water Management District shall be responsible for per diem and travel expenses of other appointees to the council.

Section 2. Lake Panasoffkee restoration program.—

(1) The Southwest Florida Water Management District, in conjunction with the Department of Environmental Protection, the Florida Game and Fresh Water Fish Commission, the Sumter County Commission, and the Lake Panasoffkee Restoration Council, shall review existing restoration proposals to determine which ones are the most environmentally sound and economically feasible methods of improving the fisheries and natural systems of Lake Panasoffkee.

(2) The Southwest Florida Water Management District, in consultation and by agreement with the Department of Environmental Protection, the Game and Fresh Water Fish Commission, and pertinent local governments, shall develop tasks to be undertaken by those entities necessary to initiate the Lake Panasoffkee restoration program recommended by the Lake Panasoffkee Restoration Council. These agencies shall:

(a) Evaluate different methodologies for removing the extensive tussocks and build up of organic matter along the shoreline and of the aquatic vegetation in the lake; and

(b) Conduct any additional studies as recommended by the Lake Panasoffkee Restoration Council.

(3) Contingent on the Legislature appropriating funds for the Lake Panasoffkee restoration program and in conjunction with financial participation by federal, other state, and local governments, the appropriate agencies shall through competitive bid award contracts to implement the activities of the Lake Panasoffkee restoration program.

Section 3. The sum of $45,000 is appropriated from the General Revenue Fund to the Southwest Florida Water Management District for the purpose of paying administrative, per diem, and travel expenses of the Lake Panasoffkee Restoration Council.

Section 4. This act shall take effect upon becoming a law.

Approved by the Governor May 21, 1998.

Filed in Office Secretary of State May 21, 1998.

APPENDIX C

CHRONOLOGICAL SUMMARY
OF LAKE PANASOFFKEE RESTORATION COUNCIL MEETINGS

Appendix C - Chronological Summary of Lake Panasoffkee Restoration Council Meetings

Members were appointed to the Lake Panasoffkee Restoration Council (LPRC) by the Sumter County Board of County Commissioners. The inaugural meeting of the LPRC was held on June 15, 1998. At this meeting members were introduced, the Florida Sunshine Law was reviewed (being a Legislatively mandated committee, the LPRC is subject to the Sunshine Law), the enacting legislation was reviewed, a schedule for future meetings was established, and LPRC officers were elected. Due to the need to submit an inaugural report to the Legislature no later than November 25, 1998, meetings were scheduled for every other week commencing with the June 15, 1998 meeting.

At the July 6, 1998 meeting, the main agenda items were a presentation by the Florida Game and Fresh Water Fish Commission (FGFWFC) on the proposed Coleman Landing Project and a presentation by the Southwest Florida Water Management District (SWFWMD) summarizing results of Surface Water Improvement and Management (SWIM) funded water quality and lake sedimentation studies. Mr. Mikel Hulon (FGFWFC) provided the LPRC with an overview of the proposed Coleman Landing Project, noting that the FGFWFC has appropriated $150,000 for the project which is designed to remove approximately 140,000 cubic yards of sediment in the project area so as to allow boater access to Lake Panasoffkee. Mr. Hulon asked to use District lands for disposal of dredged material. A dredge and fill permit application had not yet been submitted to DEP and several questions arose regarding project specifics and permit ability. Mr. Hulon asked for LPRC support of the project. The LPRC passed a motion agreeing in principal with the project, and asked the FGFWFC to come back with more specific details before any actual work is done. After Mr. Hulon's presentation, Dr. Martin Kelly (SWFWMD) provided the Council with a summary of two project reports regarding Lake Panasoffkee water quality and sediments; LPRC members were provided copies of both reports. Essentially it was presented that water quality of Lake Panasoffkee is good, although nitrate loading from some of the inflows has apparently increased in recent years. The information provided in the sediment report is particularly relevant to proposed restoration strategies for Lake Panasoffkee. Lake Panasoffkee sediments are unique due to their high inorganic content which is chiefly attributable to calcium carbonate. Aquatic macrophytes and associated algae through photosynthesis (removal of carbon dioxide from the water column) cause lake water pH to rise and as a consequence a calcium carbonate precipitate to form. The results of both studies are discussed in greater detail elsewhere in this report.

At its July 20th meeting, the LPRC was provided an overview of Florida Statutes governing Save Our Rivers and Preservation 2000 acquisition criteria by Mr. Kevin Love (SWFWMD). He explained the purposes of acquisition of specific lands bordering Lake Panasoffkee's eastern shoreline and distributed copies of *A Plan for the Use and Management of the East Lake Panasoffkee Property* prepared by the SWFWMD in 1996. This review was provided primarily in response to questions raised as a result of the FGFWFC's request to use District managed land for sediment disposal purposes in connection with the Coleman

Landing Project. The Council then discussed progress on the Coleman Landing Project; a permit application was submitted to DEP on July 10, 1998. The statutory goals of the LPRC were reviewed and the time line for submission of the LPRC's first report to the Legislature. At this meeting the LPRC began a discussion and consideration of seven issues identified in the enacting legislation. The seven issues were: (1) shoreline restoration; (2) sediment control and removal; (3) exotic species management; (4) tussock management and removal; (5) navigation; (6) water quality; and (7) fisheries habitat improvement. Due to time constraints, discussion was restricted to fisheries habitat improvements and water quality issues.

Most of the August 3 Council meeting was devoted to identification and prioritization of restoration priorities. After considerable discussion it was established that the LPRC's priorities in priority order are: (1) fisheries habitat improvement; (2) shoreline restoration; and (3) navigation. Water quality, although identified in the legislation as an issue for consideration, is good and was not identified by the LPRC as a restoration priority. There was also some discussion of the Coleman Landing Project at this meeting. SWFWMD's Executive Director, Mr. E. D. Vergara noted that the District had identified approximately 22 acres near the project site that could be used for sediment disposal assuming that all permit conditions are met. It was also noted that given mobilization and engineering cost considerations that the proposed project may be underfunded by as much as $150,000.

The two primary issues discussed at the August 17 Council meeting were permitting and engineering issues related to the Coleman Landing Project and a discussion of fisheries habitat improvement and shoreline restoration options particularly with respect to the encroachment of woody/shrubby vegetation on the lake's east side. The LPRC directed the Advisory Group to develop options/strategies for achieving its three priorities and report back to the Council at its next regularly scheduled meeting. The Council also requested a presentation on tussock removal and in-lake disposal.

Virtually the entire August 31, 1998 meeting was devoted to a consideration of permitting, engineering and funding issues related to the Coleman Landing Project. Mr. Sam McKinney (FGFWFC) updated the Council on the project, while Mr. Ken Huntington (FDEP) discussed the permitting process and related issues. It was recognized by the Council that the project could not be completed before a report to the Legislature is due and that more funding would be needed to implement the project. Due to time constraints other agenda items were deferred to the September 14, 1998 meeting.

At its September 14th meeting the Council was given a presentation by Mr. Robert Lovestrand, with DEP's Bureau of Aquatic Plant Management, regarding tussocks, how they are formed, and why they need to be controlled. Mr. Lovestrand presented case histories of specific tussock removal projects some of which involved in-lake disposal. Mr. Lovestrand discussed costs which ranged from $2,000 to $12,000 per acre for the various projects considered. Dr. Kelly reviewed recent work activities of the Advisory Group and

noted that there is some concern relative to macroinvertebrate densities in the lake, particularly snails, and it was noted that measurements taken during recent field trips indicate low dissolved oxygen concentrations in the surficial sediment. Dr. Kelly then provided the Council with a hand-out of cost options for various dredging scenarios. The handout and presentation covered estimates of dredging and disposal costs including land acquisition and dirt work; engineering and permitting costs were not included. Chairman Springstead directed the Advisory Group to meet in accordance with sunshine laws for the purpose of developing recommendations to be presented to the Council for action at its October 12 meeting.

At its September 28th meeting, Mr. Michael Holtkamp, P.E. (SWFWMD) provided the Council with an estimate of engineering and geotechnical work costs associated with the Coleman Landing Project. A hand-out itemizing the associated costs including preliminary engineering, final design and permitting, construction services, and the actual construction of the project was provided to the Council. Estimated costs for the project excluding disposal site costs (since a disposal site is available on SWFWMD managed land) was estimated to be approximately $300,000. Dr. Kelly provided the Council with a suggested outline of the report to be submitted to the Legislature no later than November 25, 1998.

As requested, the Advisory Group presented specific restoration recommendations to the Council at its October 12 meeting. The Advisory Group developed four specific recommendations at its October 8th meeting for consideration by the Council. The Advisory Group's recommendations were that the following steps should be taken in priority order:

(1) Support the Coleman Landing Pilot Project since much useful information will be generated that will facilitate permitting of other planned restoration activities. The Council should request additional funding for the pilot project, and the project should be implemented as soon as possible;

(2) Dredge to hard bottom from the 35-foot contour in the Grassy and Shell Point areas, along most of the western shoreline, and at the north end of the lake.

(3) Dredge the east, emergent-vegetation zone tying into the 35-foot contour; a three foot depth of water is recommended to discourage emergents and encourage submergents;

(4) With respect to canals, the LPRC should make project disposal areas available to residents, but property owners should fund and permit individual canal dredging efforts.

No further recommendations were developed at the October 8th Advisory Group meeting.

The LPRC discussed removal of vegetation and sediment in the woody/shrubby zone on the eastern side of the lake and gave this step priority (with concurrence from the Advisory Group) over dredging to the 34-foot contour. The LPRC took formal action on these recommendations, endorsing the Coleman Landing Project, and establishing the priorities as discussed above. Staff was directed by the LPRC to incorporate these priorities in its report to the Legislature and to prepare a draft report for Council review.

At the October 26 meeting, Dr. Kelly briefly reviewed with the Council a draft copy of its report to the Legislature. The Council discussed the organization of the report. The report will be organized to address three specific audiences: legislators, legislative aides, and those interested in technical detail. Mr. Wade asked that the Executive Summary be modified to emphasize more strongly in layman's terms the critical issues and problems of Lake Panasoffkee. Mr. McKinney provided an update on the Coleman Landing project.

The Council's report to the Legislature was the main topic of the November 9th meeting. Council members discussed and provided comments and changes to be incorporated in a re-draft of the report which will be forwarded to Council members on November 13th for their further consideration. A final version of the report will be considered at the November 23rd meeting. The Council's report to the Legislature will be forwarded to the appropriate legislators on November 24th.

Lake Panasoffkee Restoration Council

PLEASE ADDRESS CORRESPONDENCE TO THE **Southwest Florida Water Management District**
2379 BROAD STREET, BROOKSVILLE, FLORIDA 34609-6899 • 1-800-423-1476 (FLORIDA ONLY)
OR (352) 796-7211, EXTENSION 4609.

November 24, 1998

Governor Lawton Chiles
The Capitol
Tallahassee, FL 32399-0001

Subject: Lake Panasoffkee Restoration Council

Dear Governor Chiles:

The Lake Panasoffkee Restoration Council was formed pursuant to Chapter 98-69, Laws of Florida. The Council is required to report to the Legislature no later than November 25 of each year. Accordingly, it is our pleasure to respectfully submit the Council's first report, "Lake Panasoffkee Restoration Council, Report to the Legislature, November 25, 1998."

Lake Panasoffkee, the largest lake in Sumter County and the third largest lake in west central Florida, serves as a vital recreational and economic resource for the county and the region. Lake Panasoffkee is a significant sport fishery. Fifteen percent of anglers on the lake come from out of state, and the majority of Florida residents who use the lake travel more than 25 miles. While fishing remains popular, the lake's future is threatened. The fishery has declined considerably over the last 30 to 40 years. In the mid-1950s, no less than 15 fish camps operated there; today, only three remain. Almost 800 acres of lake have been lost to sedimentation and encroachment of woody/shrubby vegetation.

The enclosed report represents the Council's concerted efforts to develop a restoration plan for Lake Panasoffkee. This report proposes a number of steps with associated costs for accomplishing specific restoration goals. The report is organized in three parts. An Executive Summary briefly outlines the scope and budget of proposed restoration activities and will be useful to the reader wanting a short, concise overview. The second section, "Lake Panasoffkee Restoration Council," considers in more detail the duties, conclusions and recommendations of the Council. The six restoration steps proposed and additional data needs are discussed with associated budgets. The information in this section will be of interest to those concerned with reviewing restoration details and strategies. Finally, a series of appendices is presented. The appendices, particularly Appendix A, "Lake Panasoffkee - background information/technical assessments," are intended to provide greater insight into the state of the resource and its decline.

The Council has taken its responsibilities most seriously and has been meeting bi-weekly since June 15, 1998 to prepare this report for timely submission. Although the task has been challenging, we have appreciated the confidence and trust placed in us as well as the opportunity to be of service to our community, the State, and the unique resource that is Lake Panasoffkee.

The efforts of Representative Everett Kelly and Senator Ginny Brown-Waite, as well as other legislators who initiated the creation of the Council, is hereby sincerely appreciated. The important administrative support by the Southwest Florida Water Management District of the Council's efforts is hereby acknowledged and also sincerely appreciated along with the technical staff support offered by the District, Florida Department of Environmental Protection and the Florida Game & Freshwater Fish Commission.

We look forward to the Legislature's review and stand ready to assist in any way that may be necessary.

Respectfully submitted,

LAKE PANASOFFKEE RESTORATION COUNCIL

John W. Springstead, Chairman

Jim Wade, Vice-Chair

Billy Merritt, Secretary

George L. Buhmeyer

William W. Davis

David C. Hanson

Jim W. Veal, Sr.

Enclosures

cc: Governing Board Members
Withlacoochee River Basin Board Members

ıe following people received the ake Panasoffkee Council Report ı November 25, 1998

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The Honorable Virginia Brown-Waite
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November 23, 1998

Mr. John W. Springstead
Chairman
Lake Panasoffkee Restoration Council
727 South 14th Street
Leesburg, Florida 34748

Subject: Lake Panasoffkee Restoration Council - Report to the Legislature

Dear Mr. Springstead:

The Governing Board of the Southwest Florida Water Management District has received and reviewed the Lake Panasoffkee Restoration Council's *Report to the Legislature, November 25, 1998, as* directed in Chapter 98-69, Laws of Florida. The Governing Board, at its November 18, 1998 meeting, approved the plan as written and found that none of the recommendations proposed by the Council require re-evaluation. The Governing Board commends the members of the Lake Panasoffkee Restoration Council for their efforts in preparing this report. The District looks forward to working together with the Council, Sumter County, and the various agencies represented by the Council's Advisory Group to protect this unique and valued resource.

Sincerely,

James L. Allen
Chairman

cc: Governing Board Members
Withlacoochee River Basin Board Members

The Southwest Florida Water Management District (District) does not discriminate upon the basis of any individual's disability status. This non-discrimination policy involves every aspect of the District's functions, including one's access to, participation, employment, or treatment in its programs or activities. Anyone requiring reasonable accommodation as provided for in the Americans With Disabilities Act should contact the SWIM Section at 813-985-7481, or 1-800-423-1476 (FLORIDA), extension 2201; TDD ONLY 1-800-231-6103 (FLORIDA); FAX 813-987-6747.