

**HARRIS CHAIN OF LAKES
RESTORATION COUNCIL**

*Report To The
Florida Legislature*

November 25, 2001

**Harris Chain of Lakes Restoration Council
Report to the Florida Legislature
November 2001**

COUNCIL MEMBERS

- Mr. Skip Goerner (Chairman)
- Mr. Tom Brooks (Vice-Chairman)
- Mr. Hugh Davis (Secretary)
- Mr. Don Nicholson
- Mr. Rick Powers
- Dr. Tom Cook
- Mr. Charles Clark
- Mr. Bill Pearce
- Mr. Keith Farner

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EXECUTIVE SUMMARY

The Harris Chain of Lakes Restoration Council was officially created by action of the Florida Legislature during the 2001 legislative session (Ch. 2001-246). The Council consists of nine voting members representing a broad spectrum of individuals with diverse expertise and interests. Chapter 2001-246, Laws of Florida, charged the Harris Chain of Lakes Restoration Council with the responsibilities of reviewing 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 fish and wildlife habitat improvement, particularly as they may apply to the Harris Chain of Lakes.

The Harris Chain, with its tens of thousands of acres of lakes and wetlands, represents the headwaters of the Ocklawaha River, the major river draining central Florida. Lakes such as Lake Beauclair, Lake Dora, Lake Eustis, Lake Griffin, Lake Harris and Lake Yale with their desirable natural resources provide tourists and the citizens of Florida with diverse recreational activities. Many citizens also reside along the shores of these lakes, representing a major real estate market.

The public began expressing concern over declining water quality, aquatic vegetation, and fish populations in the Harris Chain lakes as early as the 1950s. Even following many years of declining habitat and fish populations, the estimated annual (1990) value of a single fish species, the black crappie (speckled perch), on Lake Griffin alone, was about three million dollars. By the year 2000, the value of the black crappie fishery had declined to about \$300,000, a 90% decline. Coupled with the loss of the largemouth bass fishery on the Harris Chain of Lakes, local communities continue to lose millions of fishing dollars annually. Declining water quality, fish kills, bird and alligator deaths, and the emergence of toxic algae are also causing additional millions of dollars of losses within the tourist, recreational boating, and real estate industries.

On September 6, 2001 the Harris Chain of Lakes Restoration Council began meeting to discuss issues related to the health of the lakes and the viability of possible restoration projects. Specific discussions were held regarding the viability of the St. Johns River Water Management District's marsh-flow ways at Lake Apopka and Lake Griffin. Other issues discussed included proposed total maximum daily loads (TMDL) projects for improving water quality, sediment removal, improved recreational boating access, stormwater control and restoration of fisheries. A finding of these discussions was that there exists scientific disagreement regarding the potential success of on-going restoration projects.

Information provided from qualified members of the scientific community, while largely in agreement on many issues, have important disagreements regarding the effects of nutrient control and marsh flow ways on the water quality of the Harris Chain of Lakes. The conflicts not only raise uncertainty regarding the success of current restoration projects, but raise uncertainty on the amount of time required before measurable

objectives are realized. Time estimates range from decades to hundreds of years.

The Harris Chain of Lakes Restoration Council will need time to determine which restoration projects or combinations of projects offer the best chance of success. The Council also acknowledges that specific attention will have to be paid to the development of short-term and long-term projects with an eye on the *Return on Investment* for specific restoration projects. The Council will therefore carefully examine short-term projects that can provide immediate economic benefit to local communities.

THE HARRIS CHAIN OF LAKES RESTORATION COUNCIL

Mission Statement

The mission of the Council is to maximize successful restoration of the Harris Chain of Lakes, by ensuring sensible efforts to restore clean water quality, sound environmental policy, ecological diversity, and economic stability, now and into the future.

Specifically:

- To keep the citizens of Florida first, while performing their fiduciary responsibility, and do so with great urgency
- To recommend lasting and viable solutions to the legislature for appropriations of funds and resources.
- To recommend projects that will be selected based on the ability to achieve restoration goals, sound science and prudent restoration philosophy
- To restore the Harris Chain of Lakes water quality to nothing less than pristine is our goal and our mission
- To develop a program for the improvement of the fish and wildlife habitat and natural systems of the Harris Chain of Lakes
- To propose methods of contaminated sediment removal and control nutrient loading to our lakes
- To evaluate and identify areas of human health concerns, resulting from the deterioration of our lakes
- To recommend and develop projects that substantially improve the economic benefit to the local communities

Formation - The Harris Chain of Lakes Restoration Council was officially created by action of the Florida Legislature (**Ch. 2001-246**) during the 2001 legislative session (see Appendix 1). The Restoration Council was created within the St. Johns River Water Management District and is to receive assistance from the Fish and Wildlife Conservation Commission and the Lake County Water Authority. The Legislature through the Act required the following:

Representation – The membership of the Council was to be appointed by the Lake County Legislative Delegation, which is chaired by Senator Anna Cowin. The Council consists of nine voting members representing a broad spectrum of expertise and interest. Members were appointed on August 29, 2001. The members of the Council, their affiliation or representation and duties on the Council are:

- Sport Fishing Industry----- Mr. Skip Goerner (Chairman)
- Waterfront Property Owners----- Mr. Don Nicholson
- Environmental Engineering----- Mr. Rick Powers
- Legal Profession (Attorney) ----- Mr. Hugh Davis (Secretary)
- Medical Profession (Physician) ----- Dr. Tom Cook

- Biology or Related Science ----- Mr. Charles Clark
- Engineering Profession (Engineer) ----- Mr. Bill Pearce
- Member at Large ----- Mr. Keith Farner
- Member at Large ----- Mr. Tom Brooks

The Legislation also calls for the creation of an advisory group to the Council for the purpose of providing scientific information and technical data as the Council deliberates the various issues that come before it. As of the date of this Legislative Report the following individuals make up the advisory group representing their respective agencies or entities:

- St. Johns River WMD ----- Dr. Larry Battoe
- Dept of Environmental Protection --Mr. Jim Hulbert
- Fish and Wildlife Commission ----- Mr. Bill Johnson
- Dept. of Transportation ----- (Vacant)
- U.S. Army Corps. Of Engineers ---- Mr. Pete Milam
- University of Florida ----- Dr. Daniel E Canfield Jr.
- Lake Co. Water Authority ----- Mr. Michael Perry

Duties and Responsibilities – Chapter 2001-246, Laws of Florida, charged the Harris Chain of Lakes Restoration Council with the following responsibilities:

- 1) 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 fish and wildlife habitat improvement, particularly as they may apply to the Harris Chain of Lakes.
- 2) Evaluate whether additional studies are needed.
- 3) Explore all possible sources of funding to conduct the restoration activities, and
- 4) Report to the President of the Senate and the Speaker of the House of Representatives before November 25 of each year on the progress of the Harris Chain of Lakes restoration program and any recommendations for the next fiscal year.

STATUS

Administrative Issues - On September 6, 2001 the Council held its organizational meeting, during which the Council unanimously elected the following officers:

- Chairman ----- Mr. Skip Goerner
- Vice-Chairman----- Mr. Tom Brooks
- Secretary ----- Mr. Hugh Davis

The Council decided to meet every other Thursday at 10:00 AM at the Lake County Board of Commissioners Chambers in Tavares, Florida to address critical issues facing the Council. These issues included the frequency, time and location of future meetings, budget and funding, staff requirements, and the Council's responsibility under the Sunshine and Public Records Laws.

A temporary yearly operating budget has been developed and approved. Funding needs are currently being met by the St. Johns River Water Management District, the Lake County Water Authority, and the Lake County Board of County Commissioners. The Council has also developed a funding request of \$45,000 for the fiscal 2002-2003 year. Letters of support were requested from the St. Johns River Water Management District, the Lake County Water Authority, and the Lake County Board of County Commissioners. As of this report, the Board of County Commissioners has requested Governor Bush's support for the Harris Chain of Lakes Restoration Council (see Appendix 2).

The Council has determined that the temporary staff provided by the St. Johns River Water Management District are sufficient to meet the current needs of the Council and to record minutes of the Council's meetings.

The Council is subject to the provisions of Chapters 119 and 120 of Florida Statutes. The St. Johns River Water Management District at the Council's first meetings raised issues regarding the Council's responsibility under the Sunshine and Public Records Laws. While the Council understood its responsibility to conduct open meetings, members of the Council's Advisory Group objected to a strict application of St. Johns' interpretation of the law to the scientific advisory group. The Council invited Mr. Mark Simpson of the State's Attorney's office to make a presentation on the Sunshine and Public Records Laws to the Council and Advisory group. After the presentation, it was determined that an opinion of the Attorney General was to be requested to clarify how the laws apply to the Council's Advisory Group.

Technical Issues - To date, the Council has held six (6) regular meetings to begin to address issues of a scientific and technical nature related to the effects of nutrient enrichment on the Harris Chain of Lakes and the probability of success of various

restoration activities. Presentations have been provided by advisory group members and invited scientists.

Information provided has demonstrated that well-qualified members of the scientific community, while largely in agreement, have important disagreements (see Appendix 3). These conflicts raise uncertainty regarding the success of current restoration projects, especially the amount of time required before measurable objectives are realized.

Specific discussions were held regarding the viability of St. Johns River Water Management District's marsh flow-ways at Lake Apopka and Lake Griffin. Two University of Florida scientists stated that it would take hundreds of years before the marsh flow-way at Lake Apopka could reduce in-lake nutrient and sediment concentrations to desirable levels. Scientists from the St. Johns River Water Management District disputed their findings, but still suggested it might take decades. When questions turned to Lake Griffin, there also were disagreements. Scientists from the St. Johns River Water Management District suggested that, in about a decade, only progress towards meeting their nutrient and sediment goals should be expected. St. Johns' scientists would not commit to any specific timeline for water quality improvement.

The Council also had general presentations that consisted of overviews and status reports of various agency programs, plans, projects, and activities for the purpose of building a strong information base and a foundation for the Council members. Of particular concern and special interest to the Council has been the technical data presented on topics of:

- Nutrient enrichment of lakes
- Proposed Total Maximum Daily Loads (TMDL)
- Projects for improving water quality
- Sediment removal
- Navigation and recreational boating access
- Loss and restoration of aquatic plants
- Restoration of fisheries
- Possible alternative restoration techniques

Actions for the Remainder of Fiscal Year 2001-2002 - The Harris Chain of Lakes Restoration Council for the remainder of Fiscal Year 2001-2002 (FY 01-02) will begin to evaluate and review the progress made in implementing the Surface Water Improvement and Management (SWIM) Plans for Lake Apopka and the Upper Ocklawaha River Basin. This review will also include recommendations from other local initiatives such as the Lake Apopka Restoration Council and the Lake Griffin Restoration Task Force.

The Lake Griffin Restoration Task Force was created in May 1999 as a local initiative in response to the continuing and accelerating decline of Lake Griffin. The Task Force was charged with evaluating information pertinent to the Lake and identifying strategies to restore the Lake. Because much of the information reviewed by the Lake Griffin Restoration Task Force is recent, the Council will use this report to: 1) become familiar

with the issues and projects associated with the existing management plans, 2) how they relate to the present conditions of the Harris Chain of Lakes, and 3) formulate recommendations for future action.

The Council will also review additional management issues such as the persistent and potentially toxic cyanobacteria blooms and violations of the unionized ammonia standards that have become significant and potentially affect the entire Harris Chain of Lakes. The Council recognizes that with these issues as well as the well-publicized issues of discharges of untreated wastewater (raw sewage) from municipal systems represent possible human health issues. Determining the potential health effects associated with toxic algae may require additional research and the issue will need to be explored by this Council. However in the short-term, the Council will prioritize finding out how often the releases of untreated wastewater occur and how severe the releases are, to determine the potential impacts on the lakes.

The Harris Chain of Lakes Restoration Council also acknowledges that specific attention will have to be paid to the *Return on Investment* for specific restoration projects. Problems at the Harris Chain of Lakes have severely impacted ecotourism, fisheries, and recreational boating, which have adversely affected the local economy and caused a loss in tax revenues to many local communities. The Council has directed the Council's Advisory Group to formulate a short-term rehabilitation plan that will address these problems and assist with the recovery of fish populations within 2-5 years and help provide immediate economic benefit to the region.

Appendix 1
Enacting Legislation

LAWS OF FLORIDA

CHAPTER 2001-246

Senate Bill No. 1394

An act relating to water management; creating the Harris Chain of Lakes Restoration Council; providing for membership, powers, and duties; providing for a report to the Legislature; providing for an advisory group to the council; requiring the St. Johns River Water Management District to provide staff for the council; providing for award of contracts subject to an appropriation of funds; providing for a Harris Chain of Lakes restoration program; providing for a demonstration restoration project; providing an effective date.

WHEREAS, the waterways of Lake County are of historic, hydrological, and ecological significance, and

WHEREAS, most of these Lake County waterways are Outstanding Florida Waterways, and

WHEREAS, the Lake County waterways are plagued by toxic algae sedimentation, and excessive growth of aquatic plants, which are degrading their water quality and recreational value, and

WHEREAS, despite their current problems, the Lake County waterways continue to provide wildlife habitat for fish, birds, and game and offer recreational opportunities for the residents of Lake County and visitors to the area, and

WHEREAS, the renewable economic potential of the Lake County waterways is significant, and

WHEREAS, the St. Johns River Water Management District, the Fish and Wildlife Conservation Commission, the Lake County Water Authority along with other state, regional, and local entities, have developed proposals to restore portions of the Harris Chain of Lakes, NOW, THEREFORE,

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

Section 1. The Harris Chain of Lakes Restoration Council.—There is created within the St. Johns River Water Management District, with assistance from the Fish and Wildlife Conservation Commission and the Lake County Water Authority, the Harris Chain of Lakes Restoration Council.

(1)(a) The council shall consist of nine voting members, which include: a representative of waterfront property owners, a representative of the sport

fishing industry, an environmental engineer, a person with training in biology or another scientific discipline, a person with training as an attorney, a physician, a person with training as an engineer and two residents of the county who do not meet any of the other qualifications for membership enumerated in this paragraph, each to be appointed by the Lake County legislative delegation. No person serving on the council may be appointed to a council, board, or commission of any council advisory group agency. The council members shall serve as advisors to the governing board of the St. Johns River Water Management District. The council is subject to the provisions of chapters 119 and 120, Florida Statutes.

(b) There shall be an advisory group to the council which shall consist of one representative each from the St. Johns River Water Management District, the Department of Environmental Protection, the Department of Transportation, the Fish and Wildlife Conservation Commission, the Lake County Water Authority, the United States Army Corps of Engineers, and the University of Florida, each of whom shall be appointed by his or her respective agency, and each of whom, with the exception of the representatives from the Lake County Water Authority, and the University of Florida, shall have had training in biology or another scientific discipline.

(2) Immediately after 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 St. Johns River 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 fish and wildlife habitat improvement, particularly as they may apply to the Harris Chain of Lakes.

(b) Evaluate whether additional studies are needed.

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

(d) Report to the President of the Senate and the Speaker of the House of Representatives before November 25 of each year on the progress of the

Harris Chain of Lakes restoration program and any recommendations for the next fiscal year.

(5) The St. Johns River 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 St. Johns River Water Management District shall be responsible for per diem and travel expenses of other appointees to the council.

Section 2. The Harris Chain of Lakes restoration program.—

(1) The Fish and Wildlife Conservation Commission and the St. Johns River Water Management District, in conjunction with the Department of Environmental Protection, pertinent local governments, and the Harris Chain of Lakes Restoration Council, shall review existing restoration proposals to determine which ones are the most environmentally sound and economically feasible methods of improving the fish and wildlife habitat and natural systems of the Harris Chain of Lakes.

(2) To initiate the Harris Chain of Lakes restoration program recommended by the Harris Chain of Lakes Restoration Council, the Fish and Wildlife Conservation Commission, with assistance from the St. Johns River Water Management District and in consultation and by agreement with the Department of Environmental Protection and pertinent local governments, shall develop tasks to be undertaken by those entities for the enhancement of fish and wildlife habitat. These agencies shall:

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

(b) Conduct any additional studies as recommended by the Harris Chain of Lakes Restoration Council.

(3) Contingent on the Legislature's appropriating funds for the Harris Chain of Lakes 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 Harris Chain of Lakes restoration program.

Section 3. The Fish and Wildlife Conservation Commission is authorized

to conduct a demonstration restoration project on the Harris Chain of Lakes for the purpose of creating better habitat for fish and wildlife.

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

Approved by the Governor June 15, 2001.

Filed in Office Secretary of State June 15, 2001.

Ch. 2001-246 LAWS OF FLORIDA Ch. 2001-246

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CODING: Words stricken are deletions; words underlined are additions.

Appendix 2

Board of County Commissioners Letter to Governor Bush



Board of County Commissioners
Lake County

315 West Main Street
P.O. Box 7800
Tavares, Florida 32778-7800

Phone: 352/343-9850 Fax: 352/343-9495

www.lakegovernment.com

October 16, 2001

The Honorable Jeb Bush
Governor
State of Florida
Plaza Level – The Capitol
Tallahassee FL 32399-1300

Dear Governor Bush:

The Lake County Board of County Commissioners' requests your support of the Harris Chain-of-Lakes Restoration Council's \$45,000.00 funding request.

Senate Bill 1394 created the Harris Chain of Lakes Restoration Council. While the Council's goal is to identify and develop the best methods to facilitate the restoration of the Harris Chain of Lakes, administrative funding is essential for the Council to achieve its goal. Unfortunately, administrative funding was not approved in the 2001-2002 budget.

The Lake County Board of County Commissioners, along with Senator Anna Cowin, Representative Randy Johnson, Representative Hugh Gibson and Representative Carey Baker, support the Council's request for funding.

On behalf of the Board of County Commissioners, I urge your favorable consideration of this funding request. Keeping our local waters clean and safe is very important to the citizens of Lake County and to Lake County's economic development.

Sincerely,

Catherine C. Hanson
Chairman

:jh

cc: Lake County Legislative Delegation
Skip Goerner, Harris Chain-of-Lakes Restoration Council

Appendix 3

Scientific Papers Discussing Pros and Cons Of Lake Apopka Restoration

Scientific Papers Regarding Lake Apopka Debate

Original paper

Bachmann, R. W., M. V. Hoyer, & D. E. Canfield Jr., 1999. The restoration of Lake Apopka in relation to alternative stable states. *Hydrobiologia* 394:219-232.

Lake Apopka (Florida, USA) changed in 1947 from being a clear, macrophyte-dominated lake, used primarily for fishing, into a turbid algal lake with a poor fishery. The lake has resisted various efforts to reverse the change and restore the previous state. The restoration approach emphasizes the reduction in phosphorus inputs to reduce algal blooms and clear the water. We examined the question of whether a deep-lake approach with nutrient reductions is going to work on this large (area 124 km²) and shallow (mean depth 1.7 m) lake, or if techniques such as drawdowns or wind barriers developed for shallow lakes using the theory of alternative stable states are more applicable.

The assumptions upon which the current restoration is based are not supported. The poor transparency is due more to resuspended sediments than plankton algae, so the current Secchi disk depth of 0.23 m is predicted to increase to 0.34 m with any reasonable reduction in algal levels. The failure of the macrophytes to become re-established probably is due more to unstable sediments than lack of light reaching the lake bed, and the marsh flow-way developed by the St Johns River Water Management District will be ineffective in removing particles from the lake. It would take more than 300 years to remove the fluid mud and more than 800 years to remove the rest of the low density sediments. We conclude that the loss of macrophytes in Lake Apopka is an example of a forward switch in the theory of alternative stable states, and that it will take more than a nutrient reduction program to bring about the reverse switch to a macrophyte state. We suggest an alternative approach using wave barriers to create refuges for plants, macroinvertebrates, and fish to restore Lake Apopka's largemouth bass fishery.

Schelske and Kinney comments

Schelske, C. L., & W. F. Kenney, 2001. Model erroneously predicts failure for restoration of Lake Apopka, a hypereutrophic, subtropical lake. *Hydrobiologia* 448:1-5.

A recent paper (Bachmann et al. 1999) based on analysis of literature data predicts failure for restoration plans implemented by the St. Johns River Water Management District (SJRWMD) for Lake Apopka, a large (125 km²), shallow (mean depth =1.63 m), polymictic lake in central Florida. A marsh flow-way designed to remove particulates from inflowing water from Lake Apopka as a means to improve down-stream and lake-water quality is part of the restoration plan. According to Bachmann et al. (1999), restoration "will be ineffective in removing particles from the lake" and fail because estimated time for removal of 2.21 million tons of historic sediments in a constructed marsh flow-way is 329 yr. This inadvertently proposed mining hypothesis given as a condition for successful restoration is based on questionable assumptions, i.e., removing all the historic sediments deposited over a 50-yr period with the flow-way and exporting concurrent sedimentation while historic sediments are being removed. These questionable assumptions are used in an erroneous, discontinuous model of sediment dynamics that does not justify the alternate approach for restoration of Lake Apopka suggested in their paper.

Response to Schelske and Kinney

Bachmann, R. W., M. V. Hoyer & D. E. Canfield Jr., 2001. Sediment removal by the Lake Apopka marsh flow-way. *Hydrobiologia* 448:7-10.

We review the evidence showing that the high turbidity levels of Lake Apopka are due primarily to resuspended sediments rather than phytoplankton, and that this situation is likely to persist unless there is a fundamental change in the lake. We discuss the reasons why reductions in phosphorus inputs, the gizzard shad removal program, and macrophyte plantings would not bring about such a change. Potentially the marsh flow-way could remove the flocculent sediments because of a unique combination of a very large surface area (125 km²), a mean depth of only 1.7 m, a layer of easily resuspended fluid mud, and a marsh flow-way that is designed to filter the lake volume about 2 times a year. Using several different estimates of the rate of sediment formation in the lake, our model calculates that it would take from 275 to 502 years to remove the sediments, so the lake could not attain clear water in a reasonable length of time. The model is mathematically correct but will give nonsense results if one tries to calculate removal times when the lake is accumulating sediments rather than losing them.

Comments of Lowe et al

Lowe, E. F., L. E. Battoe, M. F. Coveney, C. L. Schelske, K. E. Havens, E. R. Marzolf, & K. R. Reddy, 2001. The restoration of Lake Apopka in relation to alternative stable states: an alternative view to that of Bachmann et al. (1999). *Hydrobiologia* 448:11-18.

Bachmann et al. (1999) postulated that wind energy initiated, and has maintained, high turbidity in hypertrophic (mean chlorophyll *a* = 92 $\mu\text{g l}^{-1}$) Lake Apopka, Florida (mean depth = 1.6 m; area = 12,500 ha). They asserted that the turbid condition was initiated by a hurricane in late 1947 that destroyed submersed plant beds and that high turbidity has since been maintained by wind-driven resuspension of fluid sediments. In their view, there has been sufficient light for re-establishment of submersed plants over about 38 % of the lake bottom but plant growth has been precluded by the fluid character of the sediments. They concluded that the restoration program of the St. Johns River Water Management District, which includes reduction of the phosphorus (P) loading rate, will not restore water clarity or submersed vegetation.

An alternative explanation for Lake Apopka's turbid state is that it was initiated, and has been maintained, by excessive P loading that led to algal blooms and elimination of submersed vegetation through light limitation. The transition to the turbid state was contemporaneous with drainage of 7,300 ha of the floodplain wetland to create polders for farming, beginning in the early 1940s. Lake P budgets indicate that drainage of the farms caused a seven-fold increase in the P loading rate (0.08 g TP $\text{m}^{-2} \text{y}^{-1}$ to 0.55 g TP $\text{m}^{-2} \text{y}^{-1}$). Paleolimnological analysis of lake sediments also indicates an increase in the P loading rate in mid-century, concomitant with the decline in submersed vegetation and the increase in phytoplankton abundance. After the increase in P loading, wind disturbance may have accelerated the transition to the turbid state; but, before the increase in P loading, wind disturbance was insufficient to elicit the turbid state, as evidenced by the stability of the clear-water state in the face of 14 hurricanes and 41 tropical storms from 1881-1946.

Measurements of photosynthetically active radiation (PAR) indicate that light limitation has inhibited submersed plant growth except on the shallowest 5% of the lake bottom. Further, the correlation between the diffuse attenuation coefficient (K_{PAR}) and chlorophyll *a* (CHLA) indicates that light limitation would be removed over about 82% of the lake bottom with a reduction in CHLA from 92 $\mu\text{g l}^{-1}$ to 25 $\mu\text{g l}^{-1}$.

Recently, following a 40% reduction in the P loading rate, the mean total P (TP) concentration, mean CHLA, and total suspended solids fell by about 30% while mean Secchi depth increased by more than 20%. Submersed plant beds appeared in areas devoid of macrophytes for nearly 50 years. These improvements, during a period with no change in mean wind speeds measured at Lake Apopka, provide the strongest evidence that the turbid state has been maintained by excessive P loading and that the current restoration program, which combines P load reduction with planting and removal of planktivorous fish, will be effective.

Response to comments of Lowe et al.

Bachmann, R. W., M. V. Hoyer, and D. E. Canfield, Jr. 2001. Evaluation of recent limnological changes at Lake Apopka. *Hydrobiologia* 448:19-26.

Recent changes in submersed macrophytes and water quality variables have been offered as the strongest evidence that the current restoration program at Lake Apopka will be effective (Lowe et al., 2000), however, the new beds of submersed plants in Lake Apopka are found only on hard substrates on the fringes of the lake within 40 m of shore and are protected from waves by cattails (*Typha* spp.). They occupy only 0.02% of the lake area, and there is no indication that they can colonize the flocculent sediments that make up 90 % of the lake area. There is no correlation between annual inputs of phosphorus and total phosphorus concentrations in the lake, and patterns of change in chlorophyll and other water quality variables do not follow changes in phosphorus loads. Rather than reflecting decreases in phosphorus loading, the recent changes could be related to the harvest of benthivorous fish or are just the normal fluctuations found in lakes that have not been perturbed. Regardless of the reason the macrophytes were lost in the 1940s, the new analyses confirm our previous findings that the high turbidities in Lake Apopka are due to the resuspension of sediments, and that the fluid mud cannot support the colonization of submersed aquatic macrophytes. Even without the fluid mud, the target phosphorus concentration of 55 mg m^{-3} is too high to bring about the restoration of the former macrophyte beds in the lake.

Appendix 4

Chronological Summary of Council Meetings

Chronological Summary of the Harris Chain of Lakes Restoration Council meetings

Members were appointed to the Harris Chain of Lakes Restoration Council (HCLRC) by the Lake County Legislative Delegation at its August 29, 2001 meeting in Lake County.

The first meeting of the Harris Chain of Lakes Restoration Council (HCLRC) was held on September 6, 2001 and was primarily an organizational meeting. At this meeting the Council members and advisory members present were introduced. Officers for the HCLRC were elected. Much discussion took place on the issue of the Sunshine law and its relationship to the HCLRC and its advisory board. A request was made by the Council, to St. Johns River Water Management District (SJRWMD) intergovernmental coordinator, Gene Caputo, for a presentation on the Florida Sunshine Laws, as quickly as possible. Further discussion centered on the lack of funding for the administration of the HCLRC. No funds have yet to be allocated to this Council. The Council, by consensus, directed the chairman to seek out various agencies for their support. It was agreed that the chairman would request funding from the boards of: The Lake County Water Authority (LCWA), St. John's River Water Management District and The Lake Board of County Commissioners. A schedule for future meetings was established, and administrative matters were discussed. Support for the efforts of this council came from several places: Representative Carey Baker welcomed the Council and spoke words of support and encouragement. Several elected officials from Lake County did the same. There were several members of the public that expressed their concerns about the Harris Chain of Lakes. The comments ranged from problems with boat access on the canals to dying alligators, and hope was expressed that the Council will be able to help them.

The second meeting of the HCLRC took place on September 20, 2001. Representative Carey Baker spoke to the Council. He spoke about the world changing events that took place on, and since September 11, 2001 and noted that this happened since the last HCLRC meeting. He offered his support to the Council and will do everything that he can to help with the funding issues and anything else that he can do. The presentation of the Sunshine Laws was not available by SJRWMD and the Council requested that this be brought forward as quickly as possible. The Council agreed that they will operate in "full sunshine" until notified otherwise. Several of the advisory group members expressed dismay at the prospect of an advisory board that could not communicate together. The inability to communicate freely was seen as an impediment to their ability to be constructive. Some advisors had consulted their agency counsels and they stated that as long as the advisory board does not make recommendations, that they are not subject to the Florida Sunshine laws every single time that they communicate with each other. The HCLRC chairman notified the Council that the request for funding from the

Lake County Water Authority was turned down and the LCWA requests that the HCLRC bring back a budget to the Water Authority board for reconsideration. An announcement from SJRWMD was made in reference to funding from the District for the administration of the Council if the Council will submit a budget to the District. A presentation of an general overview of the projects on the Harris Chain of Lakes, was given, by SJRWMD. The HCLRC made requests for specific information on several of the projects. SJRWMD suggested that, more technical presentations are available to the Council in the future. Mike Perry, Executive Director of the Lake County Water Authority presented a computer presentation detailing the role of the LCWA. The presentation detailed involvement in maintaining and providing and operating structures to control water for agriculture and citrus purposes, maintain navigation aids on all canals that connect between the Harris Chain of Lakes. Mr. Perry discussed the purchase and management of 6400 acres of property around Lake County, by the Water Authority, and stated that this property was specifically for preserving and protecting those lake systems. Education and boating safety for recreation is one of their programs. Mr. Perry presented a request of the Council, from the LCWA, to investigate the effects of wastewater treatment plants on the lakes. The Lake County Public Works gave an overview of storm water management and funding available for Lake County. BCI, the storm water management consultants for Lake County, gave an overview of projects on the Lake Griffin Basin and explained how the Lake Griffin Basin became the number one priority basin for the establishment of TMDLs. BCI noted that the Clean Water Act has provisions for penalties. Bill Johnson from the Florida Fish and Wildlife Conservation Commission gave an overview of projects that they have on the Harris Chain of Lakes. Duane Carbonneau, from Florida Fish and Wildlife Conservation Commission, alligator management section, presented an overview of work on the Harris Chain since 1979. In his presentation he noted that the statewide alligator harvest and the public waters egg collection programs no longer use Lake Griffin, because of the alligator mortalities that have occurred there. The only programs that they have, currently active, on the Harris Chain, are the nuisance control program and the public waters hatchling program. The Council requested information on; each agency's authority, flow-way reports, nutrient and water budgets and data and facts concerning these issues. Several members of the public offered information and concerns on the quality of the waters of the Harris Chain of Lakes. Gene Caputo intergovernmental coordinator for SJRWMD offered a formal Agency publication list for the next meeting.

The third meeting of the HCLRC took place on October 4, 2001. Chairman Goerner announced that SJRWMD has put \$10,000 in the Councils budget. He had approached the Lake County Board of County Commissioners and has asked for their support, by granting the funding request from the HCLRC. Chairman Goerner stated that the Lake County Board of County Commissioners responded quickly and positively by instructing their acting county manager and attorney to come up with a funding source. Mary Paulic, basin coordinator for the Oklawaha Basin, of the Florida Department of Environmental Protection, gave a presentation, on the process of developing TMDL in this area. Ms. Paulic explained how a body

of water was deemed impaired utilizing state water quality criteria. In her presentation she explained how the state has to submit a report every year on water quality to the United States Environmental Protection Agency. This report is the 305 report. In this report is the 303 list (list of impaired waterbodies). A number of the lakes in the Harris Chain of Lakes are on this list. The U.S. Environmental Protection Agency (EPA federal) is requiring TMDL standards as settlement on a lawsuit. Mr. Jim Hulbert, advisory member from FDEP discussed the 1998 Clean Water Action Plan. Dr. Canfield, professor, from the University of Florida, discussed his research findings regarding the 1986 algae bloom on Lake Okeechobee. He showed the film "Living at the Lake" that details all the issues of a healthy lake. This film gave insight into the nature of a lake and understanding of some of the problems that can be addressed. In this film, an explanation of a macrophyte (plants large enough to see with the naked eye) dominated vs. algae (microscopic plants) dominated lake was discussed. Dr. Bachman, also a Professor from the University of Florida presented his research findings and opinions from an independent review that he started five years ago at Lake Apopka. He cautioned the members of the HCLRC board to be very wary of deep lake solutions in shallow lakes. His take home message is that the primary problem in Lake Apopka (the headwaters of the Harris Chain of Lakes) is not phosphorous, but it is the layer of fluid mud that covers 90% of the Lake bottom, that is now about 45 cm thick. This all started about 1947 in Lake Apopka, and the vegetation on the bottom was ripped up by a very serious weather event. When the macrophytes were lost in Apopka, wind events keep the bottom of the lake stirred up and the ensuing layer of fluid mud has never consolidated to be able to hold vegetation. Dr. Canfield pointed out to the board that there is a lot more agreement, among scientists; than there is disagreement but not to let the disagreements deflect them from their mission. Dr. Battoe from SJRWMD was questioned about the 90% figure and answered that the District feels that the ratio is more 50% and added, that is minor scientific disagreement. Dr. Bachman stated that phosphorus removal alone would not allow the plants to take root on the bottom of the lake, because of the resuspension of sediments. He said that fluid mud is the problem. Public questioning followed with a discussion on several key questions.

On October 18, 2001 the Harris Chain of lakes Restoration Council met for the fourth time. Mr. Mark Simpson, Assistant State Attorney spoke to the Council regarding the Sunshine Law and Public Record Keeping. Mr. Simpson suggested that the Council draft a letter to the Attorney General's office asking for its opinion on whether or not the advisory board is under the Sunshine Law purview, and also suggested that the letter lay out the specific details of the role of the advisory board. Chairman Goerner announced that funding requests from the Lake County Board of County Commissioners and the water authority had been approved. Dr. Larry Battoe, Assistant Director of the Environmental Sciences Division for the SJRWMD spoke on the Technical Aspects of the Restoration Programs for Lake Apopka and the Harris Chain of Lakes, with emphasis on the Lake Apopka and Lake Griffin Flow-Ways. Dr. Battoe presented a brief overview, and some background in terms of what they are doing and why they are recommending flow-ways. He also

presented data from a 1995 study by Schelske et al that concludes that when you reduce algae in the lake, more light will get to the bottom. He concluded that St. John's River Water Management District restoration plan for Lake Apopka is to: reduce phosphorous pollution, harvest gizzard shad, plant aquatic vegetation, fluctuate lake levels and build and operate a flow-way. Dr. Mike Coveney, also from the St. John's Water Management District, and who is in charge of Lake Apopka, provided information on two flow-ways that were operated in pilot or demonstration modes at Lake Apopka and Lake Griffin. Dr. Coveney concurred with the calculation of Dr. Canfield's study, that 75 g of suspended solids per cubic meter of water that will be pumped through this flow-way at one time, and from that only .2 g of phosphorous will be extracted, assuming that the removal efficiency is 100% for both the suspended solids and the phosphorous. However, Dr. Coveney disagreed with Dr. Canfield's study estimates it would take hundreds of years at that rate to effectively clean up the lakes, using just the top layer of water from the lakes. Public comment included Ms. Anne Griffin, who came before the Board, speaking as an individual and not as a Water Authority Board Member. Ms. Griffin expressed her concerns regarding the presence of unionized ammonia in Lake Griffin and of SJRWMD proposed use of alum treatments on the flow-ways to stop the phosphorous. Ms. Griffin also expressed concerns about the lift stations on the Lake Harris canal that are malfunctioning, and could be seeping into Lake Harris. Mr. Harpo Zaneis, a member of Friends of Lake Griffin Inc., came before the Board and distributed copies of a letter that he wrote to Governor Bush, regarding a previous letter that Mr. Bob Smith, President of the Voter's League, had written to Governor Bush regarding the SJRWMD. Mr. Bob Smith, President of the Voter's League, came before the Board. He said he did not understand what is intended or how valid the plans are for the cleaning of Lake Apopka.

On November 1, 2001 the Council came together for its fifth business meeting. Dr. Mike Coveney, of the St. John's River Water Management District continued his presentation from the October 18th meeting. He prepared a brief presentation on the Sunny Hill restoration project as well as the Ocklawaha Prairie restoration area. Discussion was held regarding water losses in the flow-way projects. Dr. Coveney was questioned about the nature of the losses. Flow-way reports for 2000 indicated that the evaporative loss of water was between 22 and 39% through the flow-ways. Dr. Dan Canfield discussed evapo-transpiration, and stated that even though his office and the District receive the same data, they are interpreting it differently. Bill Johnson, Fish and Wildlife, pointed out the objectives of the Emerald Marsh is to eventually reconnect them to the lake and flood them, not to keep them dry. He maintained that historical conditions would never be back again. Mike Perry, Water Authority Board, reported that the LCWA Board members were at the flow-way this past week and they were told that the pumps have been off for about the past four or five months. No water has been entering the flow-way from Lake Griffin. Chairman Goerner stated that he has the charts from SJRWMD and they show that even when Lake Griffin was at its lowest, well below minimum level, that

they let water in from Lake Griffin to the flow-way. Mr. Perry stated that SJRWMD led their trip on Monday and said that the gates were closed. Chairman Goerner explained to Mr. Perry that the pumps operate to take water out of the flow-way into Lake Griffin. Water from Lake Griffin into the flow-way is gravity fed, so when the pumps are off, water is not being discharged back into the lake, this increases the evaporative losses. Dr. Coveney, and Mr. Pete Milam from the Army Corps of Engineers, gave a presentation of Sunny Hill Farm and Ocklawaha Prairie. The Board came to a consensus regarding the interlocal agreement from the Board of Commissioners regarding funding. Jim Hulbert, FDEP, announced that they are planning a Kick Off Meeting for the Nutrient Criteria Development Process and they are tentatively looking at December 10th in Tallahassee. Mr. Rich LeBeau, resident of King's Cove, asked about the status of dredging of residential canals on Lake Griffin. Dr. Coveney and Jim Hulbert commented about a possible estimate from the District as to what the nutrient contribution is to the Harris Chain of Lakes, and specifically these lakes that are affected by the Leesburg sewage plant and also about storm water, sewage spills and septic problems.

The sixth business meeting was held on November 15, 2001 and focused primarily on the report to the legislature. Gene Caputo, St. John's Regional Water Management District, spoke to the Board regarding the inter-local agreement between the three agencies and how funding was to be handled. Mr. Jim Hulbert from the FDEP, distributed a report identifying recorded sewage spills from municipal sources. Mr. Rob Spencer, a resident of Lake Griffin expressed concerns regarding the build up of lily pads in the Lake Griffin canal near the Picciola Bridge and the State Park. He feels the build up continues to be unattended and makes navigation nearly impossible in the state park. Ms. Anne Griffin expressed her concerns regarding the Leesburg sewage spillage and the lift stations at the facility. The Council reviewed and approved the Report To The Florida Legislature. The Council directed the advisory board to develop a short-term plan to assist in the recovery of fish populations and provide immediate economic benefit to the region. The Council talked about appointing a committee to investigate the problems at the Leesburg municipal sewer system.