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All appendices are included on the CD that accompanies this report.

### **Acknowledgements**

Cover photographs courtesy of William Casey of Casey Digitalworks, Inc. of Mount Dora, Florida and Councilman Robert Kaiser, P.E. of the Harris Chain of Lakes Restoration Council. The photographs were taken on the Harris Chain of Lakes.

## Harris Chain of Lakes Restoration Council 2007 Report to the Florida State Legislature

### Executive Summary

The Harris Chain of Lakes Restoration Council (Council) was established during the 2001 Florida legislative session and, as required by Chapter 373.467 of the Florida Statutes, has prepared this *2007 Report to the Florida State Legislature*. **The purpose of the Council is to convene regular meetings in order to assess various restoration techniques and management practices to improve water quality and fisheries habitats within the Harris Chain of Lakes.** The 2007 Report discusses information gathered during technical presentations and updates provided by the various agencies and the Technical Advisory Group. The Council reviewed numerous restoration alternatives and adopted the following restoration priorities:

- 1.) Lake Griffin access canal dredging
- 2.) Wetland / aquatic vegetation enhancement and cypress tree plantings
- 3.) Florida largemouth bass restocking
- 4.) Control of nuisance aquatic vegetation
- 5.) Cyanobacteria monitoring

During the period of November 2006 through October 2007 the Council convened **eight (8)** regular monthly meetings and attended one (1) field excursion that included a site visit to the Florida Bass Conservation Center – Richloam State Fish Hatchery, in Webster, Florida.

Throughout the year the Council was provided technical information regarding impacts of historical and existing management practices on water quality, fisheries habitat, and recreational use of water bodies in the Harris Chain of Lakes and associated watersheds in the Upper Ocklawaha River Basin. Additionally, technical presentations were made and information was provided by several state and local agencies including the St. Johns River Water Management District (SJRWMD), Florida Department of Environmental Protection (FDEP), Florida Fish and Wildlife Conservation Commission (FWCC), Lake County Water Authority (LCWA), University of Florida (UF), and the UF Institute of Food and Agricultural Sciences (UF/IFAS). As required by the enacting legislation a Technical Advisory Group (TAG) was formed of representatives from these groups and served the Council through the year.

Through the course of the 2007 reporting period the Council developed specific recommendations concerning the restoration initiatives and lake management practices as described below:

### **Enhanced Lake Level Fluctuation**

This lake management issue addresses enhanced lake level fluctuation that will provide a wider range of fluctuations for the lakes, aide in restoring natural vegetation and fisheries habitat, and ultimately improve water quality. Water levels in the Harris Chain of Lakes have been largely controlled by weirs, dams and locks. Poor water quality and habitat within the Harris Chain of Lakes can be partially attributed to 40 years of these artificially controlled water levels in the lakes. The SJRWMD has an approved water level fluctuation schedule that provides for a wider range of fluctuations.

- The Council endorsed the modified lake level fluctuation schedule previously approved by the St. Johns River Water Management District and the positive effects that it would have on aquatic habitat and water quality.

### **Access Canal Dredging**

*This information will be updated.*

This lake management issue addresses the availability of boating access during periods of lake level fluctuation, drawdown or drought. The LCWA received the required permits and began access canal dredging in Lake Griffin in July 2005. The total cost of this project is \$7.2 million and is expected to be completed by November 2007. Completion of the access canal dredging project is required prior to implementing an enhanced lake level fluctuation schedule.

- The Council supports access canal dredging on Lake Griffin to improve navigability of the lake during periods of lowered water levels and was awarded \$850,000 from their 2005 – 2006 Legislative Funding Request to assist the Lake County Water Authority with the cost of this dredging project.
- The Council was previously awarded \$1 million from their 2004 – 2005 Legislative Funding Request.
- The Council was previously awarded \$500,000 from their 2003 –2004 Legislative Funding Request.
- The Council has been awarded a cumulative total of \$2.35 million in Legislative funding to assist in access canal dredging.

### **Aquatic Plant Management and Weed Control**

*This information will be updated.*

Another lake management issue discussed was the control of invasive species of aquatic plants including hydrilla, water hyacinths and water lettuce. At issue

is the process of invasive species of aquatic plants “crowding out” more desirable and beneficial species of plants.

- The Council generally supports the invasive plant management efforts of the St. Johns River Water Management District, Florida Fish and Wildlife Conservation Commission, and the Lake County Mosquito and Aquatic Plant Management Section and was awarded \$73,900 from their 2005 – 2006 Legislative Funding Request to assist in these efforts.
- The Council was previously awarded \$56,250 from their 2004 – 2005 Legislative Funding Request.
- The Council has been awarded a cumulative total of \$130,150 in Legislative funding to assist in aquatic plant management and weed control.

### **Revegetation of Aquatic Habitat, Wetland Habitat and Cypress Tree Plantings**

*This information will be updated.*

A key lake restoration measure that the Council received information on involves better management and the revegetation of near-shore aquatic habitat to provide improved fisheries habitat and water quality. The SJRWMD, FWCC and LCWA are all actively involved in aquatic plant revegetation for improved water quality and sport fish habitat.

The Council also received information on the benefits of improved wetland habitat through the planting of cypress trees. It was discussed that cypress trees play a key role in the uptake of nutrients in wetland systems and improve wildlife habitat. Areas that would benefit from this restoration effort include the Lake Apopka Marsh Flow-way, Emerald Marsh and the Lake Apopka North Shore Restoration Area.

- The Council supports near-shore aquatic revegetation as a means of water quality improvement and habitat restoration and was awarded \$37,500 from their 2004 – 2005 Legislative Funding Request to support revegetation of aquatic habitat efforts of the St. Johns River Water Management District, Florida Fish and Wildlife Conservation Commission and Lake County Water Authority.
- The Council also supports cypress trees plantings and the wetland restoration efforts of the St. Johns River Water Management District, Florida Fish and Wildlife Conservation Commission and Lake County Water Authority and was awarded \$18,750 from their 2004 – 2005 Legislative Funding Request to assist in cypress tree planting and wetland restoration efforts.

- The Council has developed a Funding Initiative to address the issues of the revegetation and improvement of aquatic habitat, wetland habitat restoration and cypress tree plantings.
- The Council was awarded \$147,800 from the Florida Legislature for their 2005 – 2006 Funding Initiative and passed Resolution 2006-5 to transfer these funds from the St. Johns River Water Management District to the Lake County Water Authority for disbursement to the proper receiving agencies.
- The Council has been awarded a cumulative total of \$204,050 in Legislative funding to support the Funding Initiative issues.
- The Council supports the appropriation of \$250,000 in their 2006 – 2007 Funding Initiative to support near-shore aquatic revegetation, cypress trees plantings, and wetland restoration

### **Sport Fish Restocking**

*This information will be updated.*

Another lake management tool reviewed by the Council was the practice of sport fish restocking, coupled with improved aquatic habitat management to provide both water quality benefits and recreational fisheries improvement. The FWCC made multiple presentations to the Council on their research, fish counts and breeding efforts. In 2006 the FWCC completed renovation of the Richloam State Fish Hatchery located in Webster, Florida and is in the process of producing advanced fingerling bass for release in the Harris Chain of Lakes and possibly Lake Apopka in Spring 2007. The University of Florida also contributed to the sport fish restocking efforts through the relocation of 5,033 largemouth bass in 2006, and xxx in 2007. Initial restocking efforts were conducted in Lake Griffin and ????, with plans to begin stocking in Lake Dora in Spring 2008. Due to the success of sport fishing tournaments over the past three years, the Harris Chain of Lakes was voted the 5<sup>th</sup> Top Bass Fishing Destination in the World in 2006 by ESPN BASSMasters.

- The Council supports sport fish restocking and research efforts being conducted by the Florida Fish and Wildlife Conservation Commission and University of Florida, and was awarded \$147,800 from their 2005 – 2006 Legislative Funding Request.
- The Council passed Resolution No. 2006-5 to transfer the funds received from the St. Johns River Water Management District to the Lake County Water Authority for disbursement to the University of Florida Institute of Food and Agricultural Sciences - Fisheries and

Aquatic Sciences Department to support sport fish restocking in the Harris Chain of Lakes.

- The Council was previously awarded \$187,500 from their 2004 – 2005 Legislative Funding Request to assist in the bass and sport fish restocking efforts.
- The Council has been awarded a cumulative total of \$335,300 in Legislative funding to support sport fish restocking.
- Additionally, the Council supports the appropriation of \$500,000 in their 2006 – 2007 Legislative Funding Request to assist in the restocking efforts.

### **Potentially Toxic Algae**

*This information will be updated.*

Another issue discussed was the potential health impacts associated with infections that may be attributed to the release of biotoxins and neurotoxins from blue-green algae identified in lakes and rivers throughout Florida. In July 2003 the Council was presented research by a medical expert in the diagnosis and treatment of people who may have become infected by biotoxins produced by algae. In July 2004 the Council was presented with information provided by a representative of the Florida Department of Health regarding the occurrence and reporting of algal bloom toxins and the infections caused by them. In December 2004 the Council was presented with research by a professor of Aquatic Botany and Marine Sciences at North Carolina State University. Throughout 2006 the Council received regular updates on the progress of programs to collect samples and identify potentially toxic algae in the Harris Chain of Lakes and throughout Florida. These programs are being developed based on the information presented to the Council and utilize Florida LAKEWATCH volunteers, in addition to personnel from the Florida Department of Health, to conduct monitoring, sampling and public education efforts.

- The Council recognizes the potential human health concerns associated with algal blooms and supports the efforts of the U.S. Environmental Protection Agency, Florida Department of Health, Lake County Water Authority, and Florida LAKEWATCH volunteers to monitor for algal blooms and educate the public on their potentially toxic effects.
- The Council supports the appropriation of \$250,000 in their 2006 – 2007 Legislative Funding Request to assist in these important efforts.

### **Rough Fish Harvest**

*This information will be updated.*

This lake management technique addresses the potential reduction of phosphorus and improvement of water quality through the removal of rough fish, primarily gizzard shad, from the lakes. Estimates of the number of shad harvested and the amount of phosphorus reduction that may be associated with their removal were presented to the Council by the SJRWMD. However, this effort is an experimental technique and the SJRWMD is in the process of conducting a study to more accurately determine the effectiveness of the harvests to reduce phosphorus in the Harris Chain of Lakes.

- The Council continued to support this experimental lake management technique as a possible method for improving water quality and is awaiting the results of an independent evaluation of the information presented by St. Johns River Water Management District before deciding whether to endorse the rough fish harvest as a means of water quality improvement.

### **Lake Apopka Marsh Flow-way System**

*This information will be updated.*

In November 2003 the SJRWMD began operation of the Lake Apopka Marsh Flow-way located near the northwest portion of Lake Apopka. The flow-way was constructed on former agricultural land that had been purchased by the SJRWMD and is located at the southern end of the Apopka-Beauclair Canal. Water from Lake Apopka enters the flow-way via the canal and then passes through a series of treatment cells where natural biological processes, along with the settling of nutrients like phosphorus and suspended solids takes place. The treated water is then pumped back into the canal where the majority of the water flows back into Lake Apopka and a portion of it enters the Harris Chain of Lakes. As with most marsh systems, the water leaving the marsh can typically contain low concentrations of dissolved oxygen, sometimes below State Water Quality Standards. To date, there has been no report of fish kills or other issues related to the discharge of water containing low dissolved oxygen concentrations.

- *The Council remains concerned with the discharge of water from the Lake Apopka Marsh Flow-way containing low dissolved oxygen and the cost effectiveness of the system. They will continue to review new or emerging technologies to reduce the amount of phosphorus and other nutrients entering the Harris Chain of Lakes.*

### **Total Maximum Daily Loads and Pollutant Load Reduction Goals**

*This information will be updated.*

Throughout the year FDEP and SJRWMD provided information to the Council regarding the development of Total Maximum Daily Loads (TMDLs) and Pollutant Load Reduction Goals (PLRGs) guidelines and implementation. The SJRWMD initially developed PLRGs that are defined as an estimated numeric

reduction in pollutant load that would be required to preserve or restore water quality consistent with applicable State water quality standards. Upon review of the PLRGs the FDEP developed TMDLs for waterbodies and lakes including those within the Harris Chain of Lakes. TMDLs are the maximum load of nutrients and pollutants that can enter a water body in order to bring impaired waters back into compliance with State water quality standards and to meet the program goals. The FDEP also developed target concentrations for the individual nutrients and pollutants to assist in meeting the TMDLs. Throughout the year the FDEP met with the Ocklawaha Basin Working Group comprising local governments and stakeholders to develop a Basin Management Action Plan (BMAP) to implement the TMDL Program. Currently the Harris Chain of Lakes does not meet the TMDLs set forth and the Ocklawaha Basin Working Group and FDEP anticipate that Lake Harris will not meet its TMDL goal in the foreseeable future.

- The Council supports the efforts of the Florida Department of Environmental Protection and the water quality improvements the Total Maximum Daily Load program will bring. The Council will continue to monitor the implementation of Pollutant Load Reduction Goals and the Total Maximum Daily Load Programs.

### **Industrial, Wastewater, and Stormwater Impacts**

#### *Will this section be included in the 2007 report?*

The Council also reviewed industrial, wastewater and stormwater management practices designed to minimize discharges that could impact water quality in the lakes. Updates on the progress of the City of Leesburg Department of Environmental Services to upgrade their existing sanitary sewer and wastewater treatment facilities were provided to the Council. Additionally, in May 2005 and January 2006 the Council was presented information on Low Impact Development and its benefits to surface water quality by Dr. Pierce Jones of the University of Florida. The concept of Low Impact Development is to encourage developers to utilize alternate construction methods which would reduce nutrient and chemical discharge to nearby water bodies, reduce the total volume of stormwater runoff discharged, and to increase the recharge of water to the Floridan Aquifer.

- The Council supports the efforts of the City of Leesburg Department of Environmental Services in their reorganization and upgrading of wastewater facilities. The Council also supports the efforts of Dr. Pierce Jones and the University of Florida Resource Efficient Communities Program as a method of improving surface water quality through Low Impact Development.

The Council was also provided technical presentations on the following water quality improvement projects:

### **Lake Beauclair Nutrient Reduction Facility**

*This information will be updated.*

The Lake Beauclair Nutrient Reduction Facility is proposed to reduce phosphorus in the water from the Apopka-Beauclair Canal. Treatment would occur prior the water to being discharged into Lake Beauclair in an effort to meet State water quality standards and the Pollutant Load Reduction Goal for the lake. The system will divert water from the canal where it will receive flocculation treatment with aluminum sulfate or alum. This treatment will initiate the settling of phosphorus, along with other nutrients and suspended solids. Once the flocculated solids settle, the water will be released to Lake Beauclair. This project is currently in the design stage and no construction has commenced.

- *The Council will continue to review the information provided by the Lake County Water Authority for the design and implementation of the Lake Beauclair Nutrient Reduction Facility, as a means to reduce phosphorus concentrations in water released through the Apopka-Beauclair Canal to downstream lakes.*

### **Lake Apopka North Shore Restoration Area**

*This information will be updated.*

The north shore of Lake Apopka has been historically used for farming operations. For nearly 50 years these agricultural operations known as muck farms, discharged fertilizers (nutrients), herbicides and pesticides into Lake Apopka, which caused severe environmental degradation to the lake. The SJRWMD is involved in several projects to reduce the level of nutrients in the water discharged from this area, increase the water storage capacity, and improve wetland / marsh wildlife habitat. Until the total restoration of the North Shore of Lake Apopka is complete and the SJRWMD is able to store and treat more stormwater at the site, the Council remains concerned with the continued discharge of phosphorus from the site to Lake Apopka.

- The Council understands the importance of these restoration projects, coupled with other water quality improvement measures. The Council will continue to review the evolution of projects by the St. Johns River Water Management District to restore the north shore of Lake Apopka and the environmental benefits to water quality within the Harris Chain of Lakes.

### **Harris Bayou Projects New Section**

*This information will be updated.*

The Harris Bayou is located between Lakes Eustis and Harris, and Lake Griffin. Historically, water naturally flowed through this system of marshes and bayou. Portions of bayou were redeveloped and used for muck farming

activities that discharged excess nutrients, primarily phosphorus, into Lake Griffin

### **Emeralda Marsh Projects**

The Emeralda Marsh is located between Lake Yale and Lake Griffin. Beginning in the 1950s a system of levees and canals were built to drain this 6,500 acre sawgrass marsh in order to establish farms in the nutrient-rich muck. As with the area north of Lake Apopka, the muck farming activities discharged excess nutrients, primarily phosphorus into Lake Griffin. The SJRWMD is involved in several projects to reduce the level of nutrients in the water discharged from this area, increase the water storage capacity, and improve wetland / marsh wildlife habitat. As with the North Shore Restoration Area of Lake Apopka, the Council remains concerned with the continued discharge of phosphorus from the Emeralda Marsh to Lake Griffin.

- The Council will continue to review the evolution of wetland restoration efforts of the St. Johns River Water Management District as a method to better manage water levels and water quality in the Emeralda Marsh and Harris Chain of Lakes.

### **Funding**

*This information will be updated.*

The issues of cost and available funding for projects were discussed throughout the year. The Council was provided information on the costs of implementing the various water quality improvement technologies and lake management practices, along with the potential benefits to be derived from their implementation. The Council voted and approved the following funding requests:

#### Individual 2006 – 2007 Funding Request

- The Council passed a motion to support of the appropriation of \$250,000 in State funds to support cyanobacteria monitoring in cooperation with the Florida Department of Health, Lake County Water Authority, and Florida LAKEWATCH volunteers to monitor for algal blooms and educate the public on the potentially toxic effects of cyanobacteria in the Harris Chain of Lakes.

#### Combined 2006 – 2007 Funding Initiative Request

- The Council passed a motion to support the appropriation of \$500,000 in their 2006 – 2007 Funding Initiative for the purpose of Florida largemouth bass and sport fish restocking to improve the economic vitality of the Harris Chain of Lakes.

- The Council passed a motion to support the appropriation of \$250,000 in their 2006 – 2007 Funding Initiative for the purposes of revegetation of aquatic habitat, restoration of wetland habitat, and cypress tree plantings.

Previously Awarded Funding

Below is a summary table outlining funding received from the Florida Legislature and disbursed for the projects which the Council agreed to support. The Council appreciates the continued support of the Florida Legislature and their efforts to assist in these water quality and habitat improvement projects on the Harris Chain of Lakes.

*Table needs to be updated.*

<b>Funding Received from the Florida State Legislature By The Harris Chain of Lakes Restoration Council 2003 through 2006</b>				
<b>Issue</b>	<b>2003-2004</b>	<b>2004-2005</b>	<b>2005-2006</b>	<b>Total per Issue</b>
Lake Griffin Access Canal Dredging	\$ 500,000	\$ 1,000,000	\$ 850,000	<b>\$ 2,350,000</b>
Aquatic Plant Management and Weed Control	-	\$ 56,250	\$ 73,900	<b>\$ 130,150</b>
Revegetation of Aquatic Habitat, Wetland Habitat and Cypress Tree	-	\$ 56,250	\$ 147,800	<b>\$ 204,050</b>
Sport Fish Restocking	-	\$ 187,500	\$ 147,800	<b>\$ 335,300</b>
Potentially Toxic Algae	No Request	-	-	-
<b>Annual Totals</b>	<b>\$ 500,000</b>	<b>\$ 1,300,000</b>	<b>\$ 1,219,500</b>	<b>\$ 3,019,500</b>

## 1.0 Establishment of the Harris Chain of Lakes Restoration Council

The environmental impacts to and the economic importance of the Harris Chain of Lakes (HCOL) led to the creation of the Harris Chain of Lakes Restoration Council (Council) during the 2001 Florida Legislative Session. A copy of Chapter 373.467, Florida Statutes (F.S.), the enacting legislation, is provided as Appendix 1 of this report.

Over the past decade, declining water quality, habitat, and fisheries have resulted in substantial economic losses to this region of central Florida. The purpose of the Council is to gather and review information provided by a variety of state and local government representatives, and by academic and industry experts, on the most effective environmental restoration technologies available to improve the water quality, habitat and fish populations of the Harris Chain of Lakes. Based on the information provided and the availability of funding, the Council then moves forward to apply the recommended environmental restorative measures.

The Harris Chain of Lakes (Figure 1) are the headwaters of the Ocklawaha River and includes lakes and interconnecting waters from Lake Apopka (30,808 acres) at the south end of the chain to Lake Griffin (9,412 acres) at the north end. The lakes are located primarily in Lake and Orange counties and also include; Lake Beauclair (1,080 acres), Lake Dora (4,385 acres), Little Lake Harris (3,359 acres), Lake Harris (15,087 acres), Lake Eustis (7,757 acres), and Lake Yale (4,020 acres). An overview of the Harris Chain of Lakes is provided as Appendix 2.

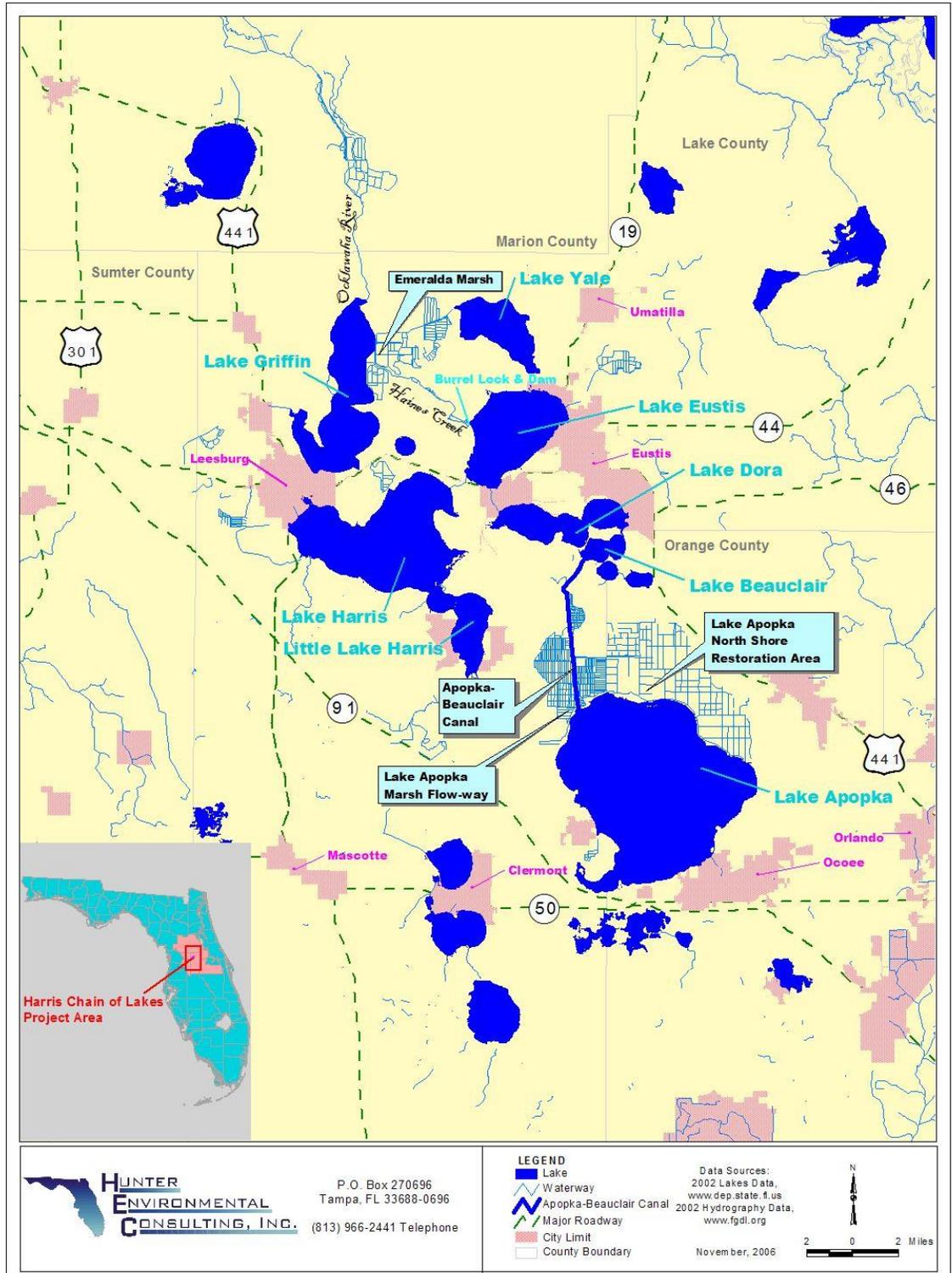
The Harris Chain of Lakes provides significant recreational opportunities and associated economic value, in addition to abundant natural resources for Florida's fish and wildlife. The Harris Chain of Lakes is federally designated as navigable water under Chapter 33, Code of Federal Regulations (CFR), Part 329.11 and the Lake Griffin State Park is designated as **Outstanding Florida Waters (OFW)** by Section 62-302.700, Florida Administrative Code (F.A.C.).

*Declining water quality and loss of fisheries habitat have lead to the following lakes being identified on the Florida Department of Environmental Protection 303(d) List of Impaired Surface Waters: This information will be updated.*

As required by the Florida State Legislature and the enacting legislation, the Council has reported to the President of the Senate and Speaker of the House of Representatives before November 25<sup>th</sup> of each year on the progress of the Harris Chain of Lakes restoration program and any recommendations for the next fiscal year. The Council has submitted the following annual reports:

- *Harris Chain of Lakes Restoration Council Report to the Legislature, November 25, 2001;*
- *Harris Chain of Lakes Restoration Council 2002 Report to the Florida Legislature;*
- *Harris Chain of Lakes Restoration Council 2003 Report to the Florida Legislature;*
- *Harris Chain of Lakes Restoration Council 2004 Report to the Florida Legislature, and;*
- *Harris Chain of Lakes Restoration Council 2005 Report to the Florida Legislature.*
- *Harris Chain of Lakes Restoration Council 2006 Report to the Florida Legislature.*

**Figure 1  
Harris Chain of Lakes located in the Upper Ocklawaha River Basin.**



## 1.1 Representation

Membership on the Council was initially appointed by the Lake County Legislative Delegation which was chaired by Senator Anna Cowin (R, District 11). Appointments are now made by members of the Delegation, chaired by Senator Cary Baker (R, District 20). The Council consists of nine voting members representing a broad spectrum of expertise and interests as outlined in Chapter 373.467, F.S. The Council elected the positions of Chairman, Vice Chairman, and Secretary, who shall serve for a period of two years and not serve consecutive terms. Below is the list of 2006 Council members and officers.

<b>Member</b>	<b>Position</b>	<b>Representing</b>
Skip Goerner	Chairman	Sport Fishing Industry
Hugh (Dave) Davis, II	Vice Chairman	Legal Profession (Attorney)
Richard Powers, P.G.	Secretary	Environmental Engineering
Keith Farner		Member at Large
Robert Kaiser, P.E.		Engineering
Donald Nicholson		Waterfront Property Owners
Richard Royal		Biological Science
Edward M. Schlein, M.D.		Medical Profession
Frederick "Ted" Woodrell		Member at Large

Election of officers was held during the January 2006 Council meeting. Skip Goerner was elected to serve as Chairman, Dave Davis was elected to serve as Vice Chairman, and Rick Powers was elected to serve as Secretary. The officers on the Council serve for a period of two (2) years. *Dr. Edward Schlein and Ted Woodrell were appointed to the Council on January 6, 2006.*

Additionally, Patrick F. Hunter, a Senior Environmental Scientist with a private consulting firm has performed the duties of Recording Secretary beginning March 2003 through October 2007. Mr. Hunter is not an appointed or elected member of the Council.

The enacting legislation also provided for the creation of a Technical Advisory Group (TAG) to serve the Council for the purpose of providing scientific information along with both technical data and guidance in their review of various technologies and issues that come before it. As of October 31, 2006 the TAG was comprised of the following individuals and their representing agencies or organizations:

Larry Battoe, Ph. D.	St. Johns River Water Management District
Barbara Bess	Florida Department of Environmental Protection
Bill Johnson	Florida Fish and Wildlife Conservation Commission
Michael J. Perry	Lake County Water Authority
Stephen Tonjes	Florida Department of Transportation

Daniel E. Canfield Jr., Ph.D. University of Florida - Institute of Food and  
Agricultural Sciences  
Peter Milam U. S. Army Corps of Engineers

## **1.2 Duties and Responsibilities**

Through Chapter 373.467, F.S., the Council is charged with the following duties and responsibilities:

- (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 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.*

## **2.0 Progress Report of the Harris Chain of Lakes Restoration Council 2007**

Since the 2006 Report to the Florida Legislature, the Council and TAG have continued to review various technologies and data relating to water quality, habitat restoration, and sport fish population recovery strategies in the Harris Chain of Lakes. The Council developed recommendations, pursuant to Section 373.467, F.S., based on the information gathered.

### **2.1 Summary of 2006 Meetings and Presentations**

The Council convened eight (8) regular monthly meetings and attended one (1) site visit to the Florida Bass Conservation Center – Richloam State Fish Hatchery, in Webster, Florida during the period of November 2006 through October 2007. Throughout the year the Council was presented scientific information and data which included water quality, aquatic habitat, fisheries status, and restorative measures as they relate to the Harris Chain of Lakes. The analytical data and scientific information reviewed addressed water quality and toxicology; littoral vegetation and fish habitat; fish restocking to provide water quality and economic benefits to the region; fish harvests as they relate to water quality; lake access canal dredging; along with other lake management issues. The Council also reviewed previous, on-going, and future projects in the Upper Ocklawaha River Basin that relate to water quality and aquatic habitat. The information received was reviewed and discussed by the Council in detail, and was then used as the basis for developing recommendations of restorative measures and management practices for the Harris Chain of Lakes. Excerpts of the meeting minutes including discussion of technical information received and the presentations given for the period of November 2006 through October 2007 are provided as [Appendix 3](#) of this report.

During the monthly meetings the Council was provided technical information regarding impacts of historic and existing management practices on the Harris Chain of Lakes and the Upper Ocklawaha River Basin. Technical presentations were made and information was provided by several state and local agencies including the St. Johns River Water Management District (SJRWMD), Florida Department of Environmental Protection (FDEP), Florida Department of Health (FDOH), Florida Fish and Wildlife Conservation Commission (FWCC), Lake County Water Authority (LCWA), University of Florida (UF), the UF Institute of Food and Agricultural Sciences (UF/IFAS), and the TAG to the Council. Below is a list of the presentations made to the Council:

2/2/07      Dr. Jan Landsberg of the FWCC – Fish and Wildlife Research Institute (FWRI) provided a presentation on cyanobacteria and Harmful Algal Blooms. ([Attachment 1](#))

Dr. Mike Coveney of the SJRWMD gave a presentation on Water Quality, the Lake Apopka Marsh Flow-way (LAMF) and projects in the Lake Apopka North Shore Restoration Area. ([Appendix x](#))

3/2/07 Dr. Mike Allen of the Fisheries and Aquatic Sciences Department at the University of Florida (UF) provided information on the effects of gizzard shad removal from area lakes. ([Appendix x](#))

Status of Aquatic Plant Management

Presentations on the current status of aquatic plant management were given by four experts in the field of aquatic sciences.

Daryl Smith, Director of Lake County Environmental Services Department

FDEP Bureau of Invasive Plant Management – Nathalie Visscher, North-Central Regional Biologist ([Attachment x](#))

FWCC Overview on Aquatic Plants and Fisheries Habitat – John Benton, Fisheries Biologist

Florida LAKEWATCH – Dr. Daniel Canfield, University of Florida UF/IFAS ([Attachment x](#))

4/6/07 Status of Aquatic Plant Management  
Presentations on the current status of aquatic plant management were given by two experts in the field of aquatic sciences.

Gary Nichols – Invasive Aquatic Plant Program Manager for the SJRWMD ([Attachment x](#))

Dr. Bill Haller – Director of the University of Florida Center for Aquatic and Invasive Plants ([Attachment x](#))

5/4/07 Site visit to the Richloam State Fish Hatchery at the Florida Bass Conservation Center, located at 3771 County Road 788, in Webster, Florida. ([Attachment x](#))

8/3/07 Dave Walker (SJRWMD) made a presentation to the Council on the current status of the Harris Bayou Project. ([Attachment x](#))

[Additional presentations will be added as needed.](#)

Throughout the year the TAG provided technical information and presentations to the Council in support of water quality and restorative issues being reviewed for

the Harris Chain of Lakes. Electronic copies of the presentations made before the Council are provided as appendices to this report as noted above. Summaries of the lake management issues discussed and the actions taken during the 2006 – 2007 period are presented in the following sections.

## **2.2 Management Issues Reviewed and Recommended Actions**

The Council has reviewed numerous management issues and restorative techniques since their inception in September 2001. After thorough review and discussion of the data provided during technical presentations and agency updates, the Council made recommendations regarding these issues as provided below.

### **2.2.1 Enhanced Lake Level Fluctuation**

**Issue: Enhanced lake level fluctuation to improve aquatic vegetation, habitat management and flood control.**

**Actions: The Council endorsed the modified lake level fluctuation schedule previously approved by the St. Johns River Water Management District.**

Poor water quality and habitat within the Harris Chain of Lakes can be partially attributed to 40 years of artificially controlled water levels in the lakes. The SJRWMD has an approved water level fluctuation schedule that will provide a wider range of fluctuations in the lakes to aid in the restoration of natural vegetation and habitat. This lake management practice will primarily provide improved near shore aquatic vegetation management and improved sport fish habitat.

In May 2002 the SJRWMD Governing Board approved an interim water level fluctuation schedule for Lake Griffin, and the permits to conduct “massive” drawdowns have been approved by the FDEP and the Army Corps of Engineers (ACoE). Enhanced fluctuation levels approved for Lake Griffin range from 54 feet above the National Geodetic Vertical Datum (NGVD) to 59.5 feet NGVD, as established by the ACoE.

As an overall restoration measure to be considered for the Harris Chain of Lakes, the Council determined that modified lake level fluctuations and drawdowns would provide substantial improvements to shoreline aquatic and fisheries habitat in the short term. Water quality improvements may be realized over the long term as a result of improved vegetation management and other lake restoration efforts. Prior to implementing the modified fluctuation schedule, the Lake Griffin Access Canal Dredging project will be complete and the following environmental conditions warrant the fluctuation:

- Ecological conditions that indicate the need for enhanced fluctuations.
- Satisfactory climatological conditions expected for time period (for example, enhanced fluctuations would not be attempted during an El Nino’ winter).
- Previous or current years should not have experienced drought conditions.

- Satisfactory conditions to store some additional water in upstream lakes.

The Council continued to endorse the modified lake level fluctuation schedule and the positive effects that it would have on aquatic habitat, sport fisheries, and water quality.

### 2.2.2 Access Canal Dredging

**Issue: Improving lake access at lowered water levels during enhanced fluctuations.**

**Actions: The Council supports access canal dredging on Lake Griffin to improve navigability of the lake during periods of lowered water levels and was awarded \$850,000 from their 2005 – 2006 Legislative Funding Request to assist the Lake County Water Authority with the cost of this dredging project. The Council was previously awarded \$1 million from their 2004 – 2005 Legislative Funding Request and \$500,000 from their 2003 –2004 Legislative Funding Request, for a cumulative total of \$2.35 million to assist in access canal dredging. *This information will be updated.***

The issue of access canal dredging is a major concern for those who utilize Lake Griffin recreationally. During periods of lake level fluctuation, drawdown or drought, boating access is limited because of the inability to navigate the shallow canals due to accumulated sediments. Dredging the canals will increase the depth of the canals in Lake Griffin and provide improved access during periods of lowered water levels, thus maintaining the economic viability of Lake Griffin’s recreational industry. Improved access to those who utilize the lake has been a concern of the Council and they support the access canal dredging efforts.

Over the previous five (5) years the Council has been provided information on the benefits and implications of access canal dredging, along with the progress of the dredging project. It was determined that access canal dredging was a necessary part of the enhanced lake level fluctuation schedule and the overall plan of lake restoration.

In July 2004 the Council was notified that the SJRWMD had received permit approval by the ACoE to utilize the Eustis muck farm as a disposal site for the dredge material from the access canals. Additionally, in July 2004 it was announced that the LCWA had received ACoE permit approval to begin the access canal dredging. A contract was signed with a dredging contractor in January 2005 and dredging began in July 2005.

Mr. Perry provided regular updates on the dredging project to the Council during the monthly meetings. In October 2007 he informed the Council that dredging

had been completed through Canal #13 and dredging of Canal #14 was underway. Dredging of the Lake Griffin access canals is anticipated to be completed by November 2007.

The Council fully supports access canal dredging on Lake Griffin to improve navigability of the lake during periods of lowered water levels and was awarded \$500,000 from their 2003-2004 funding request and \$1 million from their 2004-2005 Legislative Funding Request to assist the LCWA with the costs of dredging. The Council received \$850,000 from their 2005-2006 funding request, a portion of which will be used to assist with the funding to dredge additional canals, not originally included in the dredging schedule. The original cost of dredging approved by the LCWA was \$7.2 million. *Additional information to be included.*

### 2.2.3 Aquatic Plant Management and Weed Control

**Issues:** Invasive aquatic vegetation has the potential to overpopulate the lakes in the chain and crowd out more desirable species of aquatic plants.

**Actions:** The Council generally supports the invasive plant management efforts of the St. Johns River Water Management District, Florida Fish and Wildlife Conservation Commission, and the Lake County Mosquito and Aquatic Plant Management Section and was awarded \$73,900 from their 2005 – 2006 Legislative Funding Request to assist in these efforts. The Council passed Resolution No. 2006-5 to transfer these funds to the Lake County Water Authority for disbursement to the proper receiving agencies. The Council was previously awarded \$56,250 from their 2004 – 2005 Legislative Funding Request for a cumulative total of \$130,150 to assist in aquatic plant management and weed control. *This information will be updated.*

Another lake management issue discussed throughout the year was the control of exotic / invasive species of aquatic plants including hydrilla, water hyacinths and water lettuce. An exotic species of plant is one that is non-native to the region where it is found, having been introduced by various means from outside the region. An invasive species of plant is one that spreads rapidly, utilizing the nutrients and resources required for growth by native species. At issue is the potential for invasive species of aquatic plants to “crowd out” more desirable and beneficial species of plants, such as *Vallisneria sp.* or eel grass. The most pervasive of these aquatic plants is hydrilla, which has the potential to spread uncontrollably in the lakes.

The Council regularly received updates on the aquatic plant management efforts from the FWCC, SJRWMD, UF and the LCWA. It was determined that hydrilla

has the potential to spread throughout the Harris Chain of Lakes and could increase as water quality and clarity improves. Management efforts primarily include treatment with herbicides by the FWCC, SJRWMD, LCWA, and the Lake County Mosquito and Aquatic Weed Control Section. The goal of these efforts is to manage hydrilla by reducing populations, not through elimination. During updates to the Council, Dr. Daniel Canfield of the UF and member of the Technical Advisory Group (TAG) to the Council explained that if hydrilla were properly managed it could enhance sport fish populations by providing beneficial habitat. The Council understands that controlling the widespread growth of hydrilla is an important lake management tool and managed growth may provide beneficial fisheries habitat.

Herbicide application is the most cost effective and successful method of aquatic plant control. The most common product currently used is Fluridone which specifically targets hydrilla. This product can be applied to large areas to effectively control the spread of hydrilla. One drawback to this method of aquatic plant control is that more resistant strains of hydrilla are evolving which require higher doses of the herbicide to remain effective. Currently chemical companies who manufacture aquatic herbicides are working on the development of improved chemicals to control the resistant strains of exotic aquatic plants, without damaging the native species of aquatic plants.

Another method of aquatic plant management discussed included revegetation with desirable aquatic vegetation. The SJRWMD, FWCC and LCWA are all involved in near shore aquatic plantings as a method of minimizing exotic species of plants and improving fisheries habitat.

An additional method of aquatic weed management is through removal by mechanical harvester which physically removes the majority of plants in a targeted area. Mechanical harvesters are beneficial within canals to maintain access while not adding to the build up of detritus or dead plant material on the bottom of the lakes. Drawbacks to this as an approved method for whole lake aquatic plant management is that it is only effective in smaller, confined areas and it is non-selective as to the species of plants that it removes because it removes the majority of plants in an area.

After extensive discussion and review the Council agreed to the purchase of a mechanical harvester to maintain canals and small areas throughout the Harris Chain of Lakes. During the course of discussions it was determined that the Council could purchase a harvester and then transfer it to the Florida LAKEWATCH organization, which would operate and maintain the harvester. In April 2006 the Council approved the use of a portion of the funding received from the Florida Legislature for aquatic plant management, to purchase a mechanical harvester.

In July 2006 the Council identified a used mechanical harvester, located locally and manufactured by Aquarius Systems in North Prairie, Wisconsin. The stainless steel harvester is diesel powered, hydraulically operated and has a trailer configured with a conveyor system for loading and off loading the harvested material. The Council voted to approve the purchase of the \$20,000 mechanical harvester by the LCWA for transfer to Florida LAKEWATCH. The City of Leesburg agreed to allow the harvester to be stored at one of their Parks and Recreation facilities.

In September 2006 the Council was presented the SJRWMD Draft Upper Ocklawaha River Basin State Funding Initiative in which the Control of Nuisance Aquatic Vegetation is their #3 Priority. The SJRWMD proposes to utilize any funds received from the Florida Legislature to primarily support the efforts of the Lake County Mosquito and Aquatic Plant Management Section. Funding would also be utilized to map and monitor patches of hydrilla utilizing Global Positioning System (GPS) technology.

The Council generally supports the invasive plant management efforts of the SJRWMD, FWCC, LCWA, and the Lake County Mosquito and Aquatic Plant Management Section and was awarded \$73,900 from their 2005 – 2006 Legislative Funding Request to assist in these efforts. The Council was previously awarded \$56,250 from their 2004 – 2005 Legislative Funding Request for a cumulative total of \$130,150 to assist in aquatic plant management and weed control.

In November 2006 the Council passed Resolution No. 2006-5; A RESOLUTION OF THE HARRIS CHAIN OF LAKES RESTORATION COUNCIL REQUESTING THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT TO TRANSFER \$369,500 IN 2006 STATE APPROPRIATIONS TO THE LAKE COUNTY WATER AUTHORITY FOR THE PURPOSE OF SUPPORTING REVEGETATION WITH NATIVE VEGETATION, STOCKING OF LARGEMOUTH BASS, CONTROLLING EXOTIC AND INVASIVE VEGETATION, AND PLANTING CYPRESS TREES to transfer these funds to the LCWA for disbursement to the proper receiving agencies. A copy of that Resolution is provided as Appendix 11.

During January through April 2007 the Council heard presentations by experts in the field of aquatic sciences, aquatic plant management, and the application of aquatic herbicides. In April 2007, after careful consideration and discussion of the information provided, the Council approved the following *Consensus Items* by unanimous vote:

*Item 1 - Herbicide Application*

The current herbicide treatment and application program being performed on the Harris Chain of Lakes is conducted in accordance with the Florida Department of Environmental Protection and United States Environmental Protection Agency guidelines.

#### *Item 2 - Recommendations*

The Council agrees that until new or emerging technologies prove to be successful in improved aquatic plant management; they recommend that no changes be made to the current aquatic plant management program being conducted on the Harris Chain of Lakes. The Council encourages further investigation and research by the Florida Department of Environmental Protection to improve methods of control for nuisance and exotic species of aquatic plants.

#### **2.2.4 Revegetation of Aquatic Habitat and Cypress Tree Plantings**

**Issues:** **Enhanced near-shore aquatic vegetation can provide improved fisheries habitat and water quality. The planting of cypress trees can improve wetlands and wildlife habitat.**

**Actions:** **The Council supports the revegetation of near-shore aquatic habitats and the planting of cypress trees. Furthermore, the Council developed a Funding Initiative to address the issues of the revegetation and improvement of aquatic habitat, wetland habitat restoration, and cypress tree plantings. The Council was awarded \$147,800 from the Florida Legislature for their 2005 – 2006 Funding Initiative and passed Resolution No. 2006-5 to transfer these funds to the Lake County Water Authority for disbursement to the proper receiving agencies. The Council intends to support the appropriation of \$250,000 in their 2006 – 2007 Funding Initiative for these efforts. *This information will be updated.***

Another lake management practice discussed was the improvement of fisheries habitat and improved water quality by increasing the amount of littoral zone plant coverage. Spawning of many fish including game fish occurs within the littoral zone or near-shore portions of lakes. The drought experienced in north-central Florida during the late 1990s through the early 2000s caused lower lake levels that greatly reduced the amount of littoral plant coverage in many of the area lakes, and increased the nuisance and exotic aquatic plant species. Improvement of fisheries habitat and improved water quality can be accomplished by increasing the littoral zone plant coverage. Spawning of many fish, including game fish, occurs within the littoral zone or near-shore portions of lakes.

The Council was previously presented with information on the relationships among littoral vegetation, increased fish production, and improved water quality. Included in that information was a study conducted by the SJRWMD which addressed restoration issues for Lake Griffin. The study utilized Geographic Information Systems (GIS) mapping technology and included information on water clarity and light availability for aquatic vegetation, bathymetric data that indicated areas suitable for aquatic planting, and the potential for resuspension of sediments in the lake littoral zones. Also included in the study were estimates of soft sediment thickness in the littoral zones, which is necessary information for dredging cost estimates. The study identified areas in Lake Griffin that could be made suitable for planting desirable vegetation, with a minimum amount of soft sediment removal, generally less than two to three feet in depth. It was determined that a volume of sediments covering approximately 300 acres would need to be removed in order to achieve the goal set by the Council of 10% to 15% aquatic plant coverage in the lake. The study was conducted utilizing the light conditions within Lake Griffin in 2002. Possibly based on increased rainfall the area experienced in 2003, light conditions were determined to have increased the volume of sediments that would be required to be removed cover an area of approximately 800 acres. Additionally, revegetation efforts completed by the FWCC included the planting of approximately 500,000 littoral plants in lakes Beauclair, Dora, and Yale.

The summary of the plant surveys and information reviewed indicates that although the abundance of aquatic plants is improving in the Harris Chain of Lakes due to improved water quality and clarity, plant coverage is less than the desired percentages required to support thriving sport fish habitat. The SJRWMD, FWCC and LCWA are all actively involved in aquatic plant revegetation for improved water quality and sport fish habitat.

In January 2006 Dr. Daniel Canfield, member of the TAG to the Council provided an update on the 2004 study of Lake Apopka where students from the UF studied largemouth bass populations and aquatic macrophytes (plants). With respect to the bass counts, they noted the same catch rates as recorded by the FWCC in the 1980s and early 1990s, however; the aquatic plant populations they measured covered less than 2% of the surface area (Lake Apopka  $\approx$  30,000 acres) where fishery experts believe it should be 10 – 15% for optimum fisheries habitat.

Dr. Canfield said they also assessed the populations of eel grass (*Vallisneria sp.*) for the lake and determined that there is currently 900 meters<sup>2</sup> (m<sup>2</sup>) or 0.22 acres of this keystone aquatic plant where in 1988-1989 there was 11,000 m<sup>2</sup> or 2.72 acres. He speculated the dramatic decrease may be due to drought and other factors, including the large volume of fluid muck which does not support the plant. Dr. Canfield also cautioned that when there are reports of new colonies of *Vallisneria*, they usually consist of just a few sprigs of the plant. He said the important measure of aquatic plant populations is the total area of coverage.

In September 2006 the Council was presented the SJRWMD Draft Upper Ocklawaha River Basin State Funding Initiative in which Wetland and Aquatic Habitat Restoration is their #7 Priority and the habitat Restoration-Planting of Desirable Vegetation on Lake Apopka is their #8 Priority. The SJRWMD proposes to utilize any funds received from the Florida Legislature from their funding Initiative to plant a diversity of native aquatic and wetland plants in the Harris Chain of Lakes.

The Council supports the planting of near-shore aquatic revegetation as a means of water quality improvement and habitat restoration and was awarded \$37,500 from their 2004 – 2005 Funding Initiative to support revegetation of aquatic habitat efforts of the SJRWMD, FWCC, and LCWA.

The Council had also previously received information on the benefits of improved wetland habitat through the planting of cypress trees. It was previously discussed that cypress trees play a key role in the uptake of nutrients in wetland systems and improve wildlife habitat. Areas that would benefit from this restoration effort include the Lake Apopka Marsh Flow-way, Emerald Marsh, Venetian Gardens in the City of Leesburg, and the Lake Apopka North Shore Restoration Area. The North Shore Restoration Area along the northern portion of Lake Apopka was formerly used for farming operations. The SJRWMD has since purchased the property and is in the process of restoring the area into a series of marshes and wetlands to improve the quality of water discharged from the former farms and into Lake Apopka.

The Council also supports cypress trees plantings and the wetland restoration efforts of the SJRWMD, FWCC, and LCWA and was awarded \$18,750 from their 2004 – 2005 Funding Initiative to assist in cypress tree planting and wetland restoration efforts.

Additionally, the Council developed a Funding Initiative to address the issues of the revegetation and improvement of aquatic habitat, wetland habitat restoration and cypress tree plantings. The Council was awarded \$147,800 from the Florida Legislature for their 2005 – 2006 Funding Initiative and passed Resolution No. 2006-5 to transfer these funds to the LCWA for disbursement to the proper receiving agencies. The Council intends to request \$250,000 in their 2006 – 2007 Funding Initiative for these efforts.

### **2.2.5 Sport Fish Restocking**

**Issues: Sport fish restocking efforts will provide both recreational benefits and economic growth for the area.**

**Actions:** The Council supports sport fish restocking and research efforts being conducted by the LCWA and University of Florida, and was awarded \$147,800 from their 2005 – 2006 Legislative Funding Request. The Council passed Resolution No. 2006-5 to transfer these funds to the LCWA for disbursement to the University of Florida Institute of Food and Agricultural Sciences-Department of Fisheries and Aquatic Sciences for Florida largemouth bass restocking. Previously the Council was awarded \$187,500 from their 2004 – 2005 Legislative Funding Request to assist in the bass and sport fish restocking efforts. Additionally, the Council intends to support the appropriation of \$500,000 in their 2006 – 2007 Legislative Funding Request to assist in restocking efforts. *This information will be updated.*

Throughout the year the Council received updates and information on the benefits of restocking the Harris Chain of Lakes with Florida largemouth bass by the UF and LCWA.

During the period of December 2005 through April 2006, Dr. Daniel Canfield conducted largemouth bass restocking in Lake Griffin with the aid of graduate students from the University of Florida. In his regular updates to the Council he explained that the majority of the bass relocated were obtained from the ponds and lakes at the Orlando International Airport. He said that a directive to do so was approved by the Orange County Board of County Commissioners and that airport personnel believed reducing the number of fish in their lakes would reduce the number of bird strikes on aircraft.

The restocking efforts included the relocation of 5,033 bass greater than eight (8) inches in length and totaling over 6,000 pounds, including 21 bass that were over ten (10) pounds in size. All of the relocated fish were tagged for future identification and to assist in future fish counts. Dr. Canfield equated the value of the relocated fish to an approximate \$2 million annual return from anglers using the lake; based on National averages. Dr. Canfield said that based on the FDEP regulatory guidelines, the bass would have a value of over \$167,000. The transfer of largemouth bass is therefore, an effective management technique for restoration of the economic vitality of Lake Griffin's largemouth bass fishery.

The Council was also provided information on the technique of producing advanced fingerling bass. This technique involves the premature spawning of bass two or three months earlier than their natural spawning season. This allows the fry to grow to a size of three (3) inches or greater, prior to their release in the lakes. It is believed that releasing larger fry will allow them to better compete with the rough fish known as gizzard shad and possibly use the smaller shad fry as a food source. Additionally, advanced fingerlings released to lakes may also have a greater survival rate, as compared to the smaller fry which are more prone to

predation by larger fish. Therefore, the introduction of advanced fingerling bass to the Harris Chain of Lakes may also aide in the reduction of gizzard shad, which are considered to be a major source of nutrient resuspension and recycling, in addition to an improved survival rate.

In February 2006 Dr. Canfield informed the Council that they began using six acres of water at the United States Geological Survey (USGS) laboratory in Gainesville to conduct a program of producing advanced fingerling bass for release into the Harris Chain of Lakes in Spring 2007. Dr. Canfield explained that this is a cooperative effort with Polk County, the City of Lakeland and the City of Orlando who are allowing the UF access to their water bodies to obtain fish for spawning and restocking. He added that all of the advanced fingerlings are being fed natural food as opposed to commercially produced feed.

In his May 2006 update to the Council, Dr. Canfield said he had been offered an additional source of fish in the 200-300 acres of new ponds that have been dug at the Orlando International Airport and he has been stocking those ponds as a future source of fish. He also said that he is working with the City of Orlando and they have offered bodies of water in their jurisdiction as a possible source of fish. He explained that they are in the process of sampling those lakes to determine the viability of their use. In July 2006 Dr. Canfield told the Council that he had received permission to access lakes at the Mission Inn in Howey in the Hills. After viewing the lakes and their location he determined they could be a good source of bass for restocking any of the available lakes in the Harris Chain. Currently lakes Beauclair and Dora are not available for restocking because the SJRWMD and UF/IFAS are conducting research on the effects of gizzard excretions on water quality in those lakes.

Another source of fish for restocking the Harris Chain of Lakes is the Richloam State Fish Hatchery located in Webster. During their June 2005 meeting the Council was provided an update on the renovation of the hatchery by Rick Stout, a scientist with the FWCC and Manager of the Richloam facility. Highlights of the presentation included;

- Originally constructed in 1965 – 1966
- Largest facility in the State for indoor spawning
- They have full control over water temperature, air temperature and light
- There are six – 80 foot flowing channels or “raceways” for the fish
- The facility filters 6,600 gallons per minute which is recycled for use at the facility
- The facility can produce 1.5 million large mouth bass fingerlings per year in the 3.5 to 4 inch size class
- They breed nine species of fish including Florida largemouth bass, channel catfish, bluegill, shell crackers, and white catfish
- They produce 300,000 channel catfish per year

- Florida largemouth bass are a unique strain
- The facility allows them to work with fish genetics

At that time Mr. Stout explained that they are developing a specific feed for bass that will produce larger and healthier fish because the current feed produces bass with fatty livers that do not survive very well after being released. The new feed they are developing will have an improved balance of amino acids and fat would allow the fat to be burned up as energy and not be stored in the liver. He said the improved feed and producing larger fish may increase the success rate of the released fish to over 30%; currently the success rate is about 20%. Mr. Stout explained that the success rate will also be increased by spawning the bass a couple of months earlier than normal so when they are released, the advanced fingerlings will feed on the shad fry. The Richloam State Fish Hatchery is in the process of producing advanced fingerling bass to productively restock lakes throughout the State.

Another issue discussed regarding bass restocking involved the genetic strain of bass to be released into Florida lakes. During the July 2005 meeting John Benton, a biologist with the FWCC told the Council in the future tighter controls will be in place that regulate the genetics of bass released into the lakes, in an effort to populate the lakes with pure Florida largemouth bass. Over the years bass from outside the State have been used in restocking, which has diluted the Florida strain and the Florida largemouth bass are the most sought after by anglers. He said that permits can be issued for bass restocking, so long as those receiving the permits adhere to the rules. During the October 2005 meeting Mr. Benton explained that the FWCC proposes to implement new rules and regulations in order to protect the genetic strain of Florida bass. He said that the bass that the FWCC have been stocking over the past five to seven years have been from Florida brood stock, but in the past some of the lakes had been stocked with strains of northern bass. Mr. Benton also said that the FWCC and the University of Illinois are completing a genetic bass survey for lakes in the entire state of Florida.

In September 2006, Bill Johnson of the FWCC and member of the TAG provided an update for the Council during which he said that the Richloam State Fish Hatchery is now in operation and they are willing to provide a tour of the facility whenever the Council would like. In earlier updates he said that the hatchery should be producing advanced fingerling bass for restocking by Spring 2007. During the October 2006 Council meeting Mr. Johnson explained that restoration efforts in Lake Apopka had advanced to point where it may be feasible to begin restocking the lake with sport fish. Additionally, due to the success of sport fishing tournaments over the past two years the Harris Chain of Lakes was voted the 5<sup>th</sup> Top Bass Fishing Destination in the World in 2006 by ESPN BASSMasters.

Throughout the course of the year the Council was also provided information on fish counts, surveys, and the status of aquatic vegetation. Based on the information presented, the Council supports the efforts of the UF and FWCC on bass restocking and research, and endorses sport fish restocking as a beneficial lake management practice. The Council was awarded \$147,800 from the 2005 – 2006 Legislative Funding Request. The Council passed Resolution No. 2006-5 to transfer these funds to the LCWA for disbursement to the UF/IFAS Department of Fisheries and Aquatic Sciences for Florida largemouth bass restocking. Previously the Council was awarded \$187,500 from their 2004 – 2005 Legislative Funding Request to assist in the bass and sport fish restocking efforts. Additionally, the Council intends to request \$500,000 in their 2006 – 2007 Legislative Funding Request to assist in restocking efforts.

### **2.2.6 Potentially Toxic Algae**

**Issue:** Potential human health concerns and poor water quality associated with algal blooms.

**Actions:** The Council recognizes the potential human health concerns associated with algal blooms and supports the efforts of the Florida Department of Health, Lake County Water Authority, and Florida LAKEWATCH volunteers to monitor for algal blooms and educate the public on their potentially toxic effects. The Council intends to support the appropriation of \$250,000 in their 2006 – 2007 Legislative Funding Request to assist in these important efforts. *This information will be updated.*

Another issue discussed throughout the past four years is the potential health concerns, which have been associated with infections that can be attributed to the release of biotoxins and neurotoxins from cyanobacteria or blue-green algae.

As background to this issue, during the July 2003 meeting a presentation was given by Dr. Ritchie Shoemaker, M.D., a medical expert in the field of biotoxic and neurotoxic illnesses. His research indicated that there are potentially toxic releases from algae found in several lakes in the chain, primarily from *Cylindrospermopsis* and *Microcystis* – cyanobacterium or blue-green alga. Dr. Shoemaker's presentation also included information on *Pfiesteria* which is toxic dinoflagellate found primarily in marine environments and is associated with algae blooms and red tide. Inputs of metals, especially copper, have upset the food chain and have allowed the propagation of algal blooms. When copper, which has been used as a fungicide in area agricultural operations is introduced into the water, it kills the organisms that the *Pfiesteria* lives on (consumes) and forces it back into the water column in search of food, thus causing a "bloom." Through the food chain process, the biotoxins can be taken in by small fish near the algae they feed on. Larger fish eat the smaller fish and eventually game fish that may

then be eaten by humans can become infected with the biotoxins that can reach high concentrations. Symptoms of exposure to these biotoxins may include numbness and tingling, nausea, vomiting, headache, weakness, irregular heartbeat, prolonged difficulty with short-term memory, muscle aches, diarrhea, abdominal pain, shortness of breath, and skin problems. He believed these symptoms may have been misdiagnosed in the past as depression, Chronic Fatigue Syndrome, Fibromyalgia, Irritable Bowel Syndrome, Multiple Sclerosis, Sick Building Syndrome, Endometriosis, and learning disabilities to name a few. Dr. Shoemaker expressed his concern that the collection of symptoms is often misdiagnosed and patients have suffered from many of these symptoms for ten years or longer.

Additionally, during the July 2004 meeting Dr. Andrew Reich, the Aquatic Toxins Program Coordinator with the Bureau of Community Environmental Health – Florida Department of Health (FDOH) made a presentation. Dr. Reich explained that Harmful Algal Bloom toxins are harmful in minute (picogram) doses, they have no taste or smell, and they are very difficult to eliminate. An outbreak of cyanobacteria or blue-green algae in salt water is known as Red Tide, which can be associated with respiratory problems in people and with large fish kills. In fresh water they consist of Cyanobacterium including; *Microcystis* and *Cylindrospermopsis*. The FDOH has conducted studies which indicate that there are certain forms of cancer in humans, which can be triggered by exposure to blue-green algae. People who have reactions to Red Tide are often those who are sensitive to irritants or pulmonary disease.

Routes of exposure are via the skin, inhalation or ingestion. Mr. Reich described studies in the Chesapeake Bay where *Pfiesteria* was found to be predatory evidenced by lesions on fish that have been caused by *Pfiesteria* attacking them. He also said that the reporting developed by the Centers for Disease Control (CDC) has been centered on the issues with *Pfiesteria* and that it does not cover Red Tide or blue-green algae exposures. Mr. Reich said that the CDC is developing a reporting form that will cover other types of exposures, in order to help gather the information necessary to better assess the risks.

During the December 2004 Council meeting the Council heard another presentation on this issue by Dr. JoAnn Burkholder, an Associate Professor of Aquatic Botany and Marine Sciences at North Carolina State University. A summary of her presentation is presented below.

Dr. Burkholder began her presentation by saying that she was going to explain the differences among populations within the same species of harmful algae. Her studies indicate that different strains (populations within the same species) display different responses to environmental conditions that include the nutrients in the water column (e.g. ammonia, nitrates, and urea), water temperature and other factors. She said that due to genetic variations within the same strain, it is impossible to predict how they will react in different environmental conditions.

Dr. Burkholder also said the concept of genetic variability within the same species is one that the scientific community is slow to accept. She explained some of the different traits within these strains including; toxin production, toxicity, morphology, DNA, life history, growth rates, and nutrient metabolism or how the organism uses nutrients such as nitrogen and phosphorus.

She presented the Council with reproduction data of crossed strains which demonstrated the reproductive variability in crossing of three different strains of a toxic dinoflagellate in four combinations of pairs. The variability of the offspring production rates and the viability of the offspring varied greatly. Her point was that if only one or two strains of the same species were crossed, a firm understanding of the species could not be gained. She said that many strains must be studied to understand the species.

Dr. Burkholder's data included response to nitrogen depletion / replenishment which demonstrated that different strains in the same species respond dramatically different in both the numbers of individuals and their growth rates. She explained that in order to understand the cyanobacteria in the area lakes, it must first be determined what the dominant strain is during algal blooms; how they respond to nutrient pollution and how they produce toxins. The data provided by Dr. Burkholder also demonstrated that two strains of *Pfiesteria* that responded differently to fish excreta (i.e. waste). The non-inducible (non-toxic) strain had a very weak chemosensory attraction to the excreta while the toxic strain had a strong attraction.

Dr. Burkholder's presentation moved towards marine toxic dinoflagellates which can have chronic and sub-lethal impacts on mammals. These impacts include severe headaches, joint pain, muscle spasms, changes in blood pressure, nausea, vomiting, diarrhea; central peripheral autonomic nervous system dysfunction; reversible short-term memory loss, learning disabilities; malignant tumors, comprised immune systems; and dysfunction of the endocrine system. She went on to describe a series of tests that were conducted using 17 clones of a toxic dinoflagellate from an identical strain that produced toxins with various levels potency. A single clone of the original 17 was used to produce 15 sub-clones of the same strain. The sub-clones also produced toxins with a wide variability of potency.

Dr. Burkholder's presentation then moved on to fresh water toxic cyanobacteria which may be found in the area lakes. She described some of the chronic and sub-lethal impacts that toxic cyanobacteria can have on mammals with possible symptoms including nausea, vomiting, hemorrhaging, asthma-like symptoms; central nervous system dysfunction; malignant tumors (hepatic, abdominal, uterine and thoracic), and leukemia. She briefly talked about medical issues and deaths in humans associated with ingestion saying there are many recorded cases. Ingestion of toxic algae have produced gastrointestinal and hepatic illnesses through potable

water supplies in towns along the Ohio River (1931), a city in Zimbabwe (1966) and certain villages in China (1990s) where there have been cases of hepatic tumors. She explained that one of the best epidemiological studies conducted on toxic exposure was on the Aborigines in Australia (1979) where 140 children and 10 adults suffered diarrhea, severe kidney and liver (hepatic) damage. She explained that 70% of those people exposed to the toxin required intravenous therapy with some who suffered hypovolaemic or acidotic shock. Dr. Burkholder went on to say that South America has also had many cases of toxic exposures including Brazil (late 1980s) where 88 people, most of whom were children, died as a result of drinking water that contained dense blooms of *Microcystis*. Another instance known as Caruaru Syndrome occurred when 117 dialysis patients were given water from the public drinking water supply which contained a *Microcystis aeruginosa* bloom. As a result, 100 of those patients suffered acute liver failure and 49 of them died.

Dr. Burkholder then explained that one of the major difficulties with studying these organisms is that variability within the same strain is often dramatic. In the laboratory some strains produce toxins within a given environment and when that same strain is moved to an environment that has been reproduced to be identical to the first, they produce no toxins. The reasons for these anomalies are poorly understood. She said it is known that environmental factors can influence toxin production but not always consistently. Time is another variable that can affect toxin production where a strain that had previously produced toxin, may stop producing it over time. Dr. Burkholder said that the genetic variations of these organisms may also affect their ability to produce toxins however, only a limited amount of research has been conducted on their genetic makeup.

Dr. Burkholder also discussed *Cylindrospermopsis* that is present in area lakes saying tests have shown that due to genetic variations, 9 out of 24 colonies would be toxic. One of the things that has been discovered about some cultured strains of *Cylindrospermopsis raciborskii* is that they produce toxins outside their optimum conditions of light and temperature which for growth is 35°C (95°F) and for toxin production is 20°C (68°F). She also said that phosphorus is not the only nutrient that affects toxin production but that nitrogen is also very important. She explained that although cyanobacteria can fixate nitrogen from their environment, the organism uses large amounts of energy to do so. Therefore, the availability of nitrogen in the form of ammonia (NH<sub>4</sub>) influences the growth and toxin production of these cyanobacteria. She went on to say the amount of phosphorus and nitrogen required to stimulate algal blooms is relatively small compared to the amount that is available in most lakes.

Dr. Burkholder presented a graph that showed when the N:P ratio (the amount of nitrogen relative to phosphorus) was reduced, so did the occurrences of red tides and blue-green algal blooms. She explained that although this appears to be the case, these ratios change very slowly over time. Dr. Burkholder said that even

after the sources of nutrient input are controlled and reduced, large quantities of these nutrients are contained within the bottom sediments. Therefore, the larger the volume of nutrient-rich sediments in a lake, the longer it takes for the net N:P ratio to be reduced. Additionally, these nutrients can be resuspended in the water column through the action of wind and waves, which makes them available for algal blooms.

The presentation then moved onto *Pfiesteria*, a toxic dinoflagellate found in marine environments saying that organism has the ability to attack and “eat” the flesh of fish. She explained that *Pfiesteria* species can cause both surficial nonfocal and deep focal lesions on fish. *Pfiesteria* can cause death in fish due to the effects of the toxin it produces and the physical damage to the fish because of the lesions it can cause. Dr. Burkholder went on to explain that in the laboratory when *Pfiesteria* was allowed to physically attack fish, the mortality rate of the fish was greater than 90%. Additionally, when the water in the experiments was strained or filtered to remove the organisms, the toxin alone had the ability to kill fish 20 to 40% of the time, respectively. Humans exposed to aerosols (airborne particles) of the toxic fish killing cultures or to toxic *Pfiesteria* outbreaks, have suffered impacts to the central nervous system and difficulties with memory.

In summary, Dr. Burkholder stressed that not all strains of these algae are toxic and just because *Microcystis* is present, it is not necessarily of a toxic strain because there are also benign strains. She said that researchers face many challenges in the study of these organisms. She added when only one or a few strains are studied, there are different and often opposite interpretations from the data. Within the toxigenic species that have been examined, significant differences among strains are the norm; where the differences include morphology, life history, reproduction, nutrition, toxicity and others. She said that the underlying reasons for these differences are generally unknown.

Dr. Burkholder’s recommendation to the Council was that just because algal blooms occur in the area lakes; don’t automatically assume they are toxic. She said the toxic species are only potentially toxic and just because *Cylindrospermopsis* or *Microcystis* is present in a bloom, it could be benign. She also said that if the Council were in a position to educate the public or the press; that they should caution people not to assume a bloom is toxic or dangerous until the proper testing has been done.

*This information will be updated.*

During the January 2006 meeting Dr. Canfield notified the Council that the Florida Department of Health (FDOH) has contacted the Florida LAKEWATCH organization to work with them on evaluating the extent of potentially toxic algae in Florida lakes. He said the FDOH also wants to work with Dr. JoAnn Burkholder and others on studying the human health effects of toxic algae on people who live near and swim in the Harris Chain of Lakes. Dr. Canfield

explained that federal funding for various projects has been reduced and they are uncertain where the money will come from for these studies. Dr. Canfield also explained that there is some debate on what is considered an unsafe level of the algae toxin Microcystin. The World Health Organization believes it should be one (1) microgram per liter ( $\mu\text{g/L}$ ) in drinking water where other organizations believe it should be somewhat higher for exposure in lakes. He said that the debate and research continues but that the advice to not swim in water that is green due to an algal bloom, is good advice.

During his update to the Council in April 2006 Dr Canfield said that the UF had recently purchased a piece of equipment to test for *Microcystin*, the toxin produced by the blue-green algae *Microcystis*. He also explained that the company which manufactures the device is in the process of developing a test strip that can be used to determine if the level of *Microcystin* is above or below 20  $\mu\text{g/L}$ ; the Recreational Use Standard proposed by the World Health Organization. Dr. Canfield is working with Dr. Ed Philips (UF), Dr. JoAnn Burkholder and others to move forward with a program of testing and public awareness.

In July 2006 Dr. Canfield notified the Council that algae sampling was being conducted on the Harris Chain of Lakes through a cooperative effort between the LAKEWATCH organization and the FDOH. Dr. Canfield also said that the U.S. Environmental Protection Agency (EPA) is proposing to fund a toxic algae survey in lakes around the State. He asked if there are any reports of algae blooms on area lakes, that he be notified so the blooms can be sampled. During his September 2006 update to the Council Dr. Canfield said that concentrations of Microcystin they have found in the Harris Chain of Lakes ranges from 1  $\mu\text{g/L}$  to 4  $\mu\text{g/L}$ , which is well below the proposed recreational standard of 20  $\mu\text{g/L}$ . The Council also supports the efforts of Florida LAKEWATCH volunteers to monitor the lakes and collect samples of algal blooms when they occur.

The Council recognizes the potential human health concerns associated with algal blooms and supports the efforts of the FDOH, LCWA, and Florida LAKEWATCH volunteers to monitor for algal blooms and educate the public on their potentially toxic effects. The Council intends to support the appropriation of \$250,000 in their 2006 – 2007 Legislative Funding Request to assist in these important efforts.

### **2.2.7 Rough Fish Harvest**

**Issue:** The reduction of phosphorus and associated improvement of water quality through the removal of rough fish from the lakes.

**Actions:** The Council continued to support this experimental management technique as a possible method of water quality improvement, but

**awaits results from an independent study prior to giving it their full endorsement. *This information will be updated.***

Gizzard shad have been identified as an abundant species of fish that affects water quality within key lakes of the Harris Chain of Lakes. The rough fish harvest appears to provide phosphorus reduction by removal of the fish. The Council is awaiting the results of an independent evaluation of the information presented by SJRWMD before deciding whether to endorse the rough fish harvest as a means of water quality improvement.

The lake management issue with gizzard shad is that they are benthivorous, meaning they are bottom feeders and consume sediments in search of other food. The sediments contain large quantities of phosphorus and other nutrients that have settled to the bottom and shad eat the sediments. It was explained to the Council that the aqueous nature their excretions make the phosphorus more bioavailable in the water column. The greater bioavailability of phosphorus leads to the emergence of sometimes exotic or invasive aquatic vegetation and algal blooms.

In March 2005 the Council was presented with information on gizzard shad by Dr. Mike Allen of the UF/IFAS. An outline of the presentation given by Dr. Allen to the Council is provided below. The complete presentation, along with a presentation he gave on hydrilla management is provided as Appendix 12 of this report.

#### Gizzard Shad

- Important prey species for predator fish such as black bass and crappie.
- Often dominate fish biomass in hypereutrophic lakes
- Often dominate predator diets
- Found in large, eutrophic and hypereutrophic Florida lakes
- The number of fish increases with increased chlorophyll concentrations

Shad hatchlings outgrow bass hatchlings due to;

- Increased phosphorus accelerates their growth
- They can out compete predator fish for zooplankton
- They can feed either from the water column or bottom detritus

Impacts of Gizzard Shad

- Shad that are 30 to 40 millimeters (mm) in length can begin to eat detritus and bottom sediments
- May increase nutrients in the water column by resuspension of sediments
- Shad excrete nitrogen (N) and phosphorus (P) that are highly available to the water column
- Reducing shad abundance could influence water chemistry and clarity

Shad management efforts;

- Summary of gill netting activities in Lake Apopka
  - There is anecdotal evidence of reductions in phosphorus in lakes Griffin, Apopka and Denham
- The use of a 4” gill net leaves shad of breeding size behind (approximately 8”)

Gizzard shad harvest on Lake Dora

- Harvesting activities began on March 1<sup>st</sup>
- Evaluation of sport fish populations will be conducted over the next year on lakes Dora, Beauclair, Eustis and Harris
- Discussion of shad size vs. bycatches

After harvest at Lake Dora

- Evaluate gizzard shad population response
- Evaluate changes in sport fish abundance
- Compare to lakes with no harvest
- Results will show how commercial harvest impacts shad populations and lake trophic processes
- Bycatch impacts will be identified

Another method of gizzard shad management suggested by Dr. Allen to the Council included stocking the lakes with advanced bass fingerlings. This method involves the breeding of largemouth bass earlier than their natural season and allowing the fry to grow to three to four inches before being released into the lakes. The release of the advanced fingerlings would be timed to the initial spawning of the gizzard shad, such that the bass fingerlings would feed on the shad fry and out compete them in the lakes.

In his presentation to the Council, Dr. Allen explained that in order to have a successful bass restocking program there must be habitat restoration. As the water quality in a lake improves, macrophytes (aquatic plants) will begin to flourish and lakes which have a good amount of vegetative cover have very productive sport fish populations. Dr. Allen went on to say that increased bass populations in a lake will help control shad populations by the bass eating a percentage of the smaller shad. He said that studies of hybrid striped bass appear to have an impact on shad populations.

The SJRWMD continued to provide information on gizzard shad harvests throughout the course of this reporting year. During the April 2006 Council meeting Dr. Larry Battoe of the SJRWMD and member of the TAG reported that in the 2005-2006 harvests they had removed 950,000 pounds of shad from Lake Apopka, 300,000 pounds of shad from lakes Beauclair and Dora, and 280,000

pounds of shad from Lake Griffin; for a total of 1.6 million pounds for the total harvest.

Previously, Dave Walker of the SJRWMD had notified the Council that the SJRWMD is working with the UF/IFAS conducting research on a gizzard shad excretion project. In September 2006 Mr. Walker informed the Council that gizzard shad harvesting will continue in lakes Apopka and Griffin while lakes Dora and Beauclair are experimental lakes and no harvesting will be conducted in those lakes until 2007. In the SJRWMD Draft Upper Ocklawaha River Basin State Funding Initiative presented to the Council, In-Lake Nutrient Reduction via Rough Fish Harvesting is their #1 Priority. The SJRWMD proposes to utilize any funds received from the Florida Legislature to support additional harvesting efforts.

In March 2007 the Council was presented with information on the effects of gizzard shad removal by Dr. Mike Allen of the UF/IFAS. An outline of the presentation given by Dr. Allen to the Council is provided below. The complete presentation, along with a presentation he gave on hydrilla management is provided as Appendix 12 of this report. *This information to be updated.*

As noted above, the UF/IFAS Fisheries and Aquatic Sciences Department is also conducting a study on the effects of gizzard shad removal as a method of managing phosphorus in lakes. The Council will review the report and additional data on this measure, as they become available. Phosphorus reduction in the Harris Chain of Lakes through the harvesting of gizzard shad is still considered an experimental or research demonstration project. The Council supports the efforts of the SJRWMD, the UF Fisheries and Aquatic Sciences Department, and gizzard shad harvesting but awaits the results of the independent study.

### **2.2.8 Lake Apopka Marsh Flow-way System**

**Issue:** Are the marsh flow-ways an effective method for phosphorus reduction of nutrient-rich waters?

**Actions:** The Council understands the importance of these restoration projects coupled with other water quality improvement measures however, they remain concerned with the discharge of water from the Lake Apopka Marsh Flow-way containing low dissolved oxygen and the cost effectiveness of the system. They will continue to review new or emerging technologies to reduce phosphorus and other nutrients entering the Harris Chain of Lakes. *This information will be updated.*

In November 2003 the SJRWMD began operation of the Lake Apopka Marsh Flow-way located near the northwest portion of Lake Apopka. The flow-way is constructed on former agricultural land that had been purchased by the SJRWMD and is located at the southern end of the Apopka-Beauclair Canal. Water from Lake Apopka enters the flow-way via the canal and then passes through a series of treatment cells where natural biological processes, along with the settling of nutrients like phosphorus and other suspended solids takes place. The “treated” water is then pumped back into the canal where the majority of the water flows back into Lake Apopka and a portion of it enters the Harris Chain of Lakes through Lake Beauclair.

Previously reported average operating efficiencies for the flow-way indicate that it is removing approximately 30% of the total phosphorus, 40% of the total nitrogen and 95% of the total suspended solids in the water treated from Lake Apopka. Since the flow-way began operation there is a reported net decrease in the amount of phosphorus discharged. However, during initial operation of the facility and in response to Hurricane Charley and Hurricane Frances in 2004, there were net increases of phosphorus discharged from the flow-way. These net increases or spikes in phosphorus load discharges were a result of much higher than average rainfall and wind action resuspending the previously settled phosphorus and other solids.

One modification made to the flow-way since operation began was the installation of an additional pump to increase the volume of water that can be discharged from the facility. Initially the facility was operated with three electric pumps that discharge 50 cubic feet per second each. A fourth electric pump with a capacity of 37.5 cubic feet per second, serves as a backup to the primary pumping system. Normal operation of the facility discharges 150 – 160 cubic feet of treated water per second to the Apopka-Beauclair Canal. With the installation of the additional pump, the facility can be operated to discharge water up to 200 cubic feet per second. Approximately 7.5% of the water released from the flow-way enters Lake Beauclair and the Harris Chain of Lakes. The other 92.5% of the treated water is returned to Lake Apopka.

Cumulative data for the period of operation from November 2003 through May 2006 indicate that the flow-way has removed 6.2 tons (5.6 metric tonnes) of phosphorus, 267 tons (294 metric tonnes) of nitrogen and 9,718 tons (10,690 metric tonnes) of total suspended solids. He added that since operation of the flow-way began, 125% of Lake Apopka’s volume had been treated.

In September 2006 the Council was informed that alum injection testing within the flow-way had begun, in an effort to better control spikes of phosphorus in the water discharged from the facility. Alum or aluminum sulfate is a compound that can be applied directly to water. Dissolved and particulate phosphorus is bound or “adsorbed” to the alum, which reduces the bioavailability of the nutrient. The

bound phosphorus and alum settles to the bottom of the water column where it remains as inert floc.

In the SJRWMD Draft Upper Ocklawaha River Basin State Funding Initiative presented to the Council in September 2006, Apopka-Beauclair Canal Nutrient Reduction is their #5 Priority. The SJRWMD proposes to utilize any funds received from the Florida Legislature to support the Lake Apopka Marsh Flow-way and other efforts to improve the quality of water flowing through the Apopka-Beauclair Canal.

As with most marsh systems, the water leaving the marsh can typically contain low concentrations of dissolved oxygen, sometimes below State Water Quality Standards. To date, there has been no report of fish kills or other issues related to the discharge of water containing low dissolved oxygen concentrations. The Council remains concerned with the discharge of water from the flow-way containing low dissolved oxygen and the cost effectiveness of the system. They will continue to review new or emerging technologies to reduce phosphorus and other nutrients entering the Harris Chain of Lakes.

### **2.2.9 Total Maximum Daily Loads and Pollution Load Reduction Goals**

**Issue:** The Florida Department of Environmental Protection has set guidelines for Total Maximum Daily Loads and Pollution Load Reduction Goals as they relate to water quality.

**Actions:** The Council agreed to continue to monitor the Total Maximum Daily Load and Pollution Load Reduction Goal programs.

*This information to be updated.*

The FDEP and SJRWMD provided information to the Council regarding Total Maximum Daily Loads (TMDLs) and Pollution Load Reduction Goals (PLRGs) guidelines and implementation. PLRGs are similar in intent to TMDLs and are defined as an estimated numeric reduction in pollutant loads, which would be required to preserve or restore water quality consistent with the applicable State water quality standards. Each of the water management districts in Florida was required by the FDEP to develop PLRGs for pollutants in priority water bodies within their boundaries.

Barbara Bess, an FDEP Watershed Management Coordinator and member of the Technical Advisory Group to the Council provided updates throughout the year on the progress of the TMDL Program. During the April 2005 meeting she explained the TMDL process as a 5-year cycle that began with acquiring water quality data from all the various agencies to assess the Ocklawaha River Basin. From the assessment the FDEP assembled a list of Impaired Waters, targeted for the TMDL Program and forwarded that list to the Environmental Protection Agency (EPA).

The Verified Impaired Waters List was returned by the EPA and the FDEP began developing the TMDLs for the most critical water bodies first. Ms. Bess added that the EPA has allowed 12 years to develop TMDLs for all water bodies in the State.

Ms. Bess had previously explained that Interim PLRGs for phosphorus for six of the major lakes in the UORB including lakes Beauclair, Dora, Eustis, Griffin, Harris, and Yale, were developed by the SJRWMD. The recommended PLRGs for phosphorus were determined by calculating the difference between the current phosphorus loads within the lakes and the reduced loads needed to restore the lakes to their historic conditions. The historic phosphorus concentrations of the lakes were estimated through a review of existing conditions in reference lakes and modeling of historic conditions in the basin. Target phosphorus concentrations were calculated by the SJRWMD utilizing the state water quality standard for transparency as set forth in Section 62-302.530 of the Florida Administrative Code (F.A.C), which provides for a 10% increase in transparency for surface water bodies.

Upon completion of PLRG development the FDEP utilized the recommended load reductions to develop TMDLs for all of the lakes in the Harris Chain of Lakes except for Lake Weir. The 10 year average phosphorus concentrations and annual loads were determined for each lake and then target phosphorus concentrations were estimated using this information. The target concentration represents the total phosphorus concentration at which phosphorus loading to the lakes will achieve the load reduction necessary to meet the TMDL and to restore water quality consistent with the applicable state water quality standards. The TMDLs were adopted by rule and can be found in Chapter 62-307, F.A.C.

The current levels and interim recommendations for external total phosphorus (TP) loads for the lakes are provided in the table below:

Lake	External Total Phosphorus Load			Reduction Needed
	Current TP Load (pounds/year)	TMDL (pounds/year)	Target TP Concentration (parts per billion)	
<b>Apopka</b>	136,070	35,060	<b>55</b>	75.6%
<b>Beauclair</b>	46,746	7,056	<b>32</b>	85 %
<b>Dora</b>	39,690	13,230	<b>31</b>	67 %
<b>Eustis</b>	35,500	20,286	<b>25</b>	43 %
<b>Griffin</b>	79,121	26,901	<b>32</b>	66 %
<b>Harris</b>	26,915	18,302	<b>26</b>	32 %
<b>Weir</b>	-	-	-	-
<b>Yale</b>	3,160	2,844	<b>20</b>	10 %

Information provided by the FDEP. A TMDL for TP has not been developed for Lake Weir.

Throughout the year the FDEP met with the Ocklawaha Basin Working Group (BWG) comprising local governments and stakeholders to develop a Basin Management Action Plan (BMAP) to implement the TMDL Program. Ms. Bess said that the TMDLs and BMAP for the Upper Ocklawaha River Basin are the first ones being developed in the FDEP Central District. Once the BMAP is complete they will get local government officials to approve it, then it will be the responsibility of local governments to provide funding to implement the primarily stormwater management projects to meet the TMDLs. At the end of the first 5-year cycle a reassessment of the water quality, projects, and program goals will be conducted and adjustments made accordingly. The 5-year cycle will repeat until all the goals of the program are met.

In April 2006 Ms. Bess gave a presentation on the development of the BMAP a handout with excerpts from the Draft BMAP. A copy of that handout is provided as Appendix 13. During her presentation Ms. Bess explained that the BWG has concluded that lakes Harris, Griffin and Yale in the Harris Chain of Lakes will not be able to meet their respective Total Maximum Daily Load (TMDL) target goals. Ms. Bess explained that local governments have done a good job controlling point sources of pollutants, but they are now going to start working on other pollutant reduction measures including:

- Additional stormwater treatment and management
- Septic tank maintenance and installation of sanitary sewer systems
- Review lawn maintenance regulation and public awareness to minimize the volume of chemicals used
- Begin working with local governments to better manage future growth that minimizes polluted runoff

In August 2006 Ms. Bess gave a presentation on the final draft of the BMAP. During that presentation she provided a map of the estimated results on the lakes after implementation of the BMAP. A copy of that map is provided as Appendix 14 of this annual report. Below is a summary of her presentation.

- Basin Management Action Plan (BMAP)
  - The final draft of the BMAP has been developed
  - Many of the local governments in the Upper Ocklawaha River Basin have passed resolutions to support the BMAP
- Total Maximum Daily Loads (TMDLs)
  - A map of the basin indicated the estimated results of implementing the BMAP

- Lakes in blue and pink will meet their TMDL goals for Total Phosphorus; however the BWG does not believe it will happen in the first 5-year cycle of the TMDL Program.
- Lake Harris is not expected to meet its respective TMDL goals at any time in the near future due to growth in the area. The BWG believes that Total Phosphorus will continue to increase over the next several years.
- Local governments will have to face the growth issues [and effects on the lakes].
- Modified and new stormwater rules must be written in the next few years to include more treatment of the water released.
- The FDEP would like to see local governments review their water quality data and implement regulations to improve the quality of stormwater discharges.
- TMDL goals may be modified over time based on new or updated information.

After the presentation Mr. Walker explained that he has been the SJRWMD representative for the past two (2) years during development of the BMAP and the SJRWMD is requiring that new development conform to the Impaired Water Rule, such that water discharged from developments does not adversely affect the water quality of surface waters or add to their nutrient loads. He also said that tributary inputs to the Harris Chain of Lakes are the primary contributors to nutrient loading and cited that 93% of the nutrient load in Lake Beauclair comes from Lake Apopka. Additionally, he said that 90% of the nutrient load in Lake Dora comes from Lake Beauclair. Mr. Walker explained that the nutrient load contributions from stormwater are relatively minor when compared to the tributary contributions.

In September 2006 the Council was presented the SJRWMD Draft Upper Ocklawaha River Basin State Funding Initiative in which Support of Pollutant Load Reduction Goals for the Harris Chain of Lakes was listed as an Assessment Subproject with a #1 Priority Ranking. The SJRWMD proposes to utilize any funds received from the Florida Legislature to continue collecting water quality and plankton samples, in addition to managing the scientific database of the data collected.

Currently the Harris Chain of Lakes does not meet the TMDLs set forth. The BWG and FDEP anticipate that Lake Harris will not meet its TMDL goal in the foreseeable future. The Council supports the efforts of the FDEP and the water quality improvements the TMDL program will bring. The Council will continue to monitor the implementation of the TMDL Program and expressed concern that Lake Harris would not reach the TMDL goals.

## 2.2.10 Industrial, Wastewater, and Stormwater Impacts

*Will this section be included in the 2007 report?*

**Issues:** The potential for discharges and subsequent impacts to the Harris Chain of Lakes and especially human health from industrial, wastewater, and stormwater impacts.

**Actions:** The Council supports the efforts of the City of Leesburg Department of Environmental Services in their reorganization and upgrading of facilities. The Council also supports the efforts of Dr. Pierce Jones and the University of Florida Resource Efficient Communities Program as a method of possibly reducing stormwater runoff discharges and improving surface water quality through Low Impact Development. *This section may be removed.*

Since their inception in 2002 the Council received updates on the City of Leesburg to upgrade their wastewater conveyance and treatment facilities through Councilman Bob Kaiser. The City constructed a new wastewater treatment plant and has completed compliance related rehabilitation of the Canal Street Plant. The City of Leesburg has also completed upgrades of other facilities including lift stations and manholes, and has addressed other issues that need to be met in order to increase the operating efficiency of their sanitary system and to minimize discharges via overflows and faulty lines.

In January 2006 Councilman Kaiser formally requested that he be relieved of the duty of providing updates on the City of Leesburg's upgrades to their sanitary sewer system based on the fact that the majority of the work had been completed. The Council agreed.

The Council continues to support the efforts of the City of Leesburg Department of Environmental Services in upgrading their wastewater conveyance and treatment facilities in order to minimize nutrient-rich discharges into the Harris Chain of Lakes.

In May 2005 Dr. Pierce Jones, Director of the Program for Resource Efficient Communities at the UF gave a presentation to the Council on energy, water and development. A copy of that presentation is provided as Appendix 15. After a brief introduction of how the program was developed, he discussed the issues involving the Council.

### Harris Chain of Lakes Restoration Council

#### Challenges

- Minimize nutrient / chemical loading
- Minimize stormwater runoff
- Maximize recharge to the aquifer

Context

- Rapid Population Growth  
28 million Floridians by 2025
- Rapid Development in Lake County  
5,638 Building Permits issued in 2004

Program for Resource Efficient Communities

For 2006 Tampa Bay Water estimates the cost to deliver 1.0 million gallons of water by different sources:

Groundwater	\$ 72.43
Surface Water	\$ 75.27
Desalinated Water	\$1,060.00

Dr. Jones' presentation covered the various methods of construction for energy efficient homes and resource efficient landscaping. He gave examples of developments and builders around the State that prescribe to the Energy Star certification program. Dr. Jones suggested that the Council work with local developers to adopt certification standards which reward practices that:

- Minimize nutrient / chemical loading to the lakes
- Minimize the amount of stormwater runoff by encouraging storage and/or allowing the water to percolate into the ground
- Maximize recharge to the aquifer

Dr. Jones further suggested that the Council work with local governments, utilities and others to establish meaningful incentives which encourage builders and developers to adopt the certification standards.

In January 2006 Dr. Jones made another presentation to the Council and reminded them of the presentation he had given in 2005 on reducing nutrient-rich runoff from property under development. He went on to say that since that time, he had made additional presentations in Lake County including one to the Upper Ocklawaha River Basin, Total Maximum Daily Load (TMDL) Working Group.

Dr. Jones said that he had been asked by representatives of Lake County government to put on a workshop for County Planners to initiate a program that encourages developers to reduce negative impacts on the lakes from properties they develop. He said that one purpose of this presentation is to request funding assistance to organize the Lake County workshop. He explained that he had worked with Alachua County government to overturn an ordinance which required curb and gutter design in a particular subdivision under construction. Dr. Jones said that curb and gutter in that subdivision had the potential to discharge excessive nutrients and runoff into a nearby lake. By allowing the stormwater

runoff to collect and percolate into the ground naturally, it had reduced the runoff into the lake. Dr. Jones went on to say that this is just one example of how Low Impact Development (LID) could better manage stormwater as opposed to discharging it directly into area lakes. Overall, his work at the UF is to educate local governments to encourage developers through both reward and deterrent, in an effort to expand the use of LID.

Dr. Jones continued with his January 2006 presentation on the Program for Resource Efficient Communities:

### Florida Growth Indicators

Florida Population:

- 1980 there were approximately 10 million residents
- 2005 there were approximately 17 million residents
- 2030 there are projected to be 28 million residents

Building Permits:

- 2002 approximately 127,000 permits were issued
- 2003 approximately 155,000 permits were issued
- 2004 approximately 185,000 permits were issued

### Low Impact Development

Madera Subdivision, Gainesville – Reduced impact site design

- 88 homesites required a 7 – 8 acre park to manage stormwater
- No curb and gutter which allows more infiltration of stormwater
- Driveway paver blocks to allow infiltration as opposed to concrete driveways which simple discharges stormwater
- Reduced impact design of landscaping
  - Assistance through the Florida Yards and Neighborhoods Program
- Infiltration tanks can be used to store and release stormwater
  - Rain gutters of the house discharge to the tank

River Forest Subdivision, Bradenton

- Utilizes roadside swales as opposed to curb and gutter

### Madera Subdivision – Low Impact Lot Design

Design Outcomes:

- Reduce (minimize) nutrient / chemical loading to waterbodies
- Reduce (minimize) stormwater runoff
- Increase (maximize) recharge to the Floridan Aquifer

## Lake County Growth Indicators

### Single Family Building Permits:

- 2002 approximately 3,677 permits issued
- 2003 approximately 4,376 permits issued
- 2004 approximately 5,214 permits issued
- 2005 approximately 5,569 (through November)

## Harris Chain of Lakes Restoration

### Challenges:

- Minimize chemical and nutrient loading
- Minimize stormwater runoff
- Maximize recharge to the aquifer
- Others – including improved practices, incentives to developers and improved design

Chairman Goerner said that a booklet published by the UF called “Living on the Lake” discusses several of the issues presented by Dr. Jones. He suggested that increasing distribution of the booklet could be beneficial for development.

In August 2006 Mr. Caputo reminded the Council of the presentations they heard on Low Impact Development (LID) by Dr. Pierce Jones of the UF. Since that time, he said the acceptance of LID has been tremendous with both local governments and developers. He said that due to the success of that program, funding for additional workshops is being provided by Lake County Mosquito and Aquatic Plant Management Section, the FDEP, SJRWMD, and the EPA.

Mr. Caputo went on to say that Dr. Jones would be meeting with the City of Leesburg to discuss not only how to include LID in their regulatory process, but also how to provide incentives to developers for implementing LID. He added that the SJRWMD is providing funding for a LID workshop to be attended by representatives of St. Johns, Flagler, and Putnam counties on August 24<sup>th</sup>. Mr. Caputo said that next year the SJRWMD plans to provide funding for five (5) additional workshops and the FDEP is offering funds to assist with the development of products that come from the workshops. Additionally, he explained that UF/IFAS is working with the USEPA to provide funding for the tools local governments need to implement the LID program. Mr. Caputo said that with the tremendous success of the program in Lake County, the UF Resource Efficient Communities Program is acting as a springboard to get other local governments involved.

The Council supports the efforts of Dr. Jones and the UF Resource Efficient Communities Program as a method of possibly reducing stormwater runoff discharges and improving surface water quality.

## **2.3 Additional Lake Management Projects Presented and Reviewed**

Throughout the year the Council was presented information on proposed projects and issues related to water quality in the Harris Chain of Lakes. Final approval of these projects are in various stages of design, approval or operation by the sponsoring agencies. The Council recognizes the beneficial impacts the projects may have. Below is a summary of the proposed projects and issues presented to the Council.

### **2.3.1 The Lake Beauclair Nutrient Reduction Facility**

**Issue:** The water discharged into Lake Beauclair from the Apopka-Beauclair Canal does not meet Florida water quality standards for phosphorus.

**Actions:** The Council supports the efforts of the Lake County Water Authority to reduce phosphorus from the waters entering the Harris Chain of Lakes. *This information will be updated.*

Throughout the year the Council was presented with information on the design and progress of the Lake Beauclair Nutrient Reduction Facility. It had been previously explained that the TMDLs for phosphorus approved by the FDEP have a target concentration of 55 parts per billion (ppb) for Lake Apopka and 32 ppb for Lake Beauclair. The average phosphorus concentration in Lake Apopka prior to acquisition of the muck farms was 218 ppb and after the acquisition it had dropped to as low as 70 ppb, but is frequently higher. It was further explained that the Lake Apopka Marsh Flow-way removes approximately 30% of the phosphorus in the water from Lake Apopka before it is discharged into the Apopka-Beauclair Canal. Therefore, there needs to be a way to reduce the concentration of phosphorus even lower to meet the TMDL goal of 32 ppb for Lake Beauclair.

The Lake Beauclair Nutrient Reduction Facility is proposed to be located on a 254 acre site along the west side of the Apopka-Beauclair Canal, located just to the north of the McDonald Canal and just south of CR 48, where the SJRWMD lock and dam structure are located. The preliminary design includes two flocculation settling ponds (5 acres each) and two flocculated material drying ponds (22 acres each) to hold the material dredged from the settling ponds. It was explained that the facility will be designed to treat and discharge water at a designed flow of 300 cubic feet per second (ft<sup>3</sup>/sec). The system will divert water from the canal where it will receive flocculation treatment with aluminum sulfate or alum, which initiates the settling of phosphorus along with other nutrients and sediments. Once the solids settle to the bottom, the water is released to the canal then continues to Lake Beauclair, north of the lock and dam.

During the April 2005 meeting Lance Lombard, a Water Resources Project Manager with the LCWA gave a presentation to update the Council on the Lake Beauclair Nutrient Reduction Facility. An outline of that presentation is summarized below and the complete presentation is provided as Appendix 16.

#### Project Background

- During 1991 to 2000 the Apopka-Beauclair Canal discharged an average of 19,744 kilograms per year (kg/yr) of total phosphorus causing a persistent algal blooms in the downstream lakes
- 93% of all phosphorus going into Lake Beauclair comes from the Apopka-Beauclair Canal
- Acquisition of muck farms resulted in significant reductions in phosphorus in Lake Apopka
  - Before the acquisitions phosphorus concentrations in Lake Apopka were 218 ppb and are currently 148 ppb.
- The TMDL Target Concentration for Lake Apopka is 55 ppb
- The TMDL for TP in Lake Beauclair is 7,056 kg/yr and the Target Concentration is 32 ppb

#### Lake Apopka Marsh Flow-way

- Maximum discharge is 200 cubic feet per second (cfs)
- Phosphorus removal efficiency is 30%
- Provides “cleaner” water to the Apopka-Beauclair Canal, Lake Beauclair and downstream lakes
- The objective is to reach the goal of 55 ppb for total phosphorus in Lake Apopka

#### Lake Beauclair Nutrient Reduction Facility

- The design objective is to meet the TMDL Target Concentration of 32 ppb of total phosphorus for Lake Beauclair

Phosphorus Inputs to Lake Beauclair:

12,390 kg/yr (Apopka-Beauclair Canal) + 1,448 kg/yr (others) = 13,838 kg/yr

TMDL (Maximum Load) = 7,056 kg/yr

Required Removal = 6,782 kg/yr

- Proposed site is 254 acres located at the Apopka-Beauclair Canal Lock and Dam
- To provide offline Alum treatment of water removed from the canal, then collect the floc that settles out
- The project will utilize gravity flow for water into and out of the facility
- The settling ponds will be cleaned with a mini dredge to move the material to drying beds

- Construction costs are proposed to be \$4,261,198.00

#### Expected Results

- Totally dependent on the volume of flow from Lake Apopka
- Reduce phosphorus by 8,659 kg/yr by treating 47,844 acre-feet of water
- Discharge water to within 7% of the TMDL (assuming 100 ppb mean total phosphorus)
- Increased water clarity and revegetation

#### Schedule

- Preliminary design is submitted
- Permitting process may take considerable time
- Need to complete the design phase
- Begin construction in approximately one year

#### Project Expenses

- Design and Engineering \$230,000
- Construction \$4,260,000 +/-
- Annual Operations and Maintenance Costs \$0 to \$1,500,000
- Cooperating agencies include the SJRWMD and the FDEP

During the May 2006 meeting the Council was updated on the progress of the NuRF project by Mike Perry, Executive Director of the LCWA. Mr. Perry explained LCWA Board of Trustees (Board) approved moving forward with the 90% plans and final design of the project. He said the Board will continue to review the project in steps prior to final approval for construction. Additionally Mr. Perry said that LCWA will continue to review data from the Lake Apopka Marsh Flow-way to determine the necessity of the NuRF project

In the SJRWMD Draft Upper Ocklawaha River Basin State Funding Initiative presented to the Council in September 2006, Lake Beauclair Nutrient Reduction Facility is part of their Apopka-Beauclair Canal Nutrient Reduction Project is their #5 Priority. The SJRWMD proposes to utilize a portion of any funds received from the Florida Legislature to support this project and other efforts to improve the quality of water flowing through the Apopka-Beauclair Canal.

It is important to note that the LCWA Board has not given final approval of this project. The Board has authorized completion of the final design of the project and making application for the permits required to build and operate the facility. Construction costs are estimated at \$5.3 million and the annual operating costs are estimated to be \$1 million. The Army Corps of Engineers permit has been received and the LCWA continues to work with Lake County for a lease on the land where the facility is proposed to be constructed, and the FDEP on other

permitting issues. Upon full approval by the LCWA Board on the project, bids will be taken by private contractors to build the facility.

The Council will continue to review plans and information submitted to them for the Lake Beauclair Nutrient Reduction Facility and supports the efforts of the LCWA to reduce phosphorus and other nutrients from entering the Harris Chain of Lakes. After final approval is given by the LCWA Board, the Council will discuss supporting the project through a funding request to the Florida Legislature.

### **2.3.2 Lake Apopka North Shore Restoration Area**

**Issue: More than 50 years of farming operations along the north shore of Lake Apopka has lead to environmental degradation of the lake through the discharge of excess nutrients and agricultural chemicals.**

**Actions: The Council understands the importance of these restoration projects, coupled with other water quality improvement measures. The Council will continue to review the evolution of projects by the St. Johns River Water Management District to restore the north shore of Lake Apopka and the environmental benefits to water quality within the Harris Chain of Lakes. *This information will be updated.***

The north shore of Lake Apopka has been historically used for farming operations. For nearly 50 years these agricultural operations known a muck farms, discharged fertilizers (nutrients), herbicides and pesticides into Lake Apopka. These discharges have caused severe environmental degradation to the lake. Since 1985 the SJRWMD in partnership with other federal, state and local agencies have purchased over 19,000 acres of former muck farms to better manage and control the flow of water into Lake Apopka.

Initial efforts by the SJRWMD to restore the property included the application of an alum residual flocculent over a portion of the land to act as a soil amendment. This measure will act to bind excess nutrients such as phosphorus to the soil prior to suspension in the water column. The SJRWMD also reflooded approximately 2,000 acres of the property known as the Duda Farm in an effort to begin wetland restoration.

As background to the work being conducted at the North Shore Restoration Area a summary outline of the presentation given by Dr. Mike Coveney, a Technical Program Manager with the SJRWMD during the August 2005 Council meeting is presented below. The presentation covered projects involving Lake Apopka and Lake Beauclair that included information on the North Shore Restoration Area.

- Nutrient reduction strategies for the Upper Ocklawaha River Basin
  - Two vegetative treatment programs have been in operation for years; the Lake Apopka North Shore Restoration Area and the Emerald Marsh at Lake Griffin
  - Lakes downstream of those projects have shown significant reductions in phosphorus levels due in part to the water treatment within these wetland environments
- Convert farmlands to wetlands
  - Purpose is to reduce phosphorus and restore wetland habitat
  - Lake Apopka Marsh Flow-way was originally designed to be a much larger facility than is currently in operation
  - Pesticide residue levels on the Duda property have been reduced to levels that would allow flooding of the property
  - The permitted use of the organo-chlorine pesticide toxaphene, found on the Duda property, expired in 1990
- Phosphorus loading to Lake Apopka during the period of 1968 – 2002
  - 85% of the phosphorus loading is from current and former agricultural uses of the land
  - Atmospheric deposition accounts for approximately 8% of the phosphorus loading
  - After purchase of the farmlands by the SJRWMD in 1998 the phosphorus levels have steadily decreased
  - All water currently released into Lake Apopka is treated with alum
- Phosphorus loading reductions to Lake Apopka
  - 62.4 million grams/year historically discharged
  - 15.9 million grams/year discharged would be needed to meet TMDL for the lake
  - A 75% decrease phosphorus in runoff from agricultural lands is required to meet the TMDL
- Project phosphorus loading to accomplish 15.9 million grams/year
  - North Shore Restoration Area 37%
  - Atmospheric deposition 32%

- Contributions from springs 6%
- Contributions from tributaries 9%
- Other sources 16%
- Phosphorus loading to Lake Beauclair (estimated)
  - Dominated by flow from Lake Apopka
  - The TMDL was met in 2000 during the drought because only a limited amount of water was released from Lake Apopka
- Phosphorus loading to Lake Beauclair; Baseline versus Expected
  - With all of the treatment technologies being implemented, it will be difficult to meet the TMDL for Lake Beauclair
  - The Lake Beauclair Nutrient Reduction Facility may prove instrumental for meeting the TMDL for the lake
- Recent water quality data for the Harris Chain of Lakes for the period of June – July 2005
  - Reduced levels of phosphorus since the hurricanes of 2004
  - Increased levels of chlorophyll in Lake Griffin

In addition to the excess phosphorus available for discharge from the property the SJRWMD is also remediating an area within Unit 2 which has been determined to have increased levels of the pesticide Toxiphene. This organo-chlorine pesticide is located at what is believed to be the crash site of a crop dusting aircraft. The Council was presented with information that the SJRWMD has been conducting sampling of not only the soil, groundwater and surface water in the area, but also the testing of fish and wading birds in the area.

During the October 2005 Council meeting Dr. Gian Basili (SJRWMD) explained that the concentrations of Toxiphene appear to have been reduced by natural processes over time. One explanation he gave was that there are microbial communities in the soil that break-down the organochlorine compounds. In response to a question as to why these compounds are breaking down now as opposed to over the past 50 years he explained that in the past those communities may not have been as robust, due to active farming operations. Additional research on this issue is ongoing.

Benefits of the Lake Apopka North Shore Restoration Area include:

1. The capacity to store large volumes of stormwater runoff and better manage its discharge to Lake Apopka and the downstream lakes;
2. A portion of the property is used as the disposal facility for the dredge material from the Lake Griffin Access Canal Dredging Project, and;
3. Enhanced marshes and wetlands will provide water quality treatment by natural processes and improved wildlife habitat.

In September 2006 Dave Walker (SJRWMD) provided an update on the remediation efforts at the North Shore Restoration Area. A copy of his update is provided as Appendix 10 of this report. Mr. Walker outlined the various properties of the North Shore Restoration Area and said that the Natural Resources Conservation Service (NRCS) contributed substantial funding to purchase some of the former farmland. He said that the NRCS has provided a long-term lease of their lands to the SJRWMD and that additional coordination of restoration activities with the NRCS is required.

Mr. Walker explained that the UF and the FWCC have completed a study of concentration of the insecticide Toxaphene, in the top 12 feet of soil at the property and he displayed a map of the concentrations that they created. (Appendix 10) He went on to say that they had flooded the Duda property of the North Shore Restoration Area approximately 2 - 3 years ago and have recently received approval to flood Unit 2 of the Zellwood property.

Mr. Walker said that the SJRWMD continues to manage water levels and vegetation throughout different portions of the North Shore Restoration Area. He explained that all water released is treated with alum and the particulate matter is allowed to settle prior to the water being pumped out. Mr. Walker also said that their goal is to store more water in the North Shore Restoration Area and to release less. He explained that due to the increased rainfall over the past couple of years, the nutrient load of the water released has been equal to the entire goal of the TMDL Program for Lake Apopka.

Mr. Walker also discussed their remediation efforts. He said one method they are testing is tilling or flipping the top 3 feet of soil to bury the contaminants. The other method they are testing is the blending of the top 3 feet of soil and that preliminary results indicate an approximate 50% decrease in contaminant levels using either method. He also explained that they continue to evaluate these remediation techniques to determine, among other things, their effect on the release of phosphorus in discharges.

The Council noted that the area continues to export significant quantities of total phosphorus to Lake Apopka. The Council will therefore continue to review projects and information provided by the SJRWMD regarding ongoing and proposed remediation and restoration efforts in the Lake Apopka North Shore Restoration Area.

### 2.3.3 Harris Bayou Project

**Issue:** Improved management of water levels within the Harris Chain of Lakes and water quality benefits through nutrient uptake within the marsh.

**Actions:** The Council will continue to review the evolution of projects by the St. Johns River Water Management District to improve flow through the Harris Bayou and the environmental benefits to water quality within the Harris Chain of Lakes. *This information will be updated.*

The Harris Bayou is located between Lakes Eustis and Harris, and Lake Griffin. Historically, water naturally flowed through this system of marshes and bayou. Portions of bayou were redeveloped and used for muck farming activities that discharged excess nutrients, primarily phosphorus, into Lake Griffin.

The Council received regular updates on the progress of the Harris Bayou Project from Dave Walker (SJRWMD). Construction activities include the installation of culverts and a channel to discharge...

### 2.3.3 Emeraldal Marsh Projects

**Issue:** More than 40 years of farming operations within the Emeraldal Marsh has lead to environmental degradation of this area and Lake Griffin through the discharge of excess nutrients and agricultural chemicals.

**Actions:** The Council will continue to review the evolution of projects by the St. Johns River Water Management District to restore the Emeraldal Marsh and the environmental benefits to water quality within the Harris Chain of Lakes. *This information will be updated.*

The Emeraldal Marsh is located between Lake Yale and Lake Griffin. Beginning in the 1950s a system of levees and canals were built to drain this 6,500 acre sawgrass marsh in order to establish farms in the nutrient-rich muck. As with the area north of Lake Apopka, the muck farming activities discharged excess nutrients, primarily phosphorus into Lake Griffin.

In an effort to restore the nutrient filtering marsh the SJRWMD has initiated several projects to improve water quality and wildlife habitat in the Emeraldal Marsh. The Council has received updates on the various projects that include:

- Alum treatments to bind phosphorus with the soil as a means to reduce nutrient runoff from the site;
- Improvements to the Lake Griffin Flow-way
- Installation of pumps and culverts to better manage the water stored in the marsh, and;
- Planting of wetland vegetation and cypress trees to improve the filter capability and wildlife habitat within the marsh.

As background to these efforts, a presentation given during the March 2005 Council meeting by Dave Walker of the SJRWMD on the Emeralda Marsh and Lake Griffin Flow-way projects is provided as Appendix 17.

During that presentation Mr. Walker explained that the ACoE had approved permits to degrade the levee along the Yale-Griffin Canal. The permits also include the planting of cypress trees in the marsh. Mr. Walker explained that large areas of the marsh had been treated with alum to reduce the availability of phosphorus in discharges and an alum treatment facility will be constructed to treat water released from both the Eustis and Long farms. He said that after treatment, the water from these farms will be released into the Serpentine Swamp and East Pond for additional treatment prior to discharge into Lake Griffin.

Mr. Walker also said that the SJRWMD is currently lowering the water levels at the Laurie Brown site and pumping it into Lake Griffin while they continued to evaluate other water treatment projects that may be built on the site. He said they will initially plant wetland vegetation on the site to enhance water quality treatment and improve wildlife habitat. He also discussed the goals of the SJRWMD for phosphorus discharges from the various areas of the Emeralda Marsh. Mr. Walker explained that the maximum limit of phosphorus permitted to be discharged annually established by the Environmental Protection Agency is 5,000 pounds. Their goal is to discharge a maximum of 1,500 pounds of phosphorus per year.

Mr. Walker said that the marsh and wetland projects discussed will be able to store more water on the sites and to discharge less. This will provide better control of lake levels and also improved flood control for the area, in addition to improved water quality and wildlife habitat.

In April 2006 Dr. Larry Battoe of the SJRWMD provided an update to the Council that included information on the Emeralda Marsh projects. Below is an outline of that update.

- Emeralda Marsh
  - Alum treatment of runoff using an old SN Knight farm pond

- Alum flocculate was not able to settle due to excessive vegetation
- Removal of vegetation was completed and clear water is being discharged to Haines Creek
- Average phosphorus concentration flowing into the pond from the Emeralda Marsh is 1,500 micrograms per liter (µg/L)
- Average phosphorus discharge from the pond to Haines Creek is 50-100 µg/L
- Average phosphorus concentration of Lake Griffin is 50-100 µg/L
- Water is only discharged when water levels in the pond go beyond a set elevation
- At times the phosphorus concentration of water discharged is below that of Lake Griffin
- Average phosphorus removal with alum is 90%

The Council supports the wetland restoration efforts of the SJRWMD as a method to better manage water levels and water quality in the Harris Chain of Lakes. As with the North Shore Restoration Area of Lake Apopka, the Council remains concerned with the continued discharge of phosphorus from the Emeralda Marsh to Lake Griffin. The Council will continue to review the evolution of projects by the SJRWMD to restore the Emeralda Marsh and improve the quality of water discharged.

## **2.4 Summary of Council Recommended Actions and Consensus Items**

### **2.4.1 Actions**

Following careful review and discussion of information presented and recommendations made by the TAG, the Council voted to make the following recommendations to the Governing Board of the SJRWMD and the Florida Legislature.

*This information to be updated.*

- The Council continued to support the implementation of the enhanced lake level fluctuation schedules presented by the SJRWMD as a beneficial lake management practice. It is understood that the Lake Griffin Access Canal Dredging Project must be completed and other environmental conditions must be met prior to implementation of the fluctuation program.
- The Council fully supports access canal dredging on Lake Griffin to improve navigability of the lake during periods of lowered water levels and was awarded \$850,000 of their 2005 – 2006 funding request from the Florida Legislature to assist the LCWA with the cost of this dredging project. The Council was previously awarded \$1 million from their 2004 – 2005 Legislative Funding Request and \$500,000 from their 2003 –2004

Legislative Funding Request, for a cumulative total of \$2.35 million to assist in access canal dredging.

- The Council passed RESOLUTION 2006-5: A RESOLUTION OF THE HARRIS CHAIN OF LAKES RESTORATION COUNCIL REQUESTING THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT TO TRANSFER \$369,500 IN 2006 STATE APPROPRIATIONS TO THE LAKE COUNTY WATER AUTHORITY FOR THE PURPOSE OF SUPPORTING REVEGETATION WITH NATIVE VEGETATION, STOCKING OF LARGEMOUTH BASS, CONTROLLING EXOTIC AND INVASIVE VEGETATION, AND PLANTING CYPRESS TREES.
- The Council generally supports the invasive plant management efforts of the SJRWMD, FWCC, and the Lake County Mosquito and Aquatic Plant Management Section and was awarded \$73,900 from their 2005 – 2006 Funding Initiative to assist in these efforts. The Council passed Resolution No. 2006-5 to transfer these funds from the SJRWMD to the LCWA for disbursement to the proper receiving agencies. Previously the Council was awarded \$56,250 from their 2004 – 2005 Funding Initiative for a cumulative total of \$130,150 to assist in aquatic plant management and weed control.
- The Council supports sport fish restocking, research and efforts being conducted by the FWCC and UF/IFAS in the Harris Chain of Lakes, and was awarded \$147,800 of their 2005 – 2006 Legislative Funding Request. The Council passed Resolution No. 2006-5 to transfer these funds from the SJRWMD to the LCWA for disbursement to the UF/IFAS Department of Fisheries and Aquatic Sciences for Florida largemouth bass restocking. Previously the Council was awarded \$187,500 from their 2004 – 2005 Legislative Funding Request to assist in the bass and sport fish restocking efforts.
- The Council supports near-shore aquatic revegetation as a means of water quality improvement and habitat restoration and was awarded \$37,500 from their 2004 – 2005 Funding Initiative to support revegetation of aquatic habitat efforts of the SJRWMD, FWCC and LCWA.
- The Council also supports cypress trees plantings and the wetland restoration efforts of the SJRWMD, FWCC and LCWA and was awarded \$18,750 from their 2004 – 2005 Funding Initiative to assist in cypress tree planting and wetland restoration efforts.
- Additionally, the Council developed a 2006 – 2007 Funding Initiative to address the issues of the revegetation and improvement of aquatic habitat,

wetland habitat restoration and cypress tree plantings. The Council was awarded \$147,800 from the Florida Legislature for their 2005 – 2006 Funding Initiative to assist in these efforts and passed Resolution No. 2006-5 to transfer these funds from the SJRWMD to the LCWA for disbursement to the proper receiving agencies.

- The Council agreed that there are potential health concerns in the lakes associated with blue-green algae. They support the efforts of the FDOH, LCWA, and Florida LAKEWATCH in monitoring the lakes for potentially toxic algae and their public education efforts.

#### **2.4.2 Consensus Items**

Through their review of the technologies and research being conducted on various lake management practices, the Council agreed to support some of the efforts, but noted that further research would be necessary for some of the other technologies, and they agreed to not support others.

*This information to be updated.*

- The Council offered their continued support of the experimental investigation efforts of rough fish harvesting (predominately gizzard shad) as a method of water quality improvement, pending review of final report.
- The Council agreed to continue to review analytical data provided by the SJRWMD for the Lake Apopka Marsh Flow-way in an effort to evaluate marsh flow-way systems as a potential lake management practice.
- The Council agreed to continue to review information provided by the LCWA for the design and implementation of the Lake Beauclair Nutrient Reduction Facility as a means to reduce phosphorus concentrations in water released to downstream lakes.
- The Council agreed to continue to review information provided by the SJRWMD for projects in the Lake Apopka North Shore Restoration Area to improve the quality of water discharged to Lake Apopka and wetland habitat. The Council understands the importance of these restoration projects, coupled with other water quality improvement measures and will continue to review the evolution of projects by the SJRWMD to restore the north shore of Lake Apopka and the environmental benefits to water quality within the Harris Chain of Lakes.
- The Council offered their continued support of the efforts by the City of Leesburg Department Environmental Services in the improvement of their sanitary sewer and wastewater treatment systems. The Council also agreed to support the efforts of Dr. Pierce Jones and the University of Florida-

Resource Efficient Communities Program as a method of improving surface water quality through Low Impact Development.

- The Council agreed to support the efforts of the FDEP and the water quality improvements the Total Maximum Daily Load Program will bring. The Council will continue to monitor the implementation of Pollutant Load Reduction Goals and the Total Maximum Daily Load Programs.

## **2.5 Requested Funding**

*This information to be updated.*

The Harris Chain of Lakes Restoration Council received a combined total of \$50,000 in funding for administrative and operational costs from the LCWA (\$10,000) and the SJRWMD (\$40,000) during the 2005 – 2006 fiscal year. A portion of these funds is available for reimbursement of guest speakers who make presentations to the Council.

The Council will prepare and submit individual and combined funding initiatives to the Florida Legislature to support lake management and restoration projects as outlined below.

### **Funding:**

#### Individual Funding Request

- The Council passed a motion to support of the appropriation of \$250,000 in their 2006 – 2007 Legislative Funding Request to assist with cyanobacteria monitoring in cooperation with the Florida Department of Health and Florida LAKEWATCH in the Harris Chain of Lakes.

#### Combined Funding Initiative Request

After careful review of the lake management issues and technologies, the Council developed a Funding Initiative to provide support for projects which provide improved water quality and fisheries habitat in the Harris Chain of Lakes.

- The Council passed a motion to support the appropriation of \$500,000 in their 2006 – 2007 Funding Initiative for the purpose of Florida largemouth bass and sport fish restocking to improve the economic vitality of the Harris Chain of Lakes.
- The Council passed a motion to support the appropriation of \$250,000 in their 2006 – 2007 Funding Initiative for the purposes of revegetation of aquatic habitat, restoration of wetland habitat, and cypress tree plantings.

The Council requested no other funding during the period of this report.

Previously Awarded Funding

Below is a summary table outlining funding received from the Florida Legislature and disbursed for the projects which the Council agreed to support. The Council appreciates the continued support of the Florida Legislature and their efforts to assist in these water quality and habitat improvement projects on the Harris Chain of Lakes.

<b>Funding Received from the Florida State Legislature                      By The Harris Chain of Lakes Restoration Council                      2003 through 2006</b>				
<b>Issue</b>	<b>2003-2004</b>	<b>2004-2005</b>	<b>2005-2006</b>	<b>Total per Issue</b>
Lake Griffin Access Canal Dredging	\$ 500,000	\$ 1,000,000	\$ 850,000	<b>\$ 2,350,000</b>
Aquatic Plant Management and Weed Control	-	\$ 56,250	\$ 73,900	<b>\$ 130,150</b>
Revegetation of Aquatic Habitat, Wetland Habitat and Cypress Tree	-	\$ 56,250	\$ 147,800	<b>\$ 204,050</b>
Sport Fish Restocking	-	\$ 187,500	\$ 147,800	<b>\$ 335,300</b>
Potentially Toxic Algae	No Request	-	-	-
<b>Annual Totals</b>	<b>\$ 500,000</b>	<b>\$ 1,300,000</b>	<b>\$ 1,219,500</b>	<b>\$ 3,019,500</b>

### 3.0 Appendices

*This information to be updated.*

- Appendix 1 Enacting Legislation
- Appendix 2 Overview of the Harris Chain of Lakes
- Appendix 3 Excerpts from Monthly Meetings
- Appendix 4 Presentation by Dave Walker of the St. Johns River Water Management District on the status of modifications being made in the Harris Bayou; February 2006
- Appendix 5 Site visit to the Burrell Lock and Dam, Lowrie Brown Restoration site, and the Lake Griffin Access Canal Dredging Project; March 2006
- Appendix 6 David MacIntyre of P.B. Water gave a presentation on the growth and success of the Rapid Infiltration Basin System known as Water Conserve II in Orlando; July 2006
- Appendix 7 Presentation by Barbara Vergara, P.G. of the St. Johns River Water Management District on their Water Supply Planning Efforts; July 2006
- Appendix 8 Presentation by Dr. Mike Coveney of the St. Johns River Water Management District gave a presentation of the various efforts being conducted to reduce phosphorus concentrations in the Harris Chain of Lakes; July 2006
- Appendix 9 Presentation by Barbara Bess of the Florida Department of Environmental Protection on the Channeled Apple Snail; September 2006
- Appendix 10 Presentation by Dave Walker of the St. Johns River Water Management District on the status of the Lake Apopka North Shore Restoration; September 2006
- Appendix 11 Resolution 2006-5: A RESOLUTION OF THE HARRIS CHAIN OF LAKES RESTORATION COUNCIL REQUESTING THE ST. JOHNS RIVER WATER MANAGEMENT DISTRICT TO TRANSFER \$369,500 IN 2006 STATE APPROPRIATIONS TO THE LAKE COUNTY WATER AUTHORITY FOR THE PURPOSE OF SUPPORTING REVEGETATION WITH NATIVE VEGETATION, STOCKING OF LARGEMOUTH BASS, CONTROLLING EXOTIC AND INVASIVE VEGETATION, AND PLANTING CYPRESS TREES; November 2006
- Appendix 12 Presentation by Dr. Mike Allen of the University of Florida Institute of Food and Agricultural Sciences - Fisheries and Aquatic Sciences Department on Hydrilla Management; March 2005
- Appendix 13 Presentation by Barbara Bess of the Florida Department of Environmental Protection on the development of the Draft Basin Management Action Plan for the Total Maximum Daily Load Program; April 2006
- Appendix 14 Map which estimates the results on water quality of the lakes after implementation of the Draft Basin Management Action Plan for the Total Maximum Daily Load Program, presented by Barbara Bess of the Florida Department of Environmental Protection; August 2006

- Appendix 15 Presentation by Dr. Pierce Jones, Director of the Program for Resource Efficient Communities at the University of Florida on the concept of Low Impact Development; May 2005
- Appendix 16 Presentation by Lance Lombard of the Lake County Water Authority on the Lake Beauclair Nutrient Reduction Facility; April 2005
- Appendix 17 Presentation by David Walker of the St. Johns River Water Management District on the Emeralda Marsh and Lake Griffin Flow-way Projects; March 2005
- Appendix 18 Relevant Literature and Acknowledgements

All appendices are included on the CD that accompanies this report.

#### 4.0 Acronyms and Abbreviations

A-B Canal	Apopka-Beauclair Canal
ACoE	United States Army Corps of Engineers
B.A.S.S.	Bass Anglers Sportsman Society
BMAP	Basin Management Action Plan
BMPs	Best Management Practices
BWG	Ocklawaha Basin Working Group
CDC	Centers for Disease Control
cfs	cubic feet per second
CR	County Road
DNA	Deoxyribonucleic acid
DO	Dissolved oxygen
EPA	United States Environmental Protection Agency
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FWCC	Florida Fish and Wildlife Conservation Commission
FWS	United States Fish and Wildlife Service
IFAS	Institute of Food and Agricultural Sciences
kg/yr	kilograms per year
LCWA	Lake County Water Authority
µg/L	Micrograms per liter
N:P Ratio	Nitrogen to Phosphorus Ratio
NGVD	National Geodetic Vertical Datum
PLRG	Pollutant Load Reduction Goal
ppb	parts per billion
SJRWMD	St. Johns River Water Management District
TAG	Technical Advisory Group
TMDL	Total Maximum Daily Load
TP	Total Phosphorus
UF	University of Florida
US	United States