ORANGE CREEK BASIN
SURFACE WATER MANAGEMENT PLAN



ST JOHNS RIVER WATER MANAGEMENT DISTRICT

MAY 1996

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ORANGE CREEK BASIN
SURFACE WATER MANAGEMENT PLAN

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96-0809

EXECUTIVE SUMMARY

St. Johns River Water Management District (District) scientists have been involved in surface water investigations in the Orange Creek Basin since the late 1980's. During this period, the District developed a comprehensive hydrologic model simulating surface water movement throughout the Orange Creek Basin and used this model to predict the effects of water management alternatives on lake levels and wetlands. Other District efforts included implementation of a water quality and hydrologic monitoring network throughout the basin and land acquisition and conservation easements of environmentally sensitive wetlands around the major basin lakes.

District staff also participated on several lake task forces since the late 1980's which addressed various lake management issues. These task forces and groups were successful in identifying specific lake issues and problems, but none led to the development or implementation of restoration or management plans.

The growing public concern regarding lake issues in the basin led the District in 1993 to recommend the development of a comprehensive surface water management plan for the Orange Creek Basin. The District has authority (under Chapter 373, Florida Statutes) to function as the lead agency in the development and implementation of this plan. In addition, the District Governing Board, at the request of Governor Chiles, established the Orange Creek Basin Advisory Council. The functions of the Advisory Council are to provide guidance to District scientists in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues.

The Orange Creek Basin (OCB) Advisory Council has been meeting regularly since January 1994. Work by District scientists on the surface water management plan

for the basin was also initiated that month. The need for a basin-wide perspective on issues in the basin was apparent, as the lakes and wetlands are hydrologically and ecologically connected. This approach complemented the state's ecosystem management initiatives being formulated at that time.

The surface water management plan has been developed by District scientists in coordination with the OCB Advisory Council and the OCB Scientific Advisory Committee (SAC), which was established by the Council and advises them on technical issues. The OCB Advisory Council and OCB SAC have provided guidance to the District throughout the development of this plan.

The Orange Creek Basin Surface Water Management Plan provides a comprehensive, holistic basin-wide plan for management and restoration of aquatic and wetland resources in the basin. The plan is patterned after the successful Surface Water Improvement and Management (SWIM) program and the management plans developed for priority SWIM surface water basins. As such, this plan provides an overview of the basin, establishes basin-wide water management goals, identifies priority issues concerning basin-wide surface water management and restoration needs, establishes issue-specific goals, develops strategies to attain those goals, and describes the programs and projects necessary to implement those strategies for goal attainment.

BASIN AND SUBBASIN GOALS

The premise for developing general surface water management goals for the Orange Creek Basin is that we optimize the environmental and recreational benefits of the surface water bodies and wetlands in the basin, recognizing that they are interconnected hydrologically and ecologically. The surface water management plan therefore takes a basin-wide or holistic approach by incorporating the inter-connectedness of ecosystems

within the basin in the development of management and restoration goals and strategies. Solutions to specific issues are developed within the larger context of the entire basin.

The overall goals for surface water management in the Orange Creek Basin are:

- *TO PRESERVE, RESTORE AND MAINTAIN AQUATIC AND WETLAND RESOURCES IN THE BASIN WHILE ENHANCING, TO THE GREATEST DEGREE FEASIBLE, THOSE RECREATIONAL AND CULTURAL VALUES ASSOCIATED WITH THESE RESOURCES.*

- *TO ESTABLISH A SURFACE WATER MANAGEMENT PLAN FOR THE BASIN WHICH UTILIZES AN ECOSYSTEMS MANAGEMENT APPROACH FOR THE PROTECTION OF NATURALLY FUNCTIONAL ECOSYSTEMS AND THE MAINTENANCE OF NATIVE BIOLOGICAL DIVERSITY AND PRODUCTIVITY CONSISTENT WITH THE GENERAL POLICIES SET FORTH IN STATE WATER POLICY (CHAPTER 62-40, F.A.C.) AND IN THE DISTRICT WATER MANAGEMENT PLAN (SJRWMD 1995a).*

More specific basin-wide goals for the Orange Creek Basin, established in the context of the overall surface water management goal described above, are to:

- *Restore and maintain the basin's natural hydrology to the extent practicable and desirable.*
- *Restore and protect aquatic and wetland communities and their habitats,*
- *Protect and enhance water quality.*
- *Rehabilitate and maintain fisheries.*
- *Enhance recreational and aesthetic values.*

More specific and to the extent possible, quantitative goals for subbasins will be developed as progress is made in completing basin diagnostic projects. These subbasin goals will establish the targets toward which restoration and management progress will be

measured as the plan is implemented. Subbasin goals and, to the extent possible, subbasin management plans will be developed and incorporated into future revisions of the surface water management plan.

ISSUES

The issues addressed in this surface water management plan for the Orange Creek Basin were established through discussions with other government agencies and the public over the last ten years, and most recently through the Orange Creek Basin Advisory Council and the Orange Creek Basin Scientific Advisory Committee.

These issues constitute priority areas of focus for the management and restoration of surface water resources in the basin and are consistent with the plan's basin-wide approach. The basin issues delineated in this plan are:

- *altered hydrologic regimes.*
- *extreme low lake levels.*
- *control of exotics.*
- *protection and restoration of native aquatic plant populations.*
- *management of floating vegetation.*
- *sources of pollution in the basin.*
- *lake trophic conditions and trends.*
- *organic sediment accumulation in lakes.*
- *management and enhancement of fish and wetland wildlife habitats.*
- *land conservation and restoration.*
- *public awareness and participation.*

The plan addresses these issues from the perspective of the overall and specific basin-wide goals. For each issue, issue-specific goal(s) are established, strategies for attaining issue-specific goal(s) are described, and programs and projects that address the strategies for goal achievement are identified. Figures EX-1 through EX-11 summarize goals, strategies, programs, and projects for all 11 issues. Individual issues are described in further detail in the main body of the plan (Chapter 3).

PROGRAMS AND PROJECTS

The plan identifies and defines a total of 36 projects, organized under six major programs:

- Diagnostic Program: 10 projects.
- Feasibility Program: 6 projects.
- Restoration / Management Program: 7 projects.
- Regulatory Program: 3 projects.
- Interagency Coordination Program: 4 projects.
- Public Outreach Program: 6 projects.

Projects may be composed of one or more project elements. To facilitate cross-referencing within the document, each project has been assigned a number or code. Figures EX-12 through EX-17 summarize the projects and project elements by program, and provide information on the status of the individual project elements. Programs, projects, and project elements are described further in chapters 3 and 4.

DECISION-MAKING DURING PLAN IMPLEMENTATION

Successful implementation of this plan and attainment of all the water resource goals will depend in large part on how management and restoration decisions are made. From the outset, restoration and management decisions will consider both positive and negative impacts of decisions on the attainment of all environmental, economic, and community goals in a sub-basin. It is important that sub-basin goals not be ranked, since having unranked goals provides the balance necessary to achieve all goals in the overall decision-making process.

Cooperation and involvement of basin stakeholders (governmental agencies, local residents, business and land owners, and other members of the public) in developing and implementing the basin plan is an integral component of the ecosystem management process. The Orange Creek Basin Advisory Council, or a similar basin stakeholder council should be continued during the period of surface water management plan implementation so that basin stakeholder interests are adequately considered in making management and restoration decisions. Council meetings should be held quarterly or as often as needed so that all stakeholders have the opportunity to comment on proposed restoration and management decisions and the progress being made in implementation. A scientific advisory to serve as an advisory body to the council on technical issues should additionally be continued as necessary during the period of plan implementation.

BALANCE OF ENVIRONMENTAL AND ECONOMIC GOALS

Another important component of the ecosystem management process is the integration and balance of environmental goals with economic and community goals. The enhancement of fish and wildlife populations, recreational opportunities, and the economic benefits from recreation are all important goals in the Orange Creek Basin. In order to better measure our progress in attaining these goals, current analyses of the

economic benefits from the recreational and commercial uses of natural resources in the basin will be completed. These current economic analyses will provide baseline data by which to measure restoration and management progress toward the goal of enhancing recreational opportunities and the economic benefits from recreation.

Sub-basin restoration and management decisions should consider the economic impacts of the proposed decisions. This information will be provided to the basin advisory or stakeholder council at its regular meetings. In this way, basin stakeholders will be assured that both economic and environmental goals were considered in the decision-making process.

RESTORATION AND MANAGEMENT AUDITING

Progress in attaining all the basin and sub-basin goals in the plan must be monitored or audited on a regular basis. Management auditing is also an essential component in the ecosystem management process. Restoration and management progress will be audited on a regular basis and reported to the public and basin stakeholders. Progress toward achieving both environmental and economic goals will also be audited.

PLAN DEVELOPMENT, REVIEW AND IMPLEMENTATION

This surface water management plan was developed by District scientists utilizing existing scientific information in the literature and our past involvement in basin studies over the last 10 years. The plan has been reviewed by both the Orange Creek Basin Advisory Council and the Orange Creek Basin Scientific Advisory Committee, which include representatives from several state and local governmental agencies. On March 22 1996, the Advisory Council expressed unanimous support for the revised plan. In May 1996, the revised plan was approved by the SJRWMD Governing Board.

The projects already completed or in-progress as of FY 1995-1996 provide a sound basis for beginning the restoration and management of the surface water resources and associated natural systems. Results obtained from individual project efforts now in progress will be used to re-evaluate and re-prioritize strategies and planned projects. In this manner, the surface water management plan will be revised periodically to incorporate new knowledge toward optimal restoration and management of surface water resources in the basin. The first revision of the plan will occur within two years of approval of the plan. Future revisions will occur every three years thereafter. Subbasin restoration and management plans will be developed and updated as progress is made in completing the projects described in the overall plan.

The implementation of this plan and achievement of the goals set forth here are dependent on the continued dedication of sufficient manpower and financial resources shared by the federal, state, regional and local government agencies having responsibilities in the basin. The issues in the basin are complex, and achievement of the basin goals will be a long-term endeavor. The commitment of public resources toward implementation of this plan will require the support of the public who will ultimately benefit from these restoration and management efforts.

Figure EX-1. Issue No. 1: Altered Hydrologic Regimes.

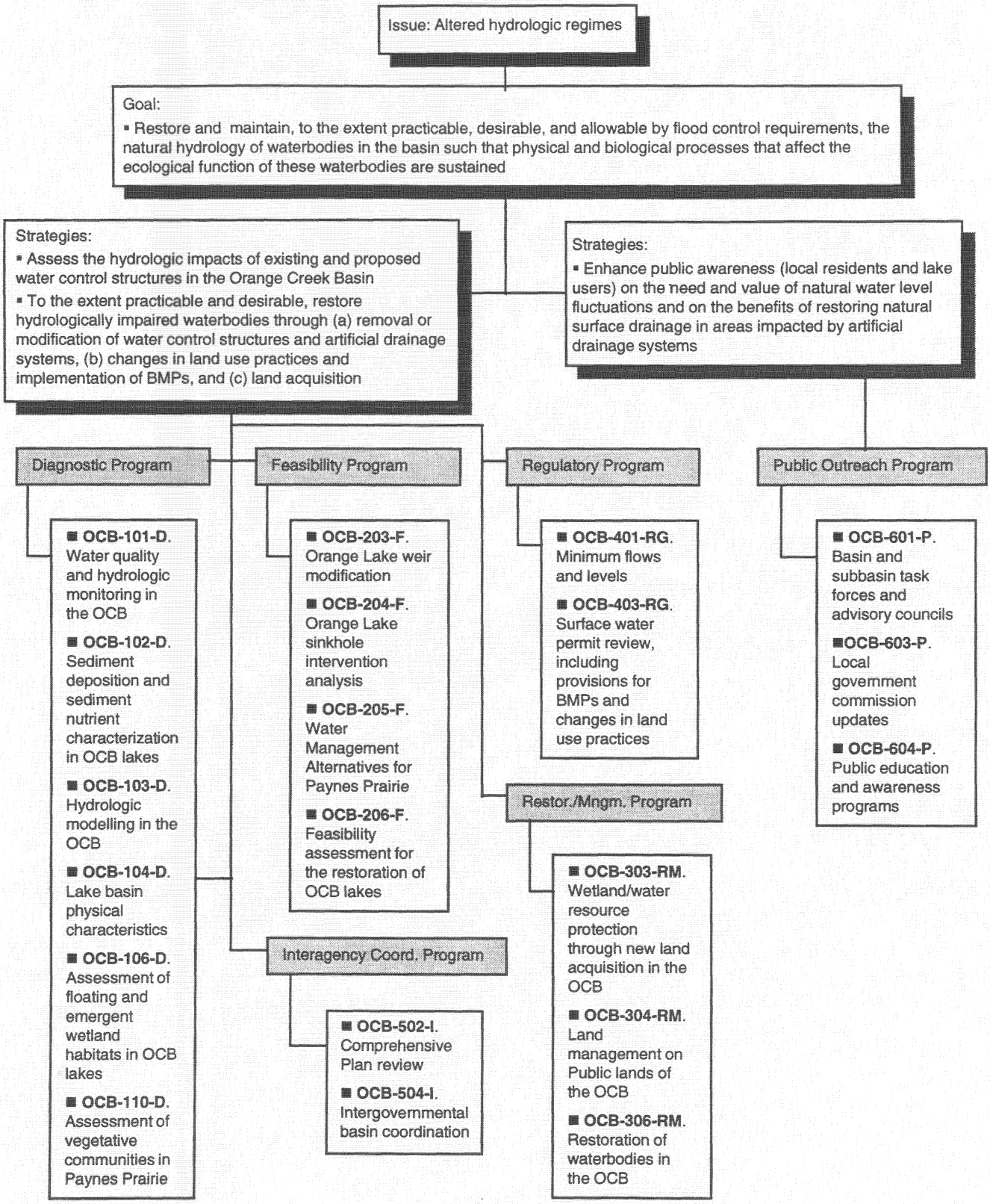


Figure EX-2. Issue No. 2: Extreme Low Lake Levels.

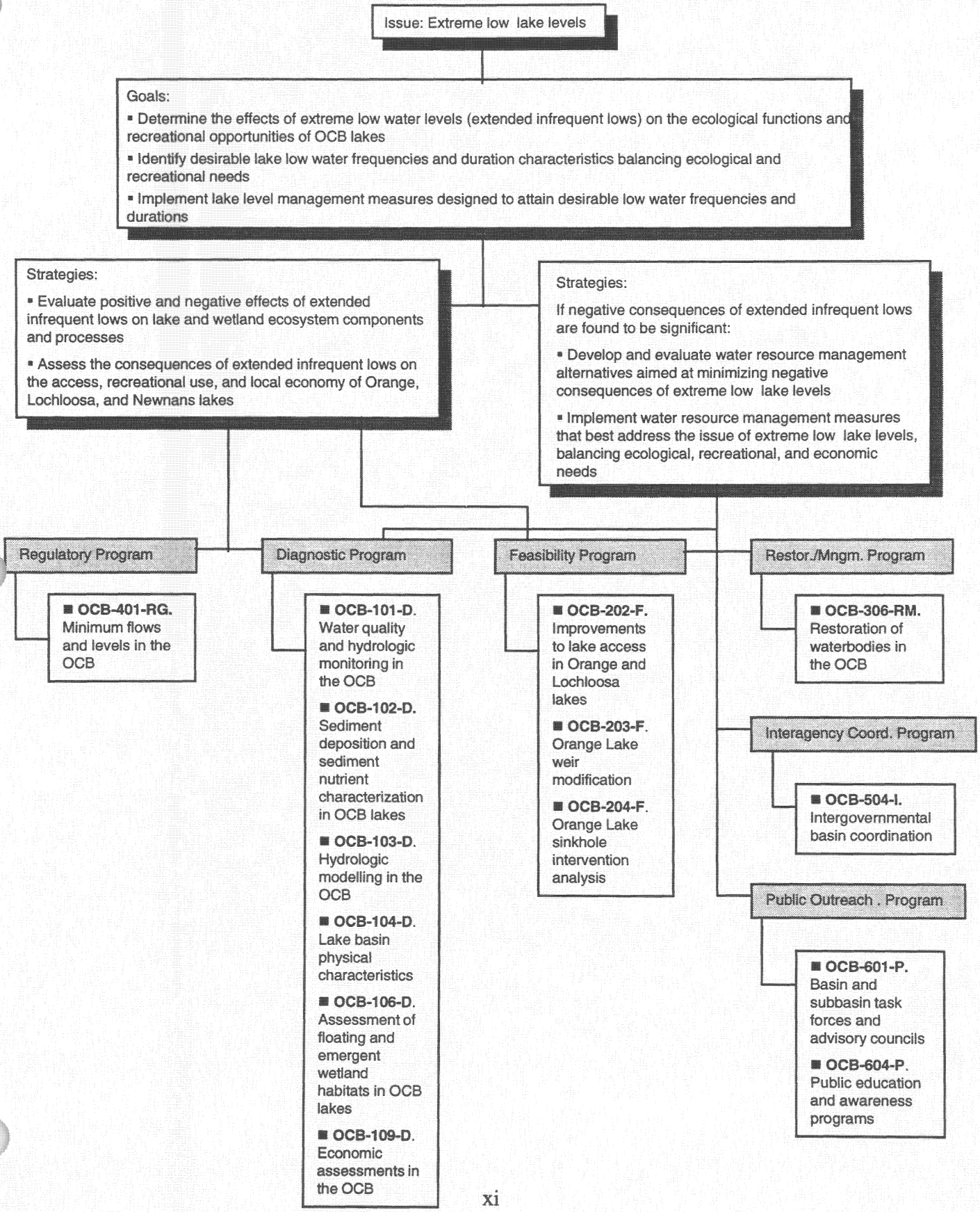


Figure EX-3. Issue No. 3: Control of Exotics.

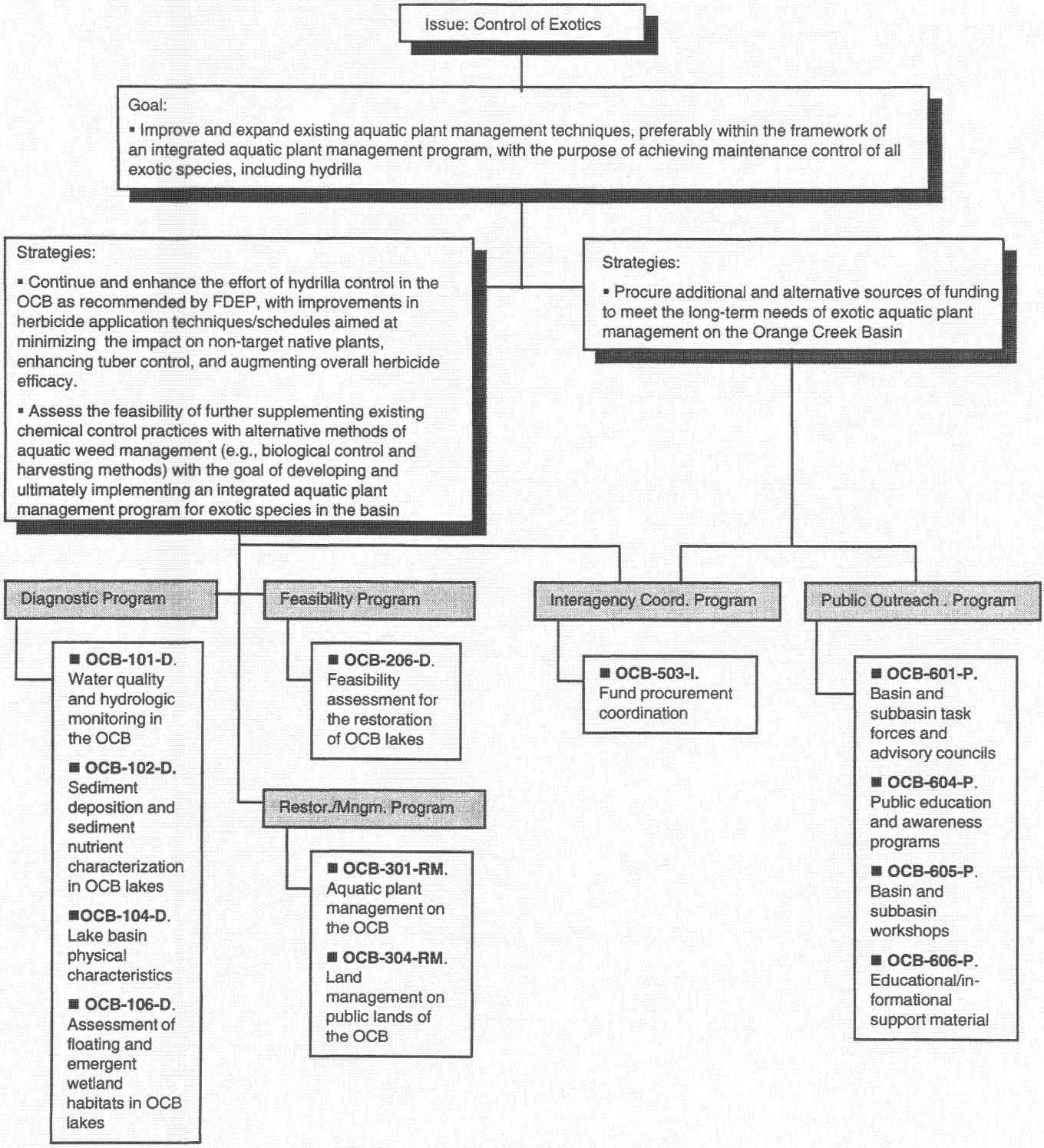


Figure EX-4. Issue No. 4: Protection and Restoration of Native Aquatic Plant Populations.

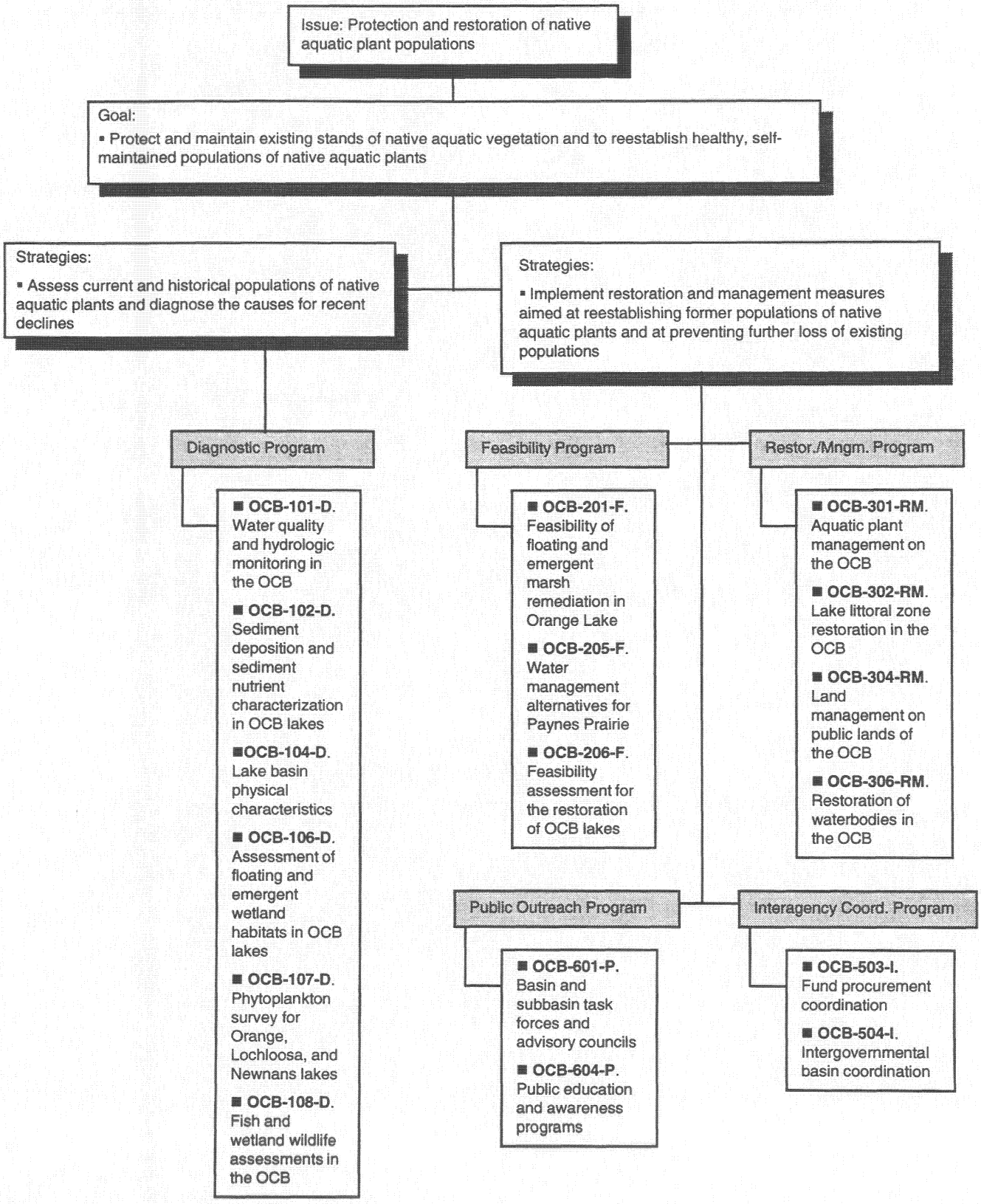


Figure EX-5. Issue No. 5: Management of Floating Vegetation.

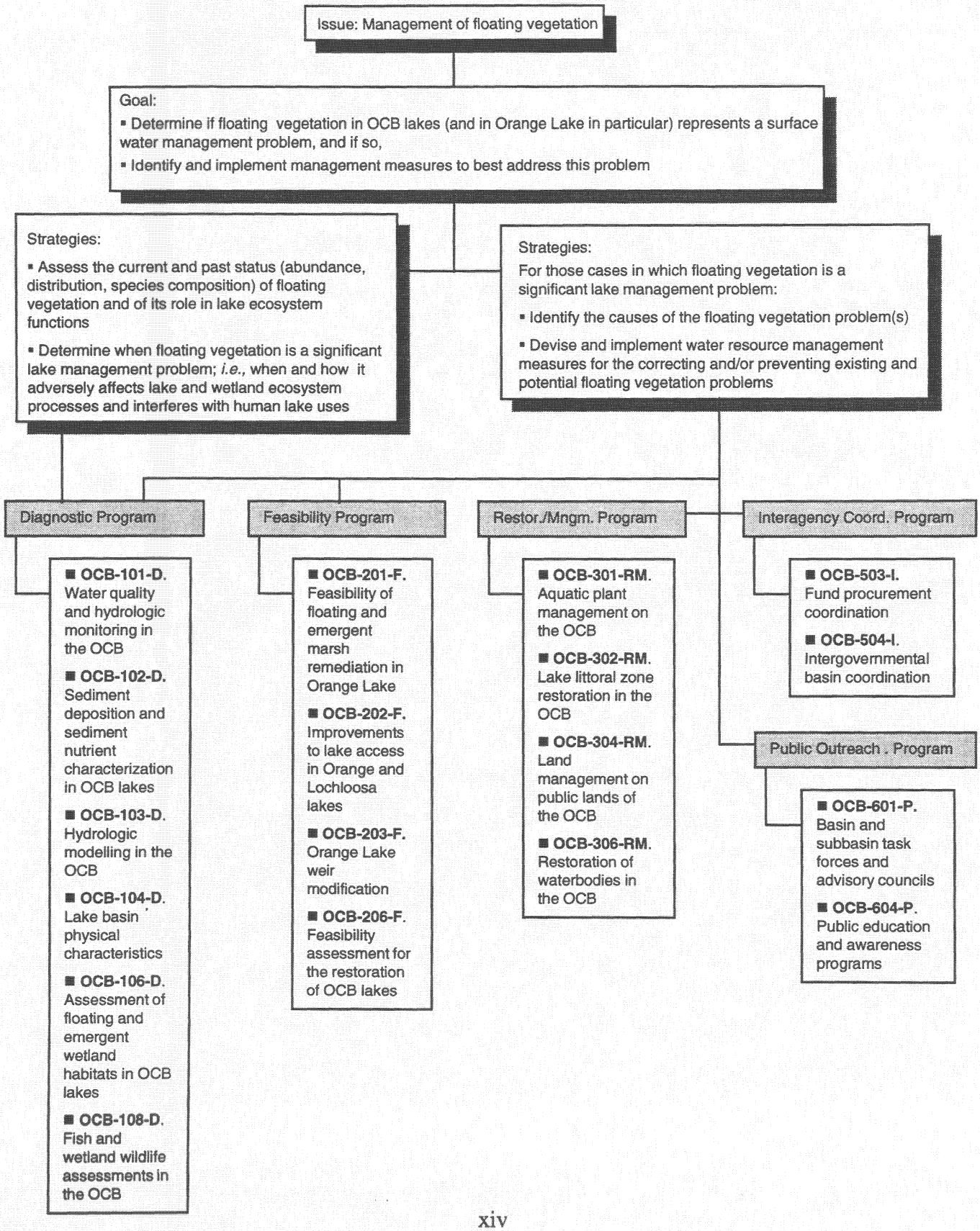


Figure EX-6. Issue No. 6: Sources of Pollution in the Basin.

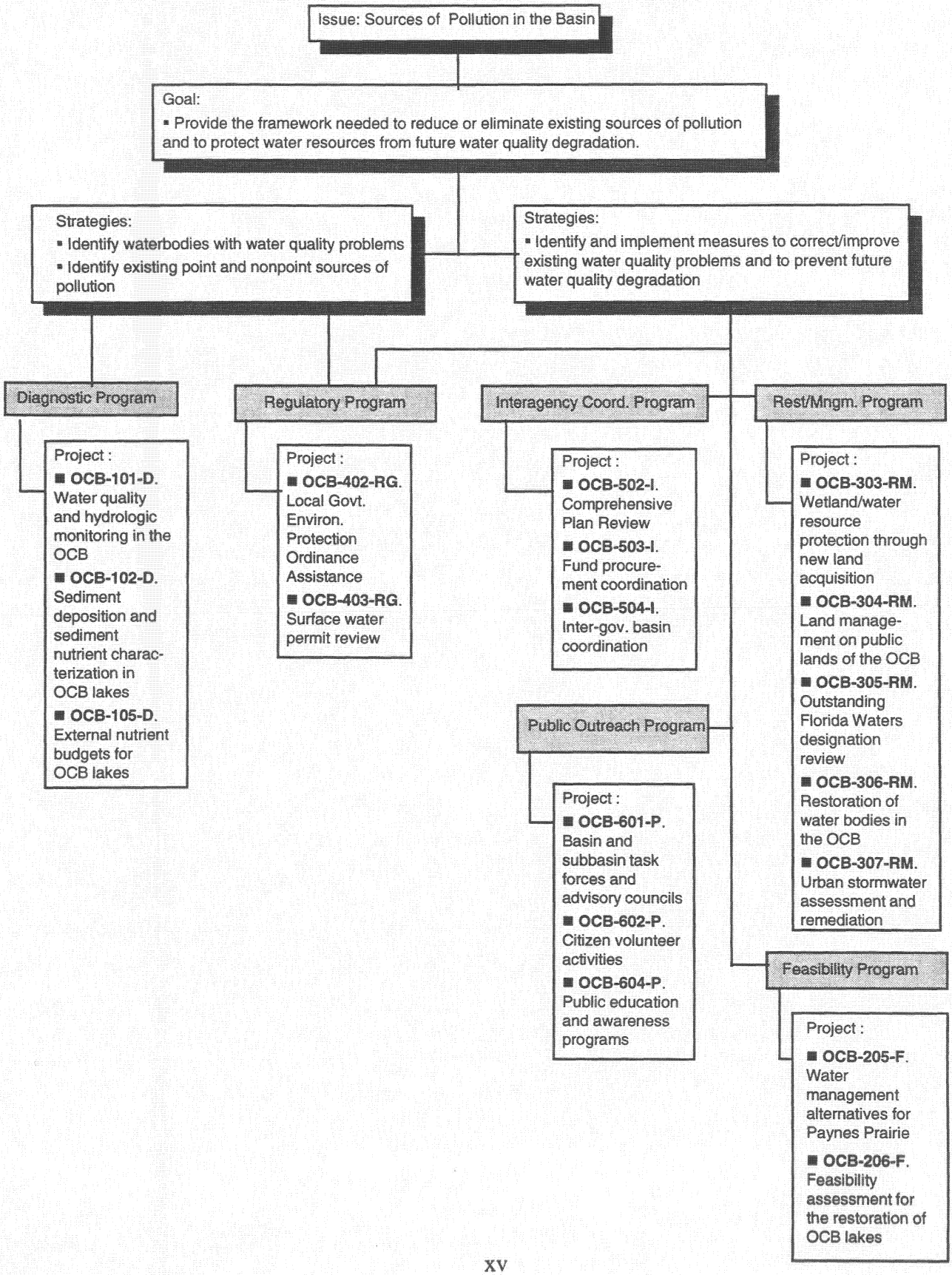


Figure EX-7. Issue No. 7: Lake Trophic Conditions and Trends.

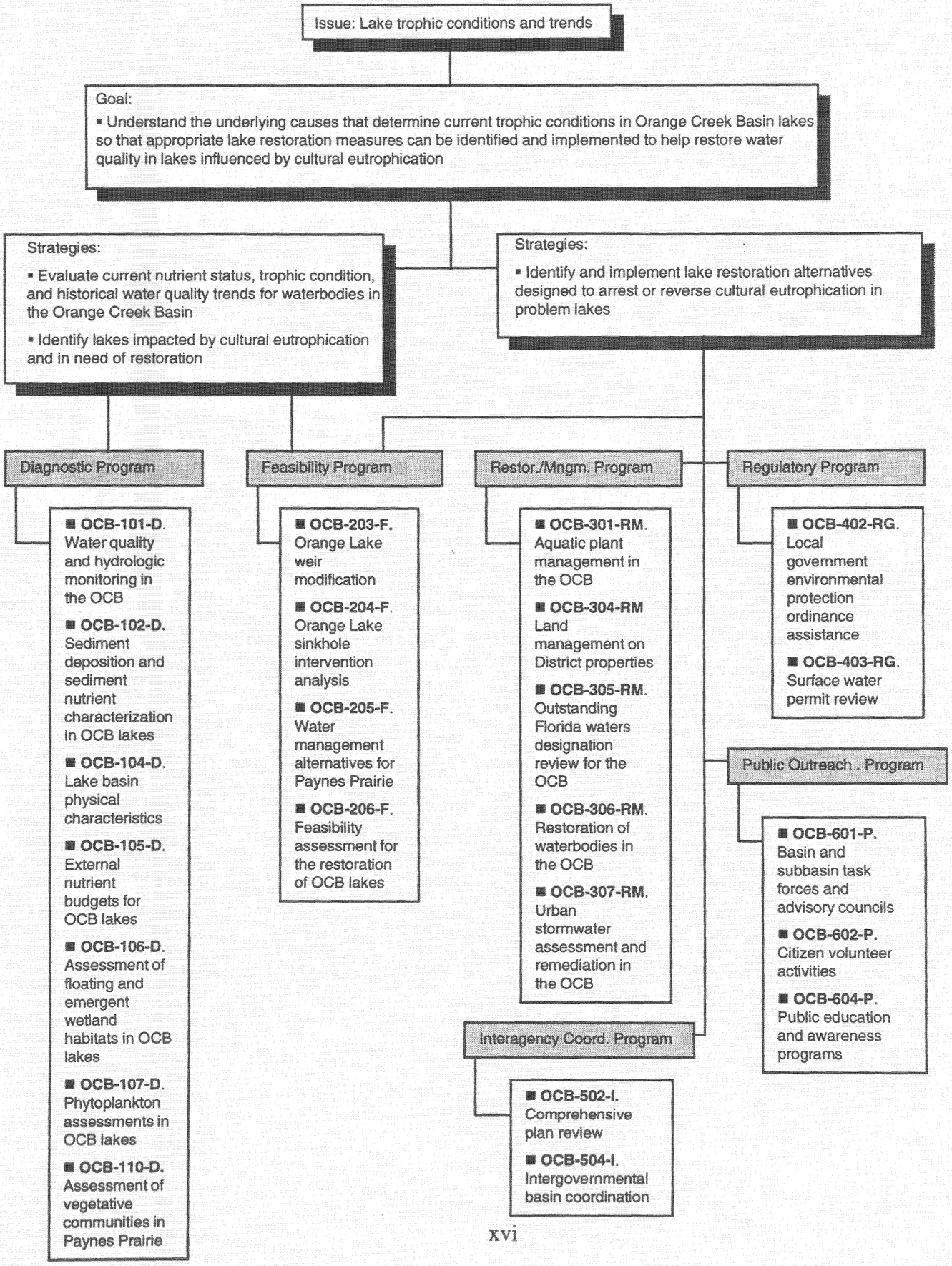


Figure EX-8. Issue No. 8: Organic sediment accumulation in lakes.

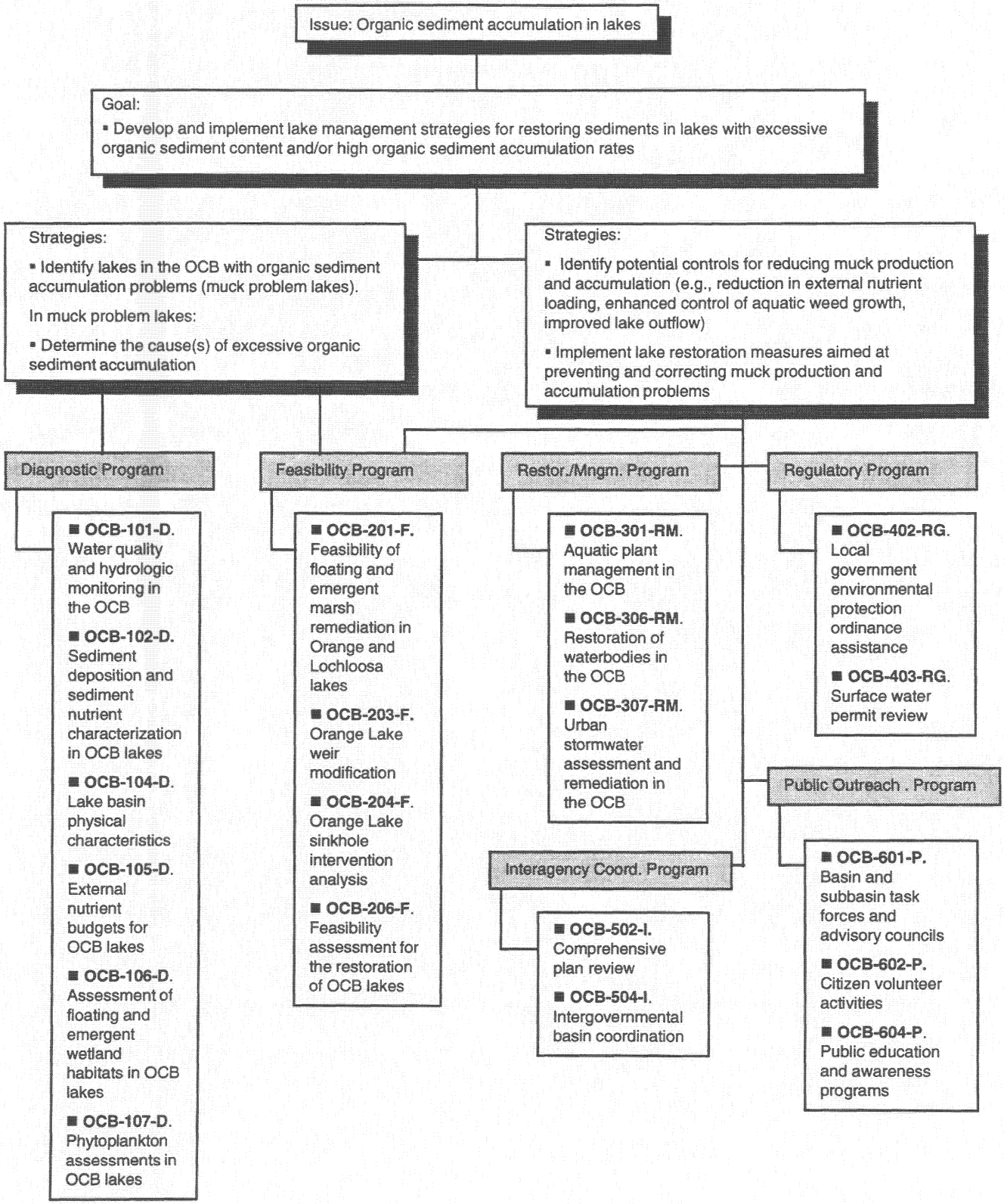


Figure EX-9. Issue No. 9: Management and enhancement of fish and wetland wildlife habitats.

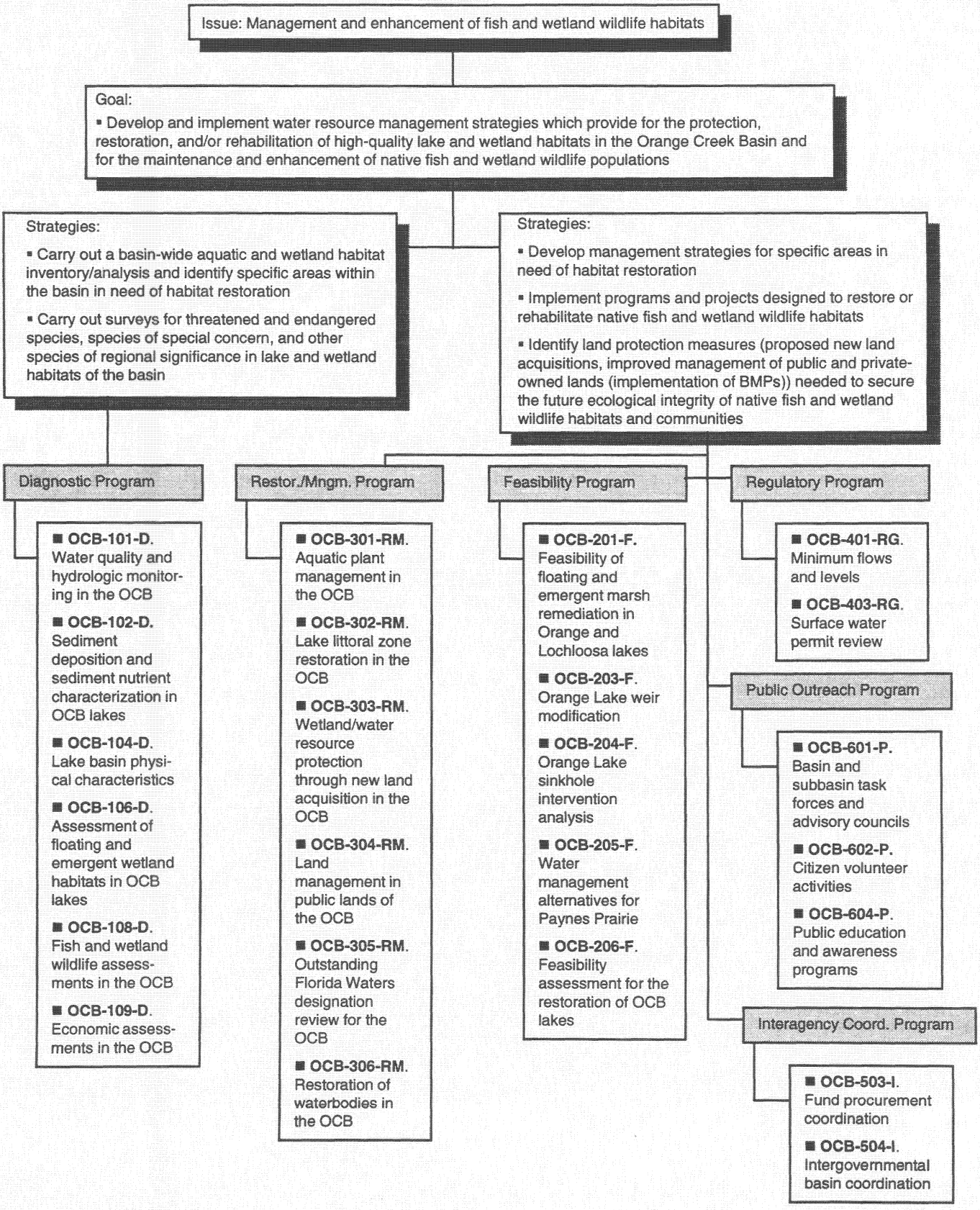


Figure EX-10. Issue No. 10: Land Conservation and Restoration.

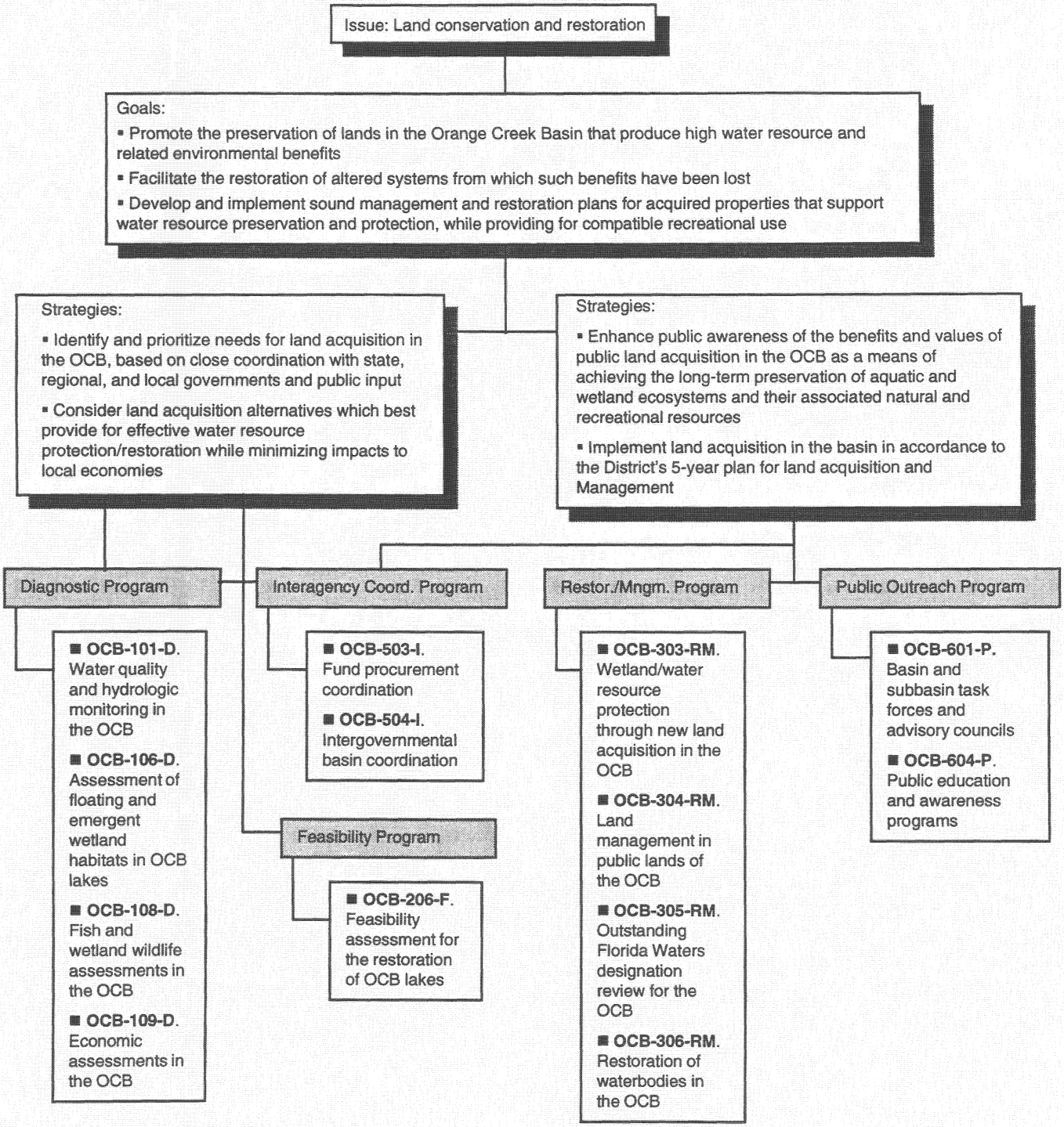
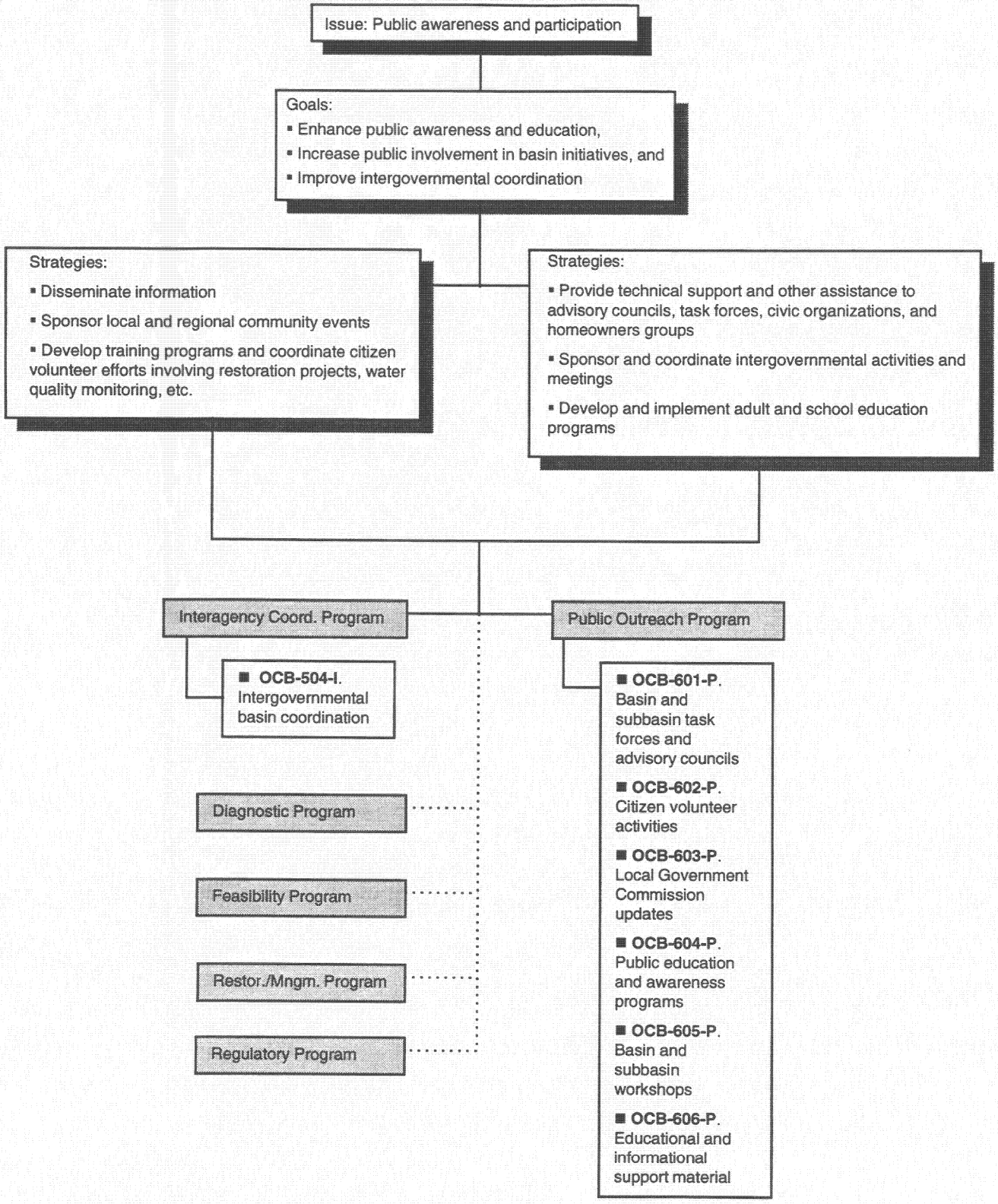


Figure EX-11. Issue No. 11: Public awareness and participation.



NOTE: Dotted lines indicate related, yet indirect support of programs to public outreach efforts in the Orange Creek Basin.

Figure EX-12

DIAGNOSTIC PROGRAM

WATER QUALITY AND HYDROLOGIC MONITORING IN THE OCB (OCB-101-D)

- ◆ District water quality monitoring in the OCB
- ◆ Review and analysis of historical and current water quality conditions in the OCB
- ◆ Inflow, outflow, and lake level monitoring in the OCB
- ● Sinkhole discharge monitoring in Orange Lake
- ● Volunteer stormwater monitoring of tributaries in the OCB (see project OCB-602-P, Public Outreach Program)
- ○ Toxic pollutant screening survey in the OCB

SEDIMENT DEPOSITION AND SEDIMENT NUTRIENT CHARACTERIZATION IN OCB LAKES (OCB-102-D)

- ★ Effects of short-term drawdown on sediments and nutrients of Newnans Lake (Phase I & II)
- ◆ Sediment and water quality reconnaissance of Newnans Lake
- ◆ Historical sediment and nutrient accumulation rates and past water quality in Orange Lake (Phase I and II)
- ● Historical sediment and nutrient accumulation rates and past water quality in Newnans Lake
- ○ Internal nutrient loading in Newnans Lake
- ○ Wind resuspension analysis in Newnans Lake

HYDROLOGIC MODELLING IN THE OCB (OCB-103-D)

- ◆ Effects of surface water management alternatives on wetlands and lake levels in the OCB

LAKE BASIN PHYSICAL CHARACTERISTICS (OCB-104-D)

- ◆ Bathymetry and sediment thickness survey of Orange Lake
- ◆ Newnans Lake outlet stream profile survey
- ◆ Orange Lake outlet stream profile survey

EXTERNAL NUTRIENT BUDGETS FOR WATERBODIES IN THE OCB (OCB-105-D)

- ◆ External Nutrient Budgets for Orange Creek Basin lakes
- ● Pollution sources in Orange, Lochloosa, and Newnans lakes

ASSESSMENT OF VEGETATIVE COMMUNITIES IN PAYNES PRAIRIE (OCB-110-D)

- ◆ Vegetative communities in Paynes Prairie and relationships with environmental factors

Project Element Status

★ Completed	● Planned - first priority
◆ In progress	○ Planned - second priority
	⊙ Planned - third priority

ASSESSMENT OF FLOATING AND EMERGENT WETLAND HABITATS IN OCB LAKES (OCB-106-D)

- ★ Wetlands mapping/inventory in the OCB
- ◆ Historical analysis of wetland vegetation in Orange, Lochloosa and Newnans lakes
- ◆ Characterization of floating and emergent vegetation in Orange Lake
- ◆ Formation of floating mats in Orange Lake and causes for historical changes
- ○ Role of floating and emergent vegetation in the nutrient dynamics of Orange Lake

PHYTOPLANKTON ASSESSMENTS IN OCB LAKES (OCB-107-D)

- ◆ Phytoplankton survey for Orange, Lochloosa, and Newnans lakes

FISH AND WETLAND WILDLIFE ASSESSMENTS IN THE OCB (OCB-108-D)

- ● Fish and wetland wildlife population and habitat analyses in Orange, Lochloosa, and Newnans lakes
- ● Inventory of T&E, SSC, and rare species in the OCB

ECONOMIC ASSESSMENTS IN THE OCB (OCB-109-D)

- ● Analyses of economic benefits from recreational and commercial uses in the OCB

Figure EX-13

FEASIBILITY PROGRAM

FEASIBILITY OF FLOATING AND EMERGENT MARSH REMEDIATION IN OCB LAKES (OCB-201-F)

◆ Feasibility of floating and emergent vegetation management in Orange and Lochloosa lakes

IMPROVEMENTS TO LAKE ACCESS IN ORANGE AND LOCHLOOSA LAKES (OCB-202-F)

★ Feasibility study of Cross Creek dredging

◆ Lake access needs

ORANGE LAKE WEIR MODIFICATION (OCB-203-F)

● Orange Lake weir modification; evaluation of management alternatives

ORANGE LAKE SINKHOLE INTERVENTION ANALYSIS (OCB-204-F)

★ High resolution seismic reflection surveys in Orange Lake

★ Engineering feasibility study, Orange Lake sinkhole remediation

◆ Karst geology and groundwater analyses in Orange Lake

● Orange Lake sinkhole intervention; evaluation of management alternatives

WATER MANAGEMENT ALTERNATIVES FOR PAYNES PRAIRIE (OCB-205-F)

★ Preliminary assessment of options for management of Sweetwater Branch surface flow into Paynes Prairie

◆ Paynes Prairie vegetation succession model

● Surface water and vegetation management options for Paynes Prairie

FEASIBILITY ASSESSMENT FOR THE RESTORATION OF OCB LAKES (OCB-206-F)

★ FGFWFC feasibility assessment of drawdown for restoring Newnans Lake (KBN Engineering)

⊙ Project elements will be developed as diagnostic projects are completed

Project Element Status

★ Completed
◆ In progress
● Planned - first priority
⊙ Planned - second priority
⊙ Planned - third priority

Figure EX-14

RESTORATION AND MANAGEMENT PROGRAM

AQUATIC PLANT MANAGEMENT IN THE OCB (OCB-301-RM)

- ◆ Aquatic vegetation monitoring in Orange, Lochloosa, and Newnans lakes
- ◆ Vegetation management in OCB lakes
- ◆ Enhancement of aquatic weed control in OCB lakes

LAKE LITTORAL ZONE RESTORATION IN THE OCB (OCB-302-RM)

- ◆ Native aquatic plant revegetation in OCB lakes (littoral planting effort by the FGFWFC currently underway at Newnans Lake)

WETLAND/WATER RESOURCE PROTECTION THROUGH NEW LAND ACQUISITION IN THE OCB (OCB-303-RM)

- ◆ Assessment of potential land acquisition in the OCB

LAND MANAGEMENT ON PUBLIC LANDS OF THE OCB (OCB-304-RM)

- ◆ Land management on District properties

OUTSTANDING FLORIDA WATERS DESIGNATION REVIEW FOR THE OCB (OCB-305-RM)

- ⊙ Expansion of OFW designations in the OCB

RESTORATION AND MANAGEMENT OF WATERBODIES IN THE OCB (OCB-306-RM)

- ⊙ Project elements will be developed as diagnostic and feasibility projects are completed.

URBAN STORMWATER ASSESSMENT AND REMEDIATION IN THE OCB (OCB-307-RM)

- ◆ Local government stormwater retrofitting assistance

Project Element Status

- ★ Completed
- ◆ In progress
- ● Planned - first priority
- ⊙ Planned - second priority
- ⊙ Planned - third priority

Figure EX-15

REGULATORY PROGRAM

MINIMUM FLOWS AND LEVELS (OCB-401-RG)
◆ Minimum flows and levels in the OCB

LOCAL GOVERNMENT ENVIRONMENTAL PROTECTION ORDINANCE ASSISTANCE (OCB-402-RG)
⊙ Remediation of nonpoint source and unregulated point source pollutant loading into waterbodies of the OCB

SURFACE WATER PERMIT REVIEW (OCB-403-RG)
◆ OCB Surface water permit review

Project Element Status

★ Completed
◆ In progress
● Planned - first priority
⊙ Planned - second priority
⊙ Planned - third priority

Figure EX-16

INTERAGENCY COORDINATION PROGRAM

OCB PLAN REVIEW (OCB-501-I)

◆ Revision of the Orange Creek Basin Surface Water Management Plan

COMPREHENSIVE PLAN REVIEW (OCB-502-I)

◆ Local government comprehensive plan review.

INTER-GOVERNMENTAL BASIN COORDINATION (OCB-504-I)

◆ Regional intergovernmental forums.

FUND PROCUREMENT COORDINATION (OCB-503-I)

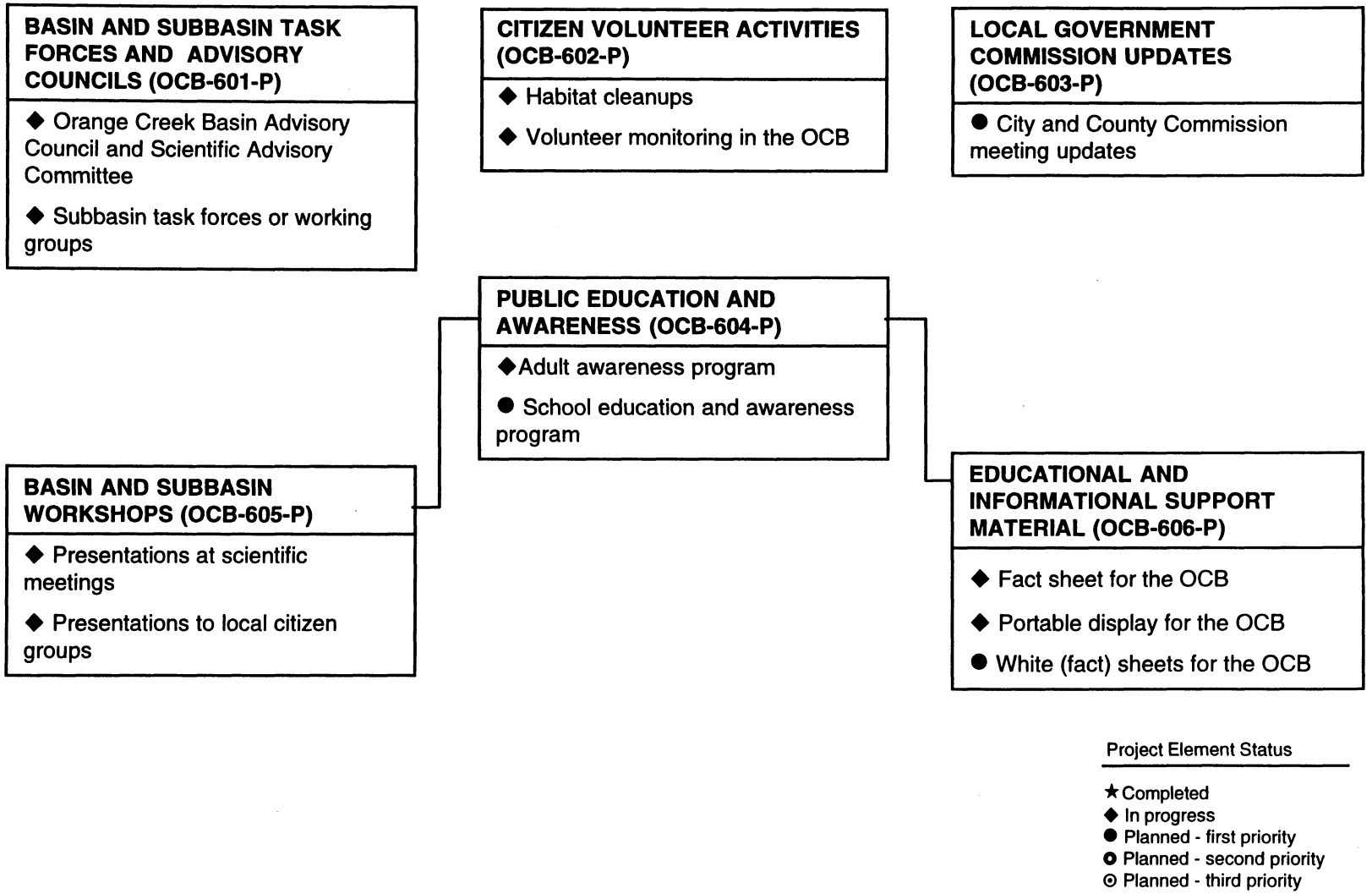
◆ Fund procurement coordination for OCB-Plan implementation

Project Element Status

★ Completed
◆ In progress
● Planned - first priority
⊙ Planned - second priority
⊙ Planned - third priority

Figure EX-17

PUBLIC OUTREACH PROGRAM



LIST OF COMMONLY USED ABBREVIATIONS

amsl	Above mean sea level
ACRWCCA	Alachua County Recreation and Water Conservation and Control Authority
Basin	Orange Creek Basin
BMPs	Best Management Practices
District	St. Johns River Water Management District
DLG	Digital Line Graph
CARL	Conservation and Recreation Lands
CUPS	Consumptive Use Permits
CFS	cubic feet per second
EPA	Environmental Protection Agency
ERP	Environmental Resources Permit
F.A.C.	Florida Administrative Code
FDCA	Florida Department of Community Affairs
FDHRS	Department of Health and Rehabilitative Service
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation (now part of FDEP)
FDNR	Florida Department of Natural Resources (now part of FDEP)
FDOT	Department of Transportation
FGFWFC	Florida Game and Fresh Water Fish Commission
FLUCCS	Florida Land Use Cover Classification Scheme
GIS	Geographic Information Systems
GRU	Gainesville Regional Utilities
IFAS	University of Florida Institute of Food and Agricultural Sciences
MGD	million gallons per day
MPO	Metropolitan Planning Organizations
MSSW	Management and Storage of Surface Waters
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPPS	Nonpoint Source Pollution Screening
OFWs	Outstanding Florida Waters
OCB	Orange Creek Basin
OCB-Plan	Orange Creek Basin Surface Water Management Plan

OCB SAC	Orange Creek Basin Scientific Advisory Committee
P-2000	Florida Preservation 2000 Act
QA/QC	Quality Assurance/ Quality Control
SJRWMD	St. Johns River Water Management District
SSARR	Streamflow Synthesis and Reservoir Regulation
SSC	Species of Special Concern
SWIM	Surface Water Improvement and Management
SWFWMD	Southwest Florida Water Management District
T&E	Threatened and Endangered Species
TSI	Trophic State Index
UF	University of Florida
USACOE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USSCS	U.S. Soil Conservation Service
WRM	Wetlands Resource Management
WQI	Water Quality Index

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1. INTRODUCTION

The ecological well-being of surface water resources in the Orange Creek Basin is a topic of growing concern by government agencies and local citizens alike. The St. Johns River Water Management District (SJRWMD) has authority (under Chapter 373, Florida Statutes) as the lead agency responsible for developing and implementing restoration and management initiatives in this basin. The overall success of these initiatives described in this surface water management plan, however, is directly dependent on the high level of coordination and cooperation necessary among the various agencies with management and regulatory responsibilities in the basin. In addition to the SJRWMD, other cooperating agencies include the Florida Game and Fresh Water Fish Commission, the Florida Department of Environmental Protection, and city and county government agencies in Alachua, Marion and Putnam counties. The missions of these and other agencies are described in section 2.2 of the plan.

In November 1993 the District's Governing Board established the Orange Creek Basin Advisory Council. The Council is composed of 11 representatives of the residential and business communities and local, regional, and state governments. The Advisory Council provides guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and promotes public awareness and intergovernmental cooperation regarding basin issues. The Orange Creek Basin Advisory Council has been meeting regularly since January 1994.

The primary guide for addressing water resource management issues in the Orange Creek Basin is the Orange Creek Basin Surface Water Management Plan (OCB-Plan). Modeled after the Surface Water Improvement and Management (SWIM) plans, the OCB-Plan is a comprehensive, holistic, and inclusive basin-wide approach to water resource management. The OCB-Plan incorporates the following perspectives:

- Views individual water resource-related issues in the larger context of the entire basin.
- Incorporates the inter-connectedness of ecosystems within the basin in developing management and restoration goals and solutions (the solution to one issue may affect other ecosystems in the basin and could exacerbate other problems).
- Considers all issues, not only pressing ones at the forefront of the public's attention, but also other issues which may not be perceived as critical by the public but are of important ecological relevance.
- Relies on active input from governmental agencies (state, regional, and local) and the local public and integrates their needs in a manner consistent with the basin-wide, holistic approach.

1.1 BASIN AND SUBBASIN GOALS

The overall goal of the OCB-Plan is to provide the information and guidelines for implementing sound surface water management decisions in the Orange Creek Basin. Once implemented, these decisions will allow for the restoration, rehabilitation, and maintenance of aquatic and wetland resources in the basin, while enhancing, to the greatest degree feasible, those recreational and cultural values associated with these resources. Economic benefits will automatically result from such an ecosystems management approach that advocates the protection of naturally functional systems and the maintenance of native biological diversity and productivity.

More specific basin-wide goals for the Orange Creek Basin, established in the context of the overall surface water management goal described above are to:

- Restore and maintain the basin's natural hydrology to the extent practicable and desirable.
- Restore and protect aquatic and wetland communities and their habitats.

- Protect and enhance water quality.
- Rehabilitate and maintain fisheries.
- Enhance recreational and aesthetic values.

More specific and, to the extent possible, quantitative goals for subbasins will be developed as progress is made in completing basin diagnostic projects. These subbasin goals will establish the targets toward which our restoration and management progress will be measured as the plan is implemented. Subbasin goals and, to the extent possible, subbasin management plans will be developed and incorporated into future revisions of the surface water management plan.

Enhancement of fish and wildlife populations (including sportfish), recreational opportunities, and the economic benefits arising from recreation are all important goals in the lake subbasins. These goals are integral components in the ecosystem management process adopted by the federal government, the state of Florida, the water management district, and in the Orange Creek Basin surface water management plan.

Goals in this plan for the basin, and goals for individual subbasins, are not and should not be ranked. For example, in making decisions, sportfish populations should not always be more important than non-game fish and wildlife populations, or vice versa. Having unranked goals provides the balance necessary to achieve all goals in the overall decision-making process.

1.2 PLAN APPROACH

The natural systems approach advocated in this surface water management plan is consistent with the general policies set forth in the State Water Policy (Chapter 62-40, F.A.C.) and supported by the SJRWMD in its District Water Management Plan (SJRWMD 1995a). The State Water Policy advocates the "preservation, restoration, and enhancement of natural water management systems"; "channelization or other alteration

of natural water bodies shall be discouraged" while "adverse impacts resulting from prior alteration of natural hydrologic patterns and fluctuations in surface and ground water levels shall be mitigated". Additionally, under its directive for flood protection and floodplain protection, State Water Policy encourages state, regional, and local governments to "implement nonstructural solutions and alternatives to water resource problems" and to "develop and implement strict floodplain management programs designed to preserve floodplain functions and associated natural systems".

Basic components of the OCB-Plan include:

- Compilation of existing information and data pertinent to the basin.
- Definition of the problems, issues, and concerns in the basin.
- Establishment of goals specific to each issue, addressing that issue from the perspective of the overall and specific basin-wide goals.
- Identification of strategies by which we can attain the issue-specific goals.
- Identification of programs and projects which address the strategies for goals achievement.
- Integration of the issues, goals, strategies, and programs and projects into a comprehensive basin-wide plan.

These components are organized in the OCB-Plan in the following way:

- Chapter 2 provides an overview of the basin.
- Chapter 3 defines eleven priority issues and presents the goals, strategies, programs, and projects that will address each issue.
- Chapter 4 summarizes and describes in further detail the projects and their constituent elements.

1.3 DECISION-MAKING DURING PLAN IMPLEMENTATION

Successful implementation of this plan and attainment of all the water resource goals will depend in large part on how management and restoration decisions are made.

It is stated from the outset that restoration and management decisions will consider both positive and negative impacts of decisions on the attainment of all environmental and economic goals in a subbasin.

Cooperation and involvement of basin stakeholders (governmental agencies, local residents, business and land owners, and other members of the public) in developing and implementing the basin plan is an integral component of the ecosystem management process. The Orange Creek Basin Advisory Council, or a similar basin stakeholder council, should be continued during the period of surface water management plan implementation so that basin stakeholder interests are adequately considered in making management and restoration decisions. Council meetings should be held quarterly or as often as needed so that all interests (i.e., stakeholders) have the opportunity to comment on proposed restoration and management decisions and the progress being made in implementation. A scientific advisory committee (appointed by the Orange Creek Basin Advisory Council) to serve as an advisory body to the council on technical issues should additionally be continued as necessary during the period of plan implementation.

1.4 BALANCE OF ENVIRONMENTAL AND ECONOMIC GOALS

Another important component of the ecosystem management process is the integration and balance of environmental goals with economic and community goals. The enhancement of fish and wildlife populations, recreational opportunities, and the economic benefits from recreation are all important goals in the Orange Creek Basin. In order to better measure our progress in attaining these goals, current analyses of the economic benefits from the recreational and commercial uses of natural resources in the basin will be completed. These current economic analyses will provide baseline data by which to measure restoration and management progress toward the goal of enhancing recreational opportunities and the economic benefits from recreation.

Subbasin restoration and management decisions should consider the economic impacts of the proposed decisions. This information will be provided to the basin

advisory or stakeholder council at its regular meetings. In this way, basin stakeholders will be assured that both economic and environmental goals were considered in the decision-making process.

1.5 RESTORATION AND MANAGEMENT AUDITING

Progress in attaining all the basin and subbasin goals in the plan must be monitored or audited on a regular basis. Management auditing is also an essential component in the ecosystem management process. Restoration and management progress will be audited on a regular basis and reported to the public and basin stakeholders. Progress toward achieving both environmental and economic goals will be audited, including the enhancement of sportfish populations, recreational opportunities, and the economic benefits from recreation.

The auditing criteria by which restoration and management progress will be measured will be established and incorporated in the plan in future revisions. These auditing criteria should include groups of measurement criteria which reflect the goals to be achieved, such as fish and wildlife population measures, bird species diversity, wetland vegetation types, water quality indices, etc. The auditing criteria will also include sportfish population measurements, recreational opportunities information, and measurements of the economic benefits from recreation.

1.6 SURFACE WATER MANAGEMENT PLAN REVISIONS

The Orange Creek Basin surface water management plan will be revised and submitted to the public and basin stakeholders for their review every three years, except for the first revision which will be completed after two years. Subbasin restoration and management plans will be developed and updated as progress is made in completing the projects described in the surface water management plan.

Projected timelines and budgets for basin projects will be developed and incorporated into the first revision of the surface water management plan. Timelines and budgets provide a general guideline for the involved agencies in establishing their annual funding and staffing priorities; the accuracy and validity of the project timelines and budgets therefore changes from year-to-year based on agency funding and staffing constraints.

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2

2. OVERVIEW OF THE BASIN

2.1 BASIN DESCRIPTION

Site Description

The Orange Creek Basin is located in the lower Ocklawaha River System, north-central Florida, in Alachua, Marion, and Putnam counties (Figure 1). It has an approximate area of 600 mi^2. The basin lies primarily within the boundaries of the St. Johns River Water Management District (95.5%), with the remainder (small portions along the northern and southwestern boundaries) under the jurisdiction of the Suwannee River and Southwest Florida Water Management Districts.

The Orange Creek Basin is comprised of six major subbasins or drainage units: (1) Hogtown Creek, (2) Paynes Prairie, (3) Newnans Lake, (4) Lochloosa Lake, (5) Orange Lake, and (6) Orange Creek. A detailed description of these subbasins is included below.

Geology And Derived Sediments

Miocene-aged sediments belonging to the Hawthorn Formation are exposed over 60% of the basin (Table 1). These consist primarily of sands, silts, clays, or combinations of these, and are composed of phosphatic, kaolinitic, and/or siliceous materials. Four types of Hawthorn sediments are exposed in the Orange Creek Basin: Statenville type, Devils Millhopper type, Groveland Park facies, and Interlachen facies (Figure 2). Further description of these soil types may be found in Brooks (1982b).

More recent phosphatic sands belonging to the Bone Valley Formation (Pliocene) represent the second most abundant geologic formation in the Orange Creek Basin (21%

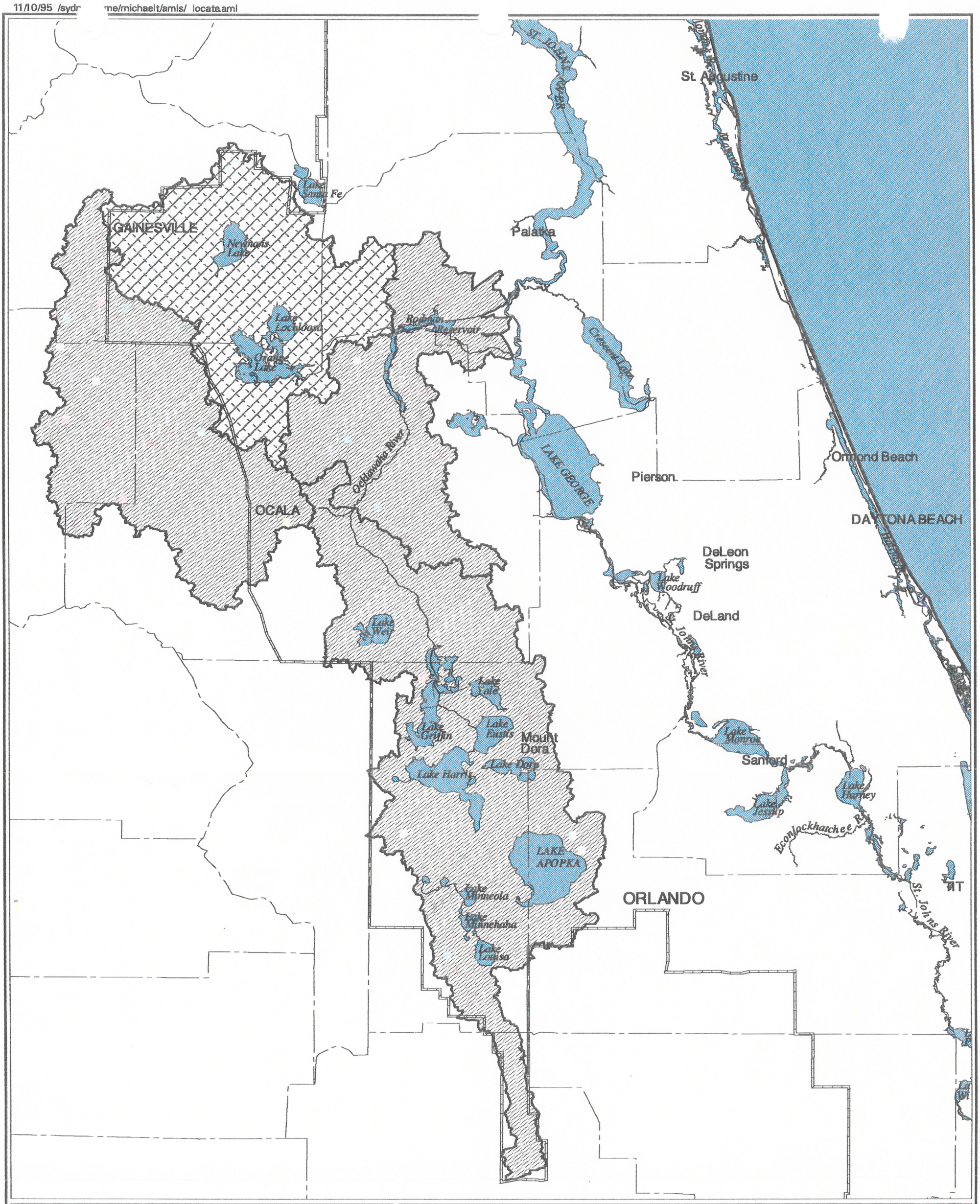


Figure 1.
The Orange Creek Basin Within the Ocklawaha River System



N

MILES
0 4 8

SCALE 1:678887
ONE INCH REPRESENTS 10.7 MILES

Map produced using MAPPER.aml on March 06, 1995

- Orange Creek Basin
- Other Basins within System
- Water
- Basin Boundary
- County Boundary
- District Boundary

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Table 1. Geology of the Orange Creek Basin. From USSCS STATSGO data base (1993) and Brooks (1982).

Geologic Formation	Code	Epoch	Percent surface areal coverage per subbasin						Total Basin Area (mi2)	% Coverage Basinwide
			Hogtown Creek	Lochloosa Lake	Newnans Lake	Orange Creek	Orange Lake	Paynes Prairie		
Ocala Limestone	Eo	Eocene	25.9%	____	____	7.4%	17.7%	23.2%	62	10.4%
Hawthorn Formation	Mh	Miocene	74.0%	56.4%	30.0%	89.5%	59.8%	47.4%	360	59.9%
Bone Valley Formation	Pbv	Pliocene	0.0%	43.4%	69.1%	0.2%	1.3%	____	126	20.9%
Terrace Deposits	PQt	Plio-Pleistocene	____	0.2%	0.9%	0.9%	21.2%	29.3%	51	8.4%
Undifferentiated Sediments	Qpa/Qh	Pleist./Holocene	____	____	____	1.9%	____	____	3	0.4%

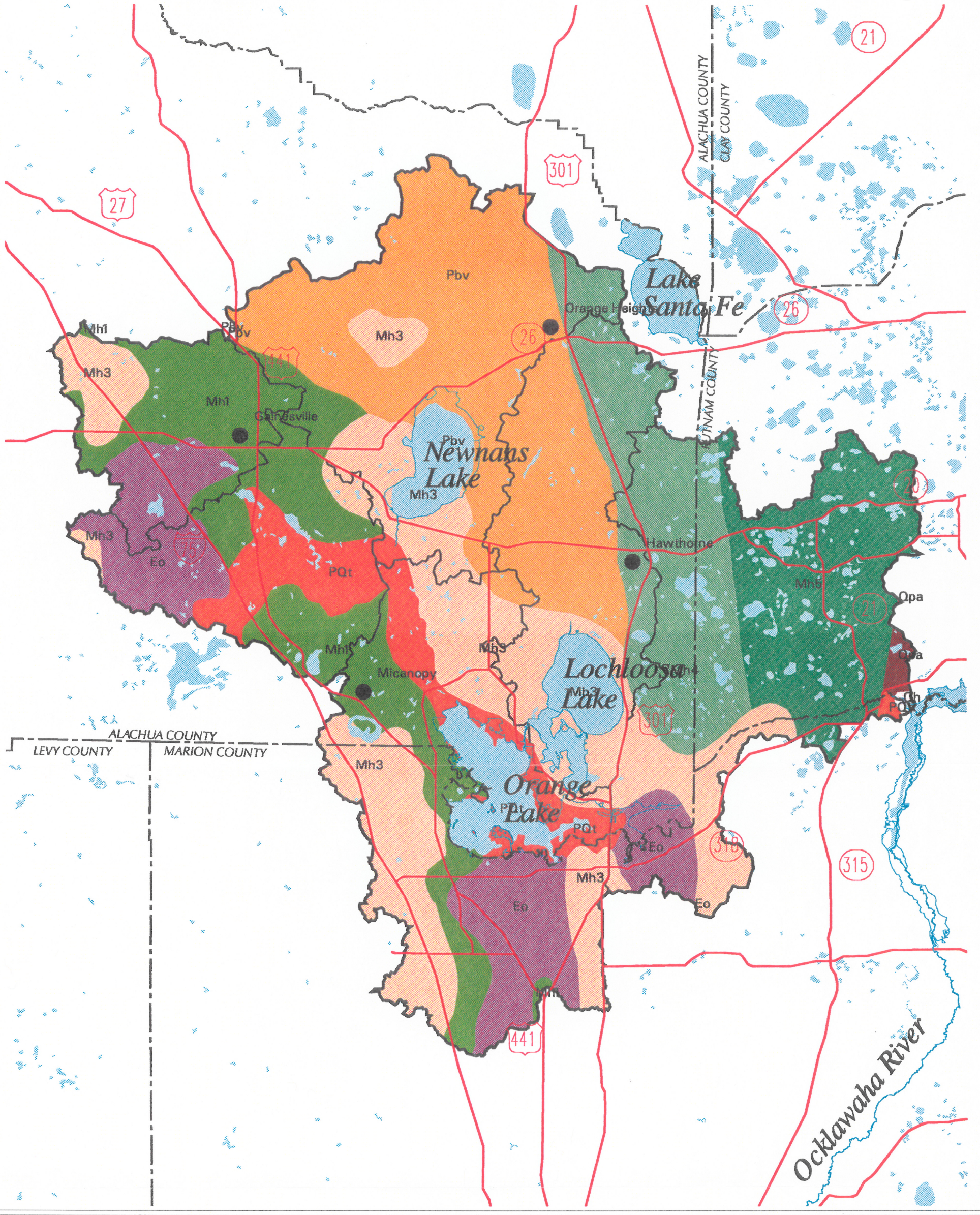
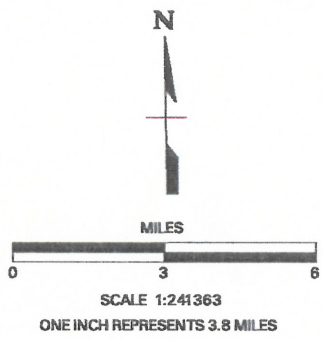


Figure 2.
Geology of the Orange Creek Basin

From Brooks 1982b, Geologic Map of Florida. Scale 1:500,000





Map produced using MAPPER.aml on March 06, 1995

Holocene
- Qh Undifferentiated Sediments

Pleistocene
- Qpa Princess Ann

Plio-Pleistocene
- PQt Terrace deposits

Pliocene
- Pbv Bone Valley Formation

Miocene -- Hawthorn Formation
- Mh1 Devils Millhopper type
- Mh3 Statenville type
- Mh4 Groveland Park facies
- Mh5 Interlachen facies

Eocene
- Eo Ocala Limestone

surface areal coverage) and are located primarily in Lochloosa and Newnans Lake subbasins (Table 1). Ocala limestones (Eocene) are the third most abundant geologic formation(10% surface areal coverage) and are found primarily in Hogtown Creek, Paynes Prairie, and Orange Lake subbasins.

Geologically younger formations of post-Pliocene epochs (dominated by Plio-Pleistocene "Terrace Deposits") are found at the surface over the remaining 9% of the area in the Orange Creek Basin (Table 1; Figure 2).

Climate

Climate in the Orange Creek Basin is basically humid and subtropical in nature. At Gainesville, the average temperature is 70.2 °F, with lowest monthly average temperatures occurring in January (58.8°F) and highest occurring in August (81.3°F) (Jessen 1972). Winter temperatures tend to be more variable than summer temperatures, as they are influenced by cold continental air masses arriving mainly from the northwest.

Rainfall patterns over the Orange Creek Basin are best inferred from climatologic data collected at the Gainesville and Ocala National Oceanographic and Atmospheric Administration (NOAA) weather stations. Long-term averages of annual rainfall are 50.7 inches for Gainesville (1903-1995) and 52.0 inches for Ocala (1949-1995). Normal annual rainfall (defined as the average of measurements taken over the last three calendar decades; 1961-1990) for both Gainesville and Ocala 51.6 (Adkins & Rao 1995).

Rainfall in the area follows a general seasonal pattern, although it can vary considerably from year to year. The region receives over half of its annual rainfall from June through September. This summertime precipitation is generally caused by regional convective storms, although occasional tropical storms or hurricanes can also contribute large amounts of rainfall. The drier season generally runs from late October through

May, with November typically being the driest month. A secondary peak in annual rainfall usually occurs in the late winter months (February-March), as a result of cyclonic storms associated with major fronts (Fernald & Patton 1984).

Long-term trends in rainfall patterns for the Orange Creek Basin may be inferred from annual and cumulative (sum of annual) rainfall departure graphs for the Gainesville and Ocala NOAA climatological stations (Figure 3). Rainfall departures (annual and cumulative) are calculated relative to the long-term average rainfall for each station. A rising cumulative departure line indicates a trend of above average rainfall and a declining line indicates a trend of below average rainfall or drought. The steepness of the line indicates the severeness of the departure from the long-term average rainfall value.

Long-term trends are best observed for the Gainesville station, which has the longest rainfall record (93 years). The Gainesville annual rainfall departure data (third panel, Figure 3) indicate that drought conditions prevailed in the Gainesville area up until the 1940's, followed by a high rainfall period which lasted about 30 years (until the 1970's). Since the 1970s', rainfall has again been below average, with the exception of a brief period of high rainfall from 1982 to 1983. The rainfall deficit during this more recent drought period has been most severe since 1989, as indicated by the sharp drop in the cumulative departure lines for both the Gainesville and Ocala weather stations (panels 2 and 4, Figure 3). A reversal in this trend since 1993-1994 seems to indicate the beginning of a recovery from this latest drought episode.

Physiography

The Orange Creek Basin lies within a topographic area of Florida known as the Central Highlands (Clark et al. 1964). This area is generally characterized by a karst topography and by the presence of shallow, flat-bottomed lakes, level prairies, irregular

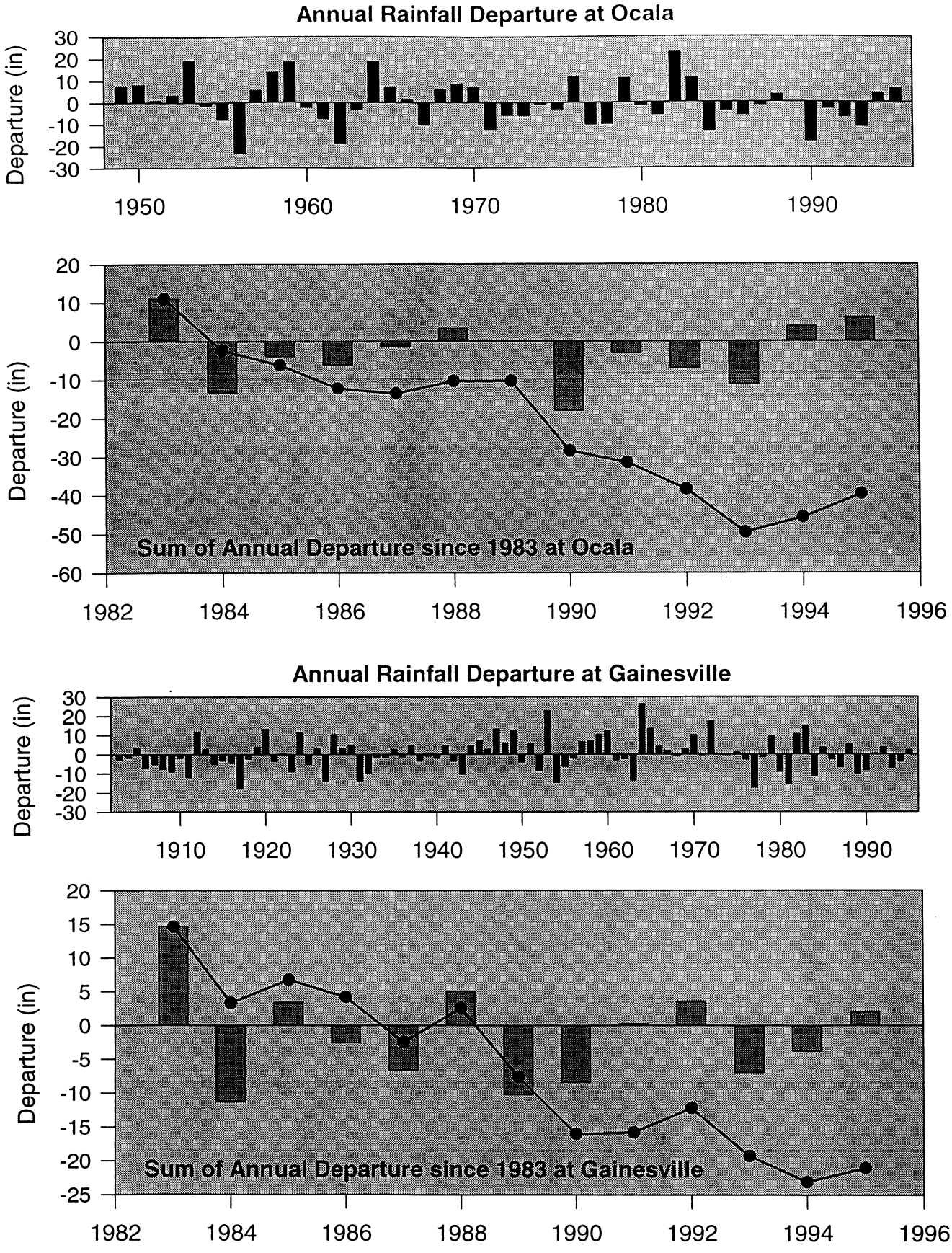


Figure 3. Annual rainfall departure for the period of record, and the sum of annual rainfall departures since 1983 at Ocala and Gainesville. Departures based on long-term averages (51.95 in for Ocala; 50.71 in for Gainesville). *Source of Data: National Weather Service.*

drainage patterns, and sinkholes and other solution features (Sellards 1910, 1912, Pirkle, 1956). Physiographically, the area may be subdivided into two provinces: an upland plateau, north of Gainesville which includes most of northeastern Alachua County, and a central and southern transitional area (Gottgens & Montague 1987).

The physiography of the Orange Creek Basin is depicted in Figure 4 (from Brooks 1982a). Brooks' physiographic analysis is based on a three-tier classification system comprised of sections, districts, and subdistricts.

A minor portion of the basin (located at the headwater region of Newnans Lake) falls within the Sea Island District of the Atlantic Coastal Plain Section. This is an area in which limestones are overlain by a thick layer of clastic sediments and the geomorphology is influenced primarily by fluvial (erosional) processes.

Most of the Orange Creek Basin lies within the Florida Section, primarily within the Ocala Uplift and Central Lake districts (Figure 4). The landscape tends to be strongly influenced by the underground solution of Cretaceous, Tertiary and Quaternary limestones, which commonly lie at or near to the earth's surface. In certain areas, however (e.g. the Northern Peninsular Slopes Subdistrict of the Ocala Uplift District), a relatively impermeable layer of sandy/clayey sediments (Hawthorn Formation) overlies the Ocala limestones, acting as a confinement layer for the underlying aquifer. A more detailed description of the Orange Creek Basin's physiography (based on Brooks 1982a) is included in Appendix A.

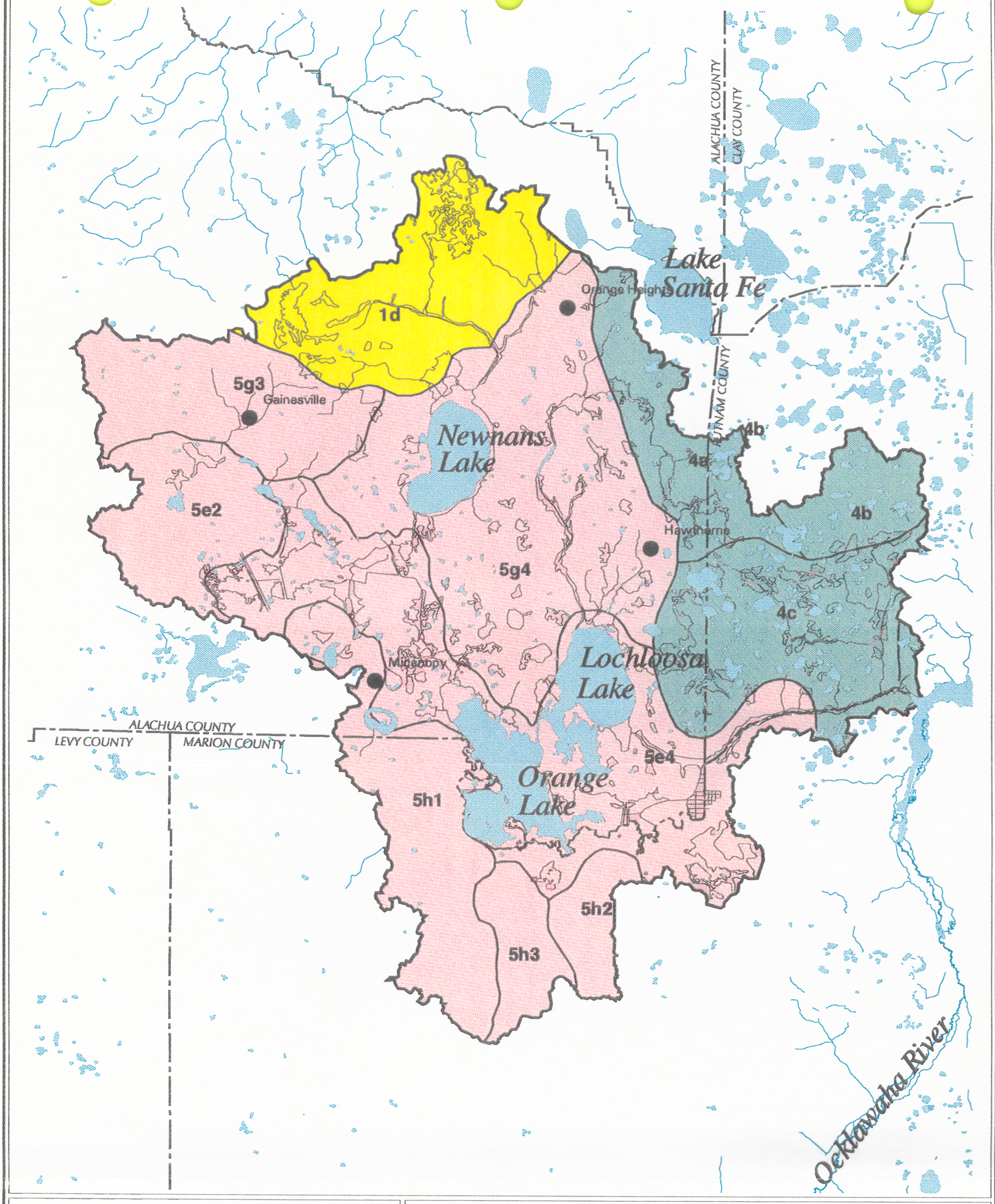
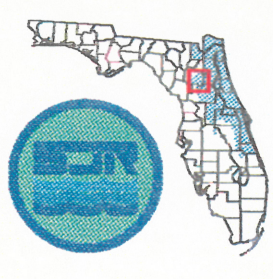
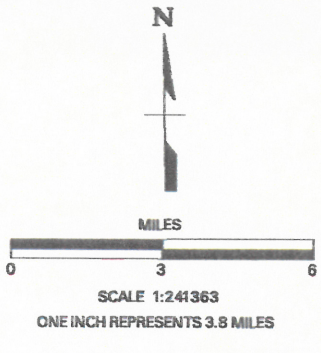


Figure 4. Physiographic Provinces of the Orange Creek Basin

From: Brooks 1982a. Basemap USGS 1:500,000

See Appendix A for a detailed description of the physiographic units





Map produced using MAPPER.aml on March 06, 1995

- 1d - Sea Island District
  - 1 - Okefenokee Upland
    - d. High Flatwoods
- 5 - Ocala Uplift District
  - e. Northern Peninsular Plains
    - 2. Haile Limestone Plain
    - 4. Alachua Prairies
  - g. Northern Peninsular Slopes
    - 3. San Felasco Hammock
    - 4. Newnans Lake Basin
  - h. Marion Hills
    - 1. Fairfield Hills
    - 2. Anthony Hills
    - 3. Kendrick Hills
- 4 - Central Lake District
  - a. Perched Lakes and Prairies
  - b. Interlachen Sand Hills
  - c. St. Johns Offset
- Water
- Orange Creek Basin Boundary
- Subdistrict Boundary
- County Boundary

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Hydrography

Overview

The Orange Creek Basin can be subdivided into six major drainage units or subbasins: (1) Hogtown Creek, (2) Paynes Prairie, (3) Newnans Lake, (4) Lochloosa Lake, (5) Orange Lake, and (6) Orange Creek (Figure 5). Acreages of the individual subbasins are summarized in Table 2. The hydrographic features of each subbasin (as percent coverage) are presented in Table 3.

GIS-based analyses of the USGS 1:100,000 Digital Line Graph (DLG) Hydrography data base reveal the existence of 374 lakes (2 acres in size or larger) in the basin. Ninety percent, or 337 of these lakes are small (under 50 acres), nine percent, or 33 are medium-sized (between 50 and 1000 acres), and one percent, or four are large (greater than 1000 acres). The largest of the lakes (Newnans Lake, Orange Lake, and Lochloosa Lake), and Paynes Prairie represent the major hydrographic features in the basin. With the exception of Hogtown and Paynes Prairie subbasins which are closed drainage units, overall drainage in the Orange Creek Basin is through Orange Creek and into the Ocklawaha River at Rodman Reservoir (Figure 5).

The direction of surface drainage in the Orange Creek Basin is from Newnans Lake to Paynes Prairie and Orange Lake, from Lochloosa Lake into Orange Lake, and from Orange Lake into Orange Creek. During occasionally high lake levels, Lochloosa Lake can additionally discharge directly into Orange Creek through Lochloosa Slough. Drainage from Newnans Lake to Orange Lake was artificially created in the 1920's with the construction of Camps Canal. Prior to that, Newnans Lake water flowed naturally into Paynes Prairie through Prairie Creek, moved by sheetflow across the Paynes Prairie marshes to Alachua Lake, and ultimately discharged to Alachua Sink.

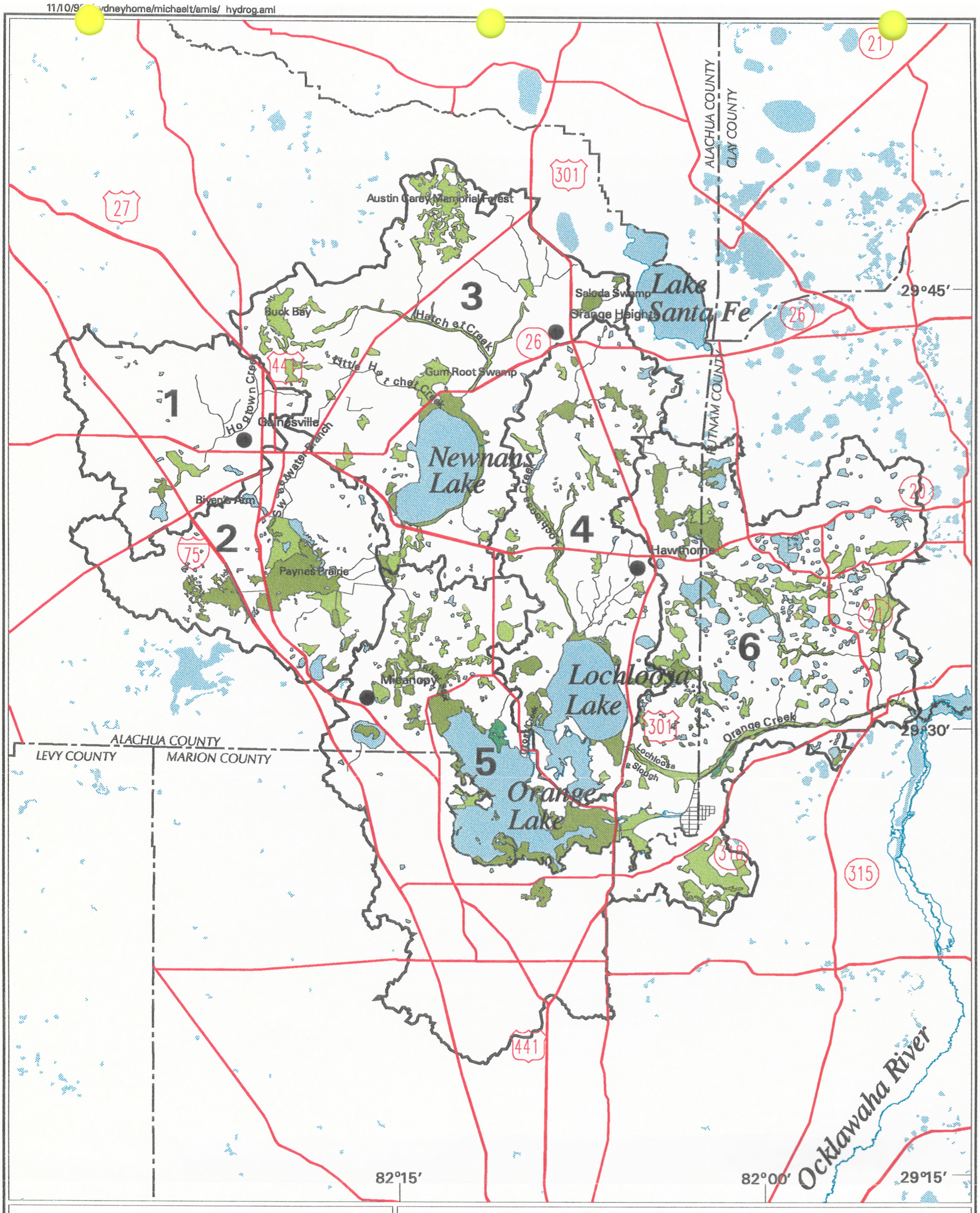


Figure 5.
Orange Creek Basin Hydrography

Based on 1:100,000 USGS topographic maps



N

MILES

0 2.5 5

SCALE 1:223887

ONE INCH REPRESENTS 3.53 MILES

Map produced using MAPPER.aml on March 06, 1995

- Open water
- Intermittent water bodies
- Deepwater wetlands
- Marsh or wetland
- Highways
- Orange Creek Basin boundary
- Sub-Basin boundary
- County boundary

Subbasins

1. Hogtown Creek
2. Paynes Prairie
3. Newnans Lake
4. Lochloosa Lake
5. Orange Lake
6. Orange Creek

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Table 2. Acreage of subbasins in the Orange Creek Basin. Areas calculated from the District GIS hydrographic coverage for the Orange Creek Basin, derived from USGS 1:100,00 topographic maps.

Subbasin	Sub-basin No.	Area within SJRWMD	Total Area	% Area within SJRWMD
Hogtown Creek	1	43.73	49.53	88.29
Paynes Prairie	2	64.30	64.48	99.73
Newnans Lake	3	114.80	124.00	92.58
Lochloosa Lake	4	86.16	87.98	97.93
Orange Lake	5	127.11	137.41	92.50
Orange Creek	6	138.69	138.69	100.00
	TOTAL	574.80	602.09	95.47

Table 3. Hydrographic composition of the OCB. Areas calculated from the District GIS hydrographic coverage for the Orange Creek Basin, derived from USGS 1:100,00 topographic maps.

Subbasin	Sub-basin No.	Area (mi^2)	% as Open Water	% as Marshes	% as Deep-water Wet-lands	% as Inter-mittent water-bodies	% as Total hydro-graphic features
Hogtown Creek	1	49.53	1.29	1.22	.56	0.00	3.08
Paynes Prairie	2	64.48	3.05	3.9	9.94	0.00	16.89
Newnans Lake	3	124.00	7.91	8.99	2.50	0.00	19.40
Lochloosa Lake	4	87.98	14.85	4.17	5.32	0.00	24.34
Orange Lake	5	137.41	10.93	2.83	7.08	0.39	21.22
Orange Creek	6	138.69	6.54	11.00	3.53	0.22	21.28
Total Basin		602.09	8.23	6.16	4.83	0.14	19.36

In the northern portion of the basin (Newnans Lake Subbasin), permeable Ocala limestones are overlain by relatively impermeable clayey formations (Hawthorn Formation) and surface runoff remains an important form of drainage (Jessen 1972). Runoff from Newnans Lake subbasin averages about 7.4 inches/year or 14% of the long-term average annual rainfall at Gainesville (51 inches) (Adkins & Rao 1995). Runoff from Orange Creek (at the Outlet of Orange Lake) and Lochloosa Slough combined represents only 7% (4.1 inches) of the average annual rainfall. This decline in the runoff-to-rainfall ratio indicates a progressive increase in evapotranspiration and seepage from the headwaters to the lower reaches of the basin (Adkins & Rao 1995).

A water budget for contributing subbasins within the Orange Creek Basin is depicted in Figure 6 (generated from 50-year simulations using SSARR). Overall, the volume of water entering all three lakes (Newnans, Orange, and Lochloosa) as direct rainfall is equal to the volume of water lost through evaporation. However, relative to total water inputs (surface inflows and direct precipitation), surface water outflows are highest in Newnans Lake (68% of inputs), intermediate in Lochloosa Lake (47% of inputs), and lowest in Orange Lake (35% of inputs). Low relative surface outflows from Orange Lake reflect the significance of seepage associated with sinkhole activity in this lake. In the closed (non-contributing) subbasins of Paynes Prairie and Hogtown Creek (water budgets not included), evapotranspiration and seepage account for all of the water outputs.

The primary active sinkholes in the Orange Creek Basin are Alachua, Haile, and Orange Lake sinks. Other factors being equal, seepage via these sinkholes will increase as piezometric levels of the underlying aquifer decrease during times of drought (Pirkle & Brooks 1959, Robison *et al.* 1996). However, groundwater from deep aquifers does not seem to regularly enter the lakes (Deevey 1988). Springs flowing into Lochloosa Lake (Magnesia Springs and small springs along the northeastern shoreline of Lochloosa Lake) are a notable exception.

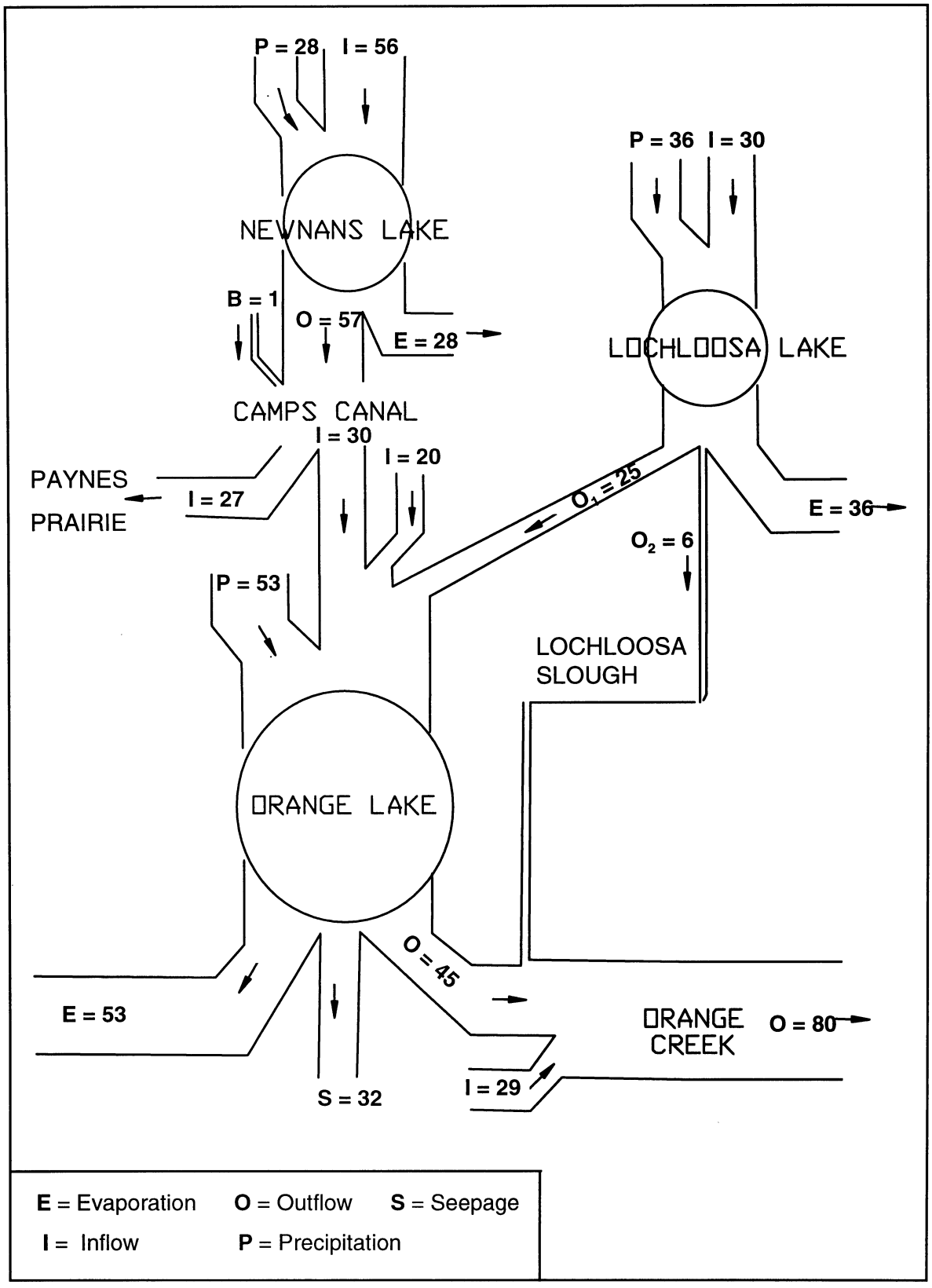


Figure 6. Water budget for Newnans Lake, Lochloosa Lake, Orange Lake, and Orange Creek subbasins (acre-feet). Values reflect existing conditions (Prairie Creek dam removed) based on 50-year simulations using the SSARR hydrologic model (Robison *et al.* 1996).

The direction of deep groundwater flow follows Floridan aquifer potentiometric surface gradients and therefore does not always correspond to the direction of surface flow throughout the basin.. For example, water entering the Floridan aquifer via Alachua Sink (Paynes Prairie) tends to flow in a northwesterly direction (into the Suwannee River Water Management District), whereas groundwater entering the aquifer through the Orange Lake sinkhole area flows primarily to the southwest (toward Rainbow Springs) (Figure 7).

Groundwater recharge represents the linkage between surface water and ground water. Recharge areas and rates for the Orange Creek Basin are depicted in Figure 8 (SJRWMD, unpublished data).

Hydrographic description of the major subbasins

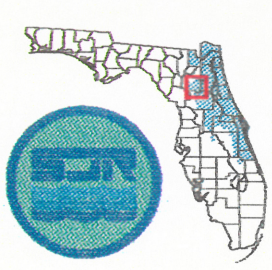
1. Hogtown Creek Subbasin

The Hogtown Creek Subbasin is a closed watershed with a drainage area of approximately 50 mi^2. About two thirds of the city of Gainesville is drained by Hogtown Creek. The creek originates in pine flatwoods in the north central part of Gainesville, flows into Hogtown Prairie to the southwest of the city, and ultimately drains into the Floridan aquifer through Haile Sink (Huber et al. 1981). The major tributary to Hogtown Creek is Possum Creek which drains the northwest region of the city. To the south of Hogtown Prairie is Kanapaha Prairie (and Kanapaha Lake), a shallow depression basin that is hydrologically connected to Haile Sink but does not contribute surface flow to Hogtown Creek.

The Hogtown Creek/Haile Sink system, together with its neighboring Sweetwater Branch/Alachua Sink system to the east, provide for the return of substantial amounts of groundwater recharge from urban, agricultural, and

Figure 7.
Potentiometric Surface of Floridan Aquifer in the Orange Creek Basin.

Potentiometric data collected May 1990.
Basemap SJRWMD 1:500,000.



N

MILES
0 2.5 5

SCALE 1:231898
ONE INCH REPRESENTS 3.66 MILES

Map produced using MAPPER.aml on March 06, 1995

Potentiometric Surface (above MSL)

- 50 ft
- 60 ft
- 70 ft
- 80 ft
- Water
- Potentiometric Surface (ft above MSL)
- Major Road
- Orange Creek Basin Boundary
- Sub-Basin Boundary
- County Boundary
- Direction of groundwater flow in the Floridan aquifer

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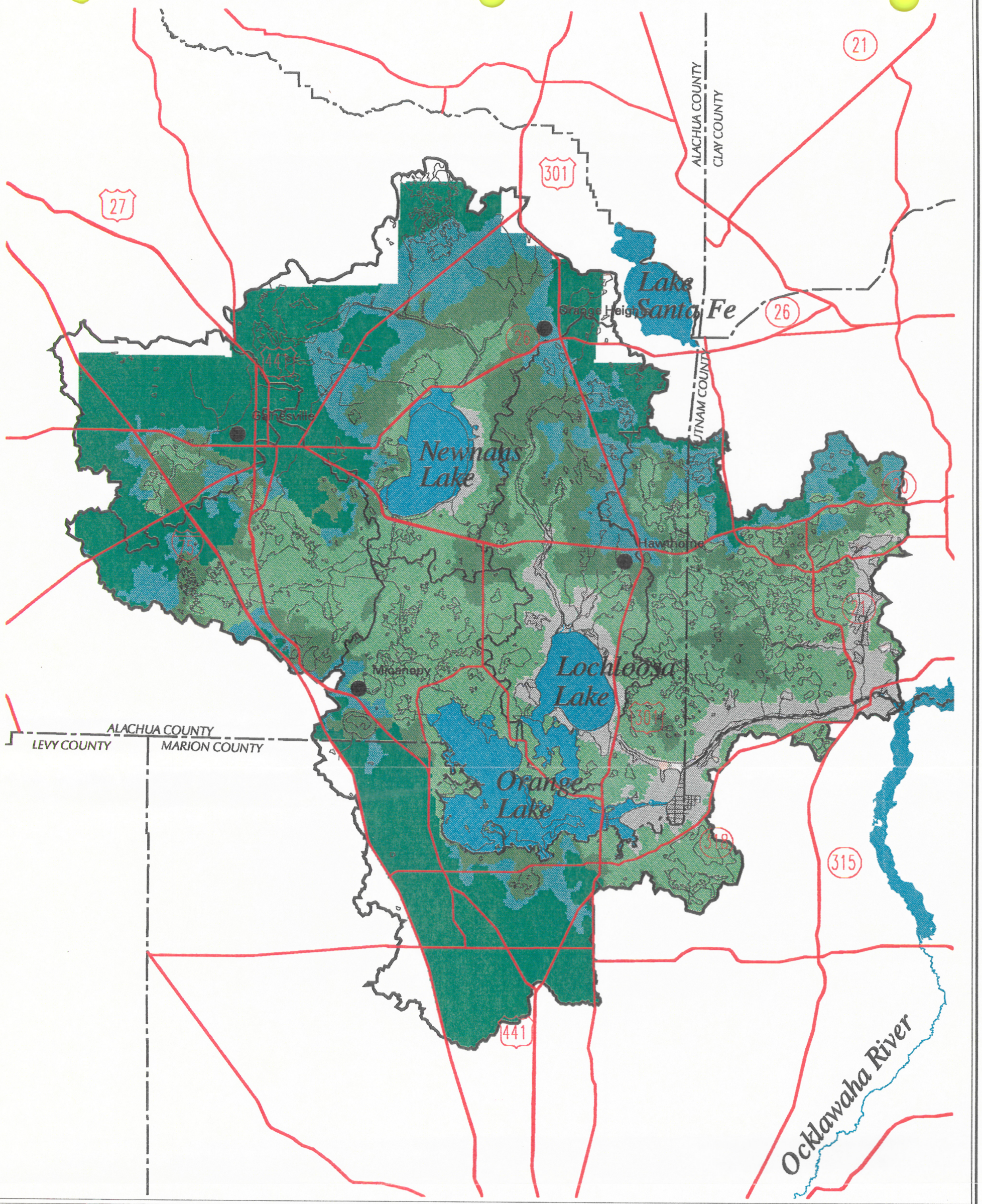
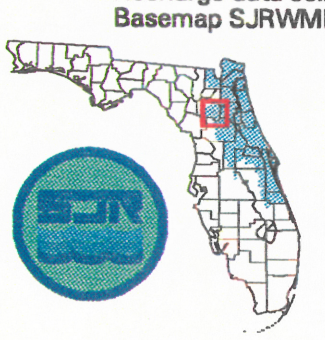
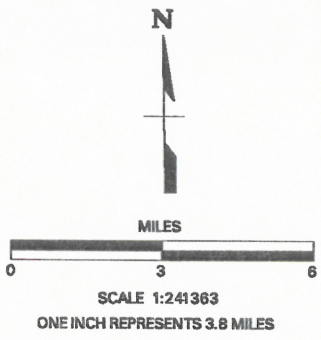


Figure 8.
Recharge Areas of the Floridan Aquifer in the Orange Creek Basin

Recharge data collected May 1990.
Basemap SJRWMD 1:500,000.





SCALE 1:241363

ONE INCH REPRESENTS 3.8 MILES

Map produced using MAPPER.aml on March 06, 1995

Recharge (in/yr)

- 0 - 4
- 4 - 8
- 8 - 12
- 12 or more
- Discharge
- Water
- Orange Creek Basin Boundary
- Sub-Basin Boundary
- County Boundary
- Major Road

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wetland runoff into the upper zone of the Floridan aquifer (Huber et al. 1981). Additionally, the Kanapaha Wastewater Treatment Plant (Gainesville Regional Utilities) contributes to groundwater recharge in the Hogtown Creek subbasin through injection wells located near Haile Sink.

2. Newnans Lake Subbasin

Newnans Lake Watershed. The Newnans Lake Subbasin has a drainage area of 124 mi^2. The main sources of inflow to Newnans Lake are Hatchet and Little Hatchet creeks. Hatchet Creek has many tributaries and drains large areas of undeveloped land such as Buck Bay, the Austin Carey Memorial Forest, and Saluda Swamp, to the northeast and northwest of Newnans Lake (Figure 5). Little Hatchet Creek discharges into Newnans Lake through Gum Root Swamp. It drains rural lands to the north and east of Gainesville, and receives runoff from portions of northeast Gainesville, including the regional airport and the Gainesville Industrial Area.

Newnans Lake. Based on 50-year (1942-1991) historical records (Figure 9), Newnans Lake elevations fluctuate 90% of the time between 65 and 68 ft above mean sea level with a median lake elevation of 66.4 ft (Prairie Creek dam in place). Fluctuations of 2-3 ft tend to occur annually, which explains the relatively jagged shape of the Lake's hydrograph (Figure 9). Frequent low lake levels (between 65 and 64 ft) occur on average every 5 to 7 years. Extreme drought events in which lake levels dropped below 64 ft occurred for a short period in 1962, and presumably also occurred during the 1956-7 drought, when no monitoring was done. Since 1991, flashboards have been removed from the Prairie Creek Dam in an effort to promote a more natural fluctuation and flushing of the lake.

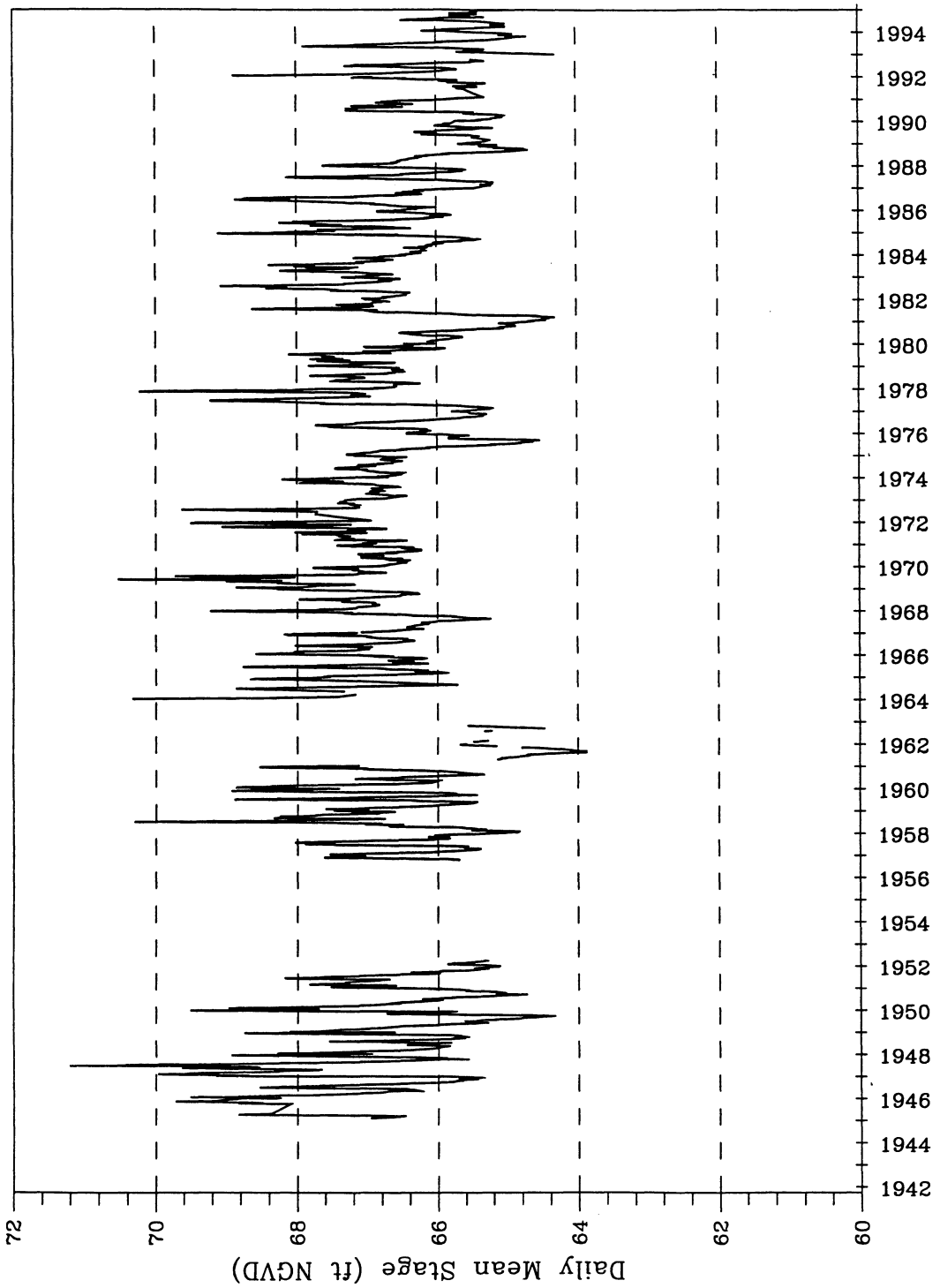


Figure 9. Long-term hydrograph for Newnans Lake (1942-1995). Modified from Adkins and Rao (1995).

Normal fluctuation in the lake's surface area ranges from about 6,200 acres at 65 ft to about 7,400 acres at 68 ft. During frequent drought events, lake area rarely drops below 6000 acres. Other morphometric characteristics for Newnans Lake are summarized in Table 4.

3. Paynes Prairie Subbasin

The Paynes Prairie Subbasin covers an area of approximately 64 mi^2. A large part of the basin lies within the Paynes Prairie State Preserve, an area managed by the Florida Department of Environmental Protection (FDEP).

The Prairie receives runoff from urbanized areas of Gainesville that have little stormwater storage capacity. Sweetwater Branch, the only major creek entering the basin, drains approximately 3 mi^2 of eastern Gainesville and conveys stormwater and treated effluent discharged from the Gainesville Main Street sewage treatment plant. An earthen levee segregates runoff from the creek to a small area of the prairie before discharging into Alachua Sink. Boulware Springs is also within the Prairie Subbasin, however, its discharges are also segregated by the Sweetwater Branch levee. Bivens Arm, a small surface water inflow to the Prairie, drains urbanized areas in the south and southeast parts of Gainesville.

Additional surface water inflows enter the prairie from Prairie Creek through gated culverts controlled by the FDEP. This structure conveys only a portion of the flow from Prairie Creek/Camps Canal (an average of approximately 45% on an annual basis). Historically, all of the Prairie Creek flow meandered across the prairie before discharging into Alachua Sink. Alachua Sink, a natural sinkhole located on the northeast boundary of the prairie, is the only drainage outlet for this subbasin. It receives inflow from

Table 4. Morphometric characteristics of Newnans, Orange, and Lochloosa lakes. Z_{MAX}=maximum depth, Z_{AVG}=mean depth, D_L=shoreline development*, D_V=volume development**.

LAKE	BASIN DRAINAGE AREA (km^2)	MEDIAN LAKE STAGE (m-amsl)	LAKE AREA AT MEDIAN STAGE (ha)	Z_{MAX} (m)	Z_{AVG} (m)	D_L	D_V	RESIDENCE TIME (yrs)
NEWNANS	321 [a]	20.2 [b]	2,700 [b]	4.0 [c]	1.5 [c]	1.20 [c]	1.13 [c]	0.60 [e]
ORANGE	356 [a]	17.6 [b]	5,400 [b]	3.0 [c]	1.8 [c]	1.63 [c]	1.80 [c]	0.95 [d]
LOCHLOOSA	230 [a]	17.7 [b]	3,600 [b]	3.7 [f]	2.9 [f]	---	2.34 [c]	---

[a] This report.
[b] Robison *et al.* 1993
[c] Shannon & Brezonik 1972***
[d] Deevey 1988
[e] Gottgens & Crisman 1992(b)
[f] Baker *et al.* 1981

* D_L is the ratio of the length of the shore line to the length of the circumference of a circle of area equal to that of the lake.

** D_V is the ratio of the volume of the lake to that of a cone with basal area equal to the area of the lake and with height equal to Z_{MAX} of the lake ($D_V=3\times Z_{AVG}/Z_{MAX}$).

*** D_L computed using the following lake surface areas: Newnans Lake: 2433 ha, Orange Lake: 3324ha.

Paynes Prairie, Boulware Springs and Sweetwater Branch. Discharges from the prairie to the sink are regulated by a gated control structure operated by the FDEP.

4. Orange Lake Subbasin

Orange Lake Watershed. The Orange Lake Subbasin covers an area of approximately 137 mi^2. Its main surface water inflows are from Prairie Creek/Camps Canal through the River Styx, and from Cross Creek. These two conveyances connect the Newnans and Lochloosa subbasins, respectively, to Orange Lake (Figure 5).

Historically, runoff from the River Styx, which drained swamps and sloughs north of Orange Lake, and Cross Creek were the only surface water sources to the lake. Orange Lake received additional water when Prairie Creek flow was diverted from Paynes Prairie to the lake by construction of the Camps Canal and levee system in the 1920s. The canal system was used to de-water Paynes Prairie for conversion to rangeland. The FDEP restored partial flows from Prairie Creek to Paynes Prairie during 1975 by breaching Camps Canal levee at the point where Prairie Creek originally entered the Prairie.

The Orange Lake Subbasin discharges into Orange Creek through a fixed-notch weir constructed in 1963, which is located adjacent to U.S. Highway 301. Approximate weir top elevation is 57.8 ft above mean sea level. The notch in the weir was originally designed for an elevation of 55.5 ft. Unauthorized filling of the notch in 1990, however, increased the effective elevation to 57.08 ft.

Additional surface water outflow from Orange Lake is to the Floridan aquifer through lake bottom seepage. Most of the seepage outflow is probably

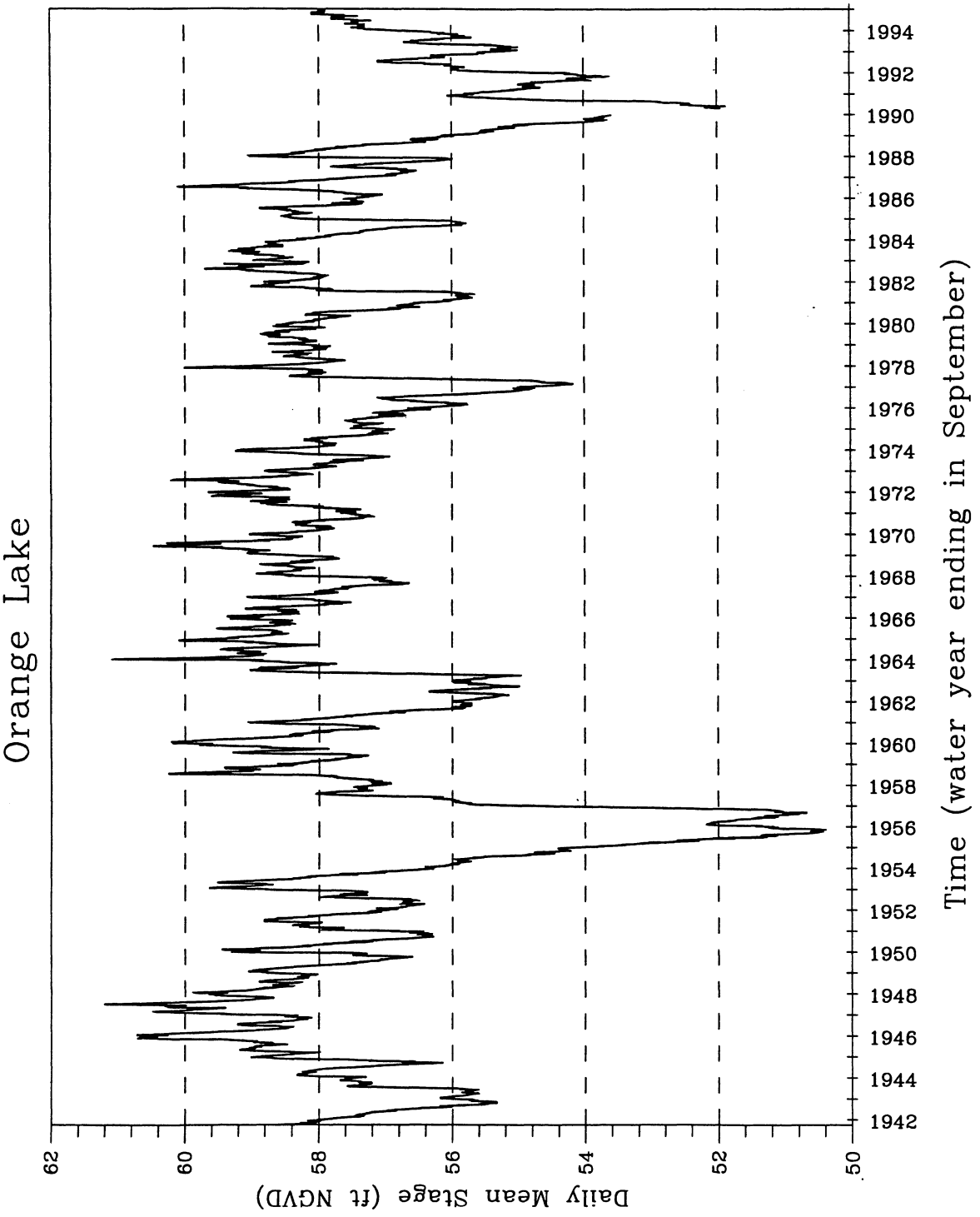


Figure 10. Long-term hydrograph for Orange Lake (1942-1995). Modified from Adkins and Rao (1995).

5. Lochloosa Lake Subbasin

Lochloosa Lake Watershed. The Lochloosa Lake Subbasin covers an area of approximately 88 mi^2. The major drainage feature of the basin is Lochloosa Creek which drains a 51 mi^2 area of rural lands to the northwest of the lake. It receives runoff from Orange Heights at its farthest extremity and runoff from Campville and Grove Park along its course. Magnesia Spring discharges into Lochloosa Creek.

A dendritic system of spring-fed streams drains flatwoods to the northeast of the lake and receives runoff from the city of Hawthorne and the area south along US Highway 301 (US 301). Iron Spring and Sulphur Spring in the city of Hawthorne flow into this watershed.

The main outflow of the subbasin is through Cross Creek to Orange Lake. During high lake stages, Lochloosa Slough conveys discharge eastward from the basin to the Orange Creek Subbasin.

Lochloosa Lake. Based on 50 year (1942-1991) historical record, the median elevation of Lochloosa Lake is 58.1 ft above mean sea level (Figure 11). Ninety percent of the time, lake levels fluctuate between 56 ft and 59 ft. On an annual basis, lake fluctuations average 2.2 ft. Moderate frequent drought events for Lochloosa Lake (lake levels between 55-56 ft) occur about once every 5 to 10 years. During this time, water levels in the Lake are on average about one foot higher than in downstream Orange Lake. At lower lake stages, however, Lochloosa lake can remain about 2 to 3 feet above Orange Lake (e.g. during the 1956 and 1991 droughts) (Figure 12). The elevation of the bottom of Cross Creek determines the point of divergence in stage height of the two lakes (approximately 54.5 ft). Once water level falls below this

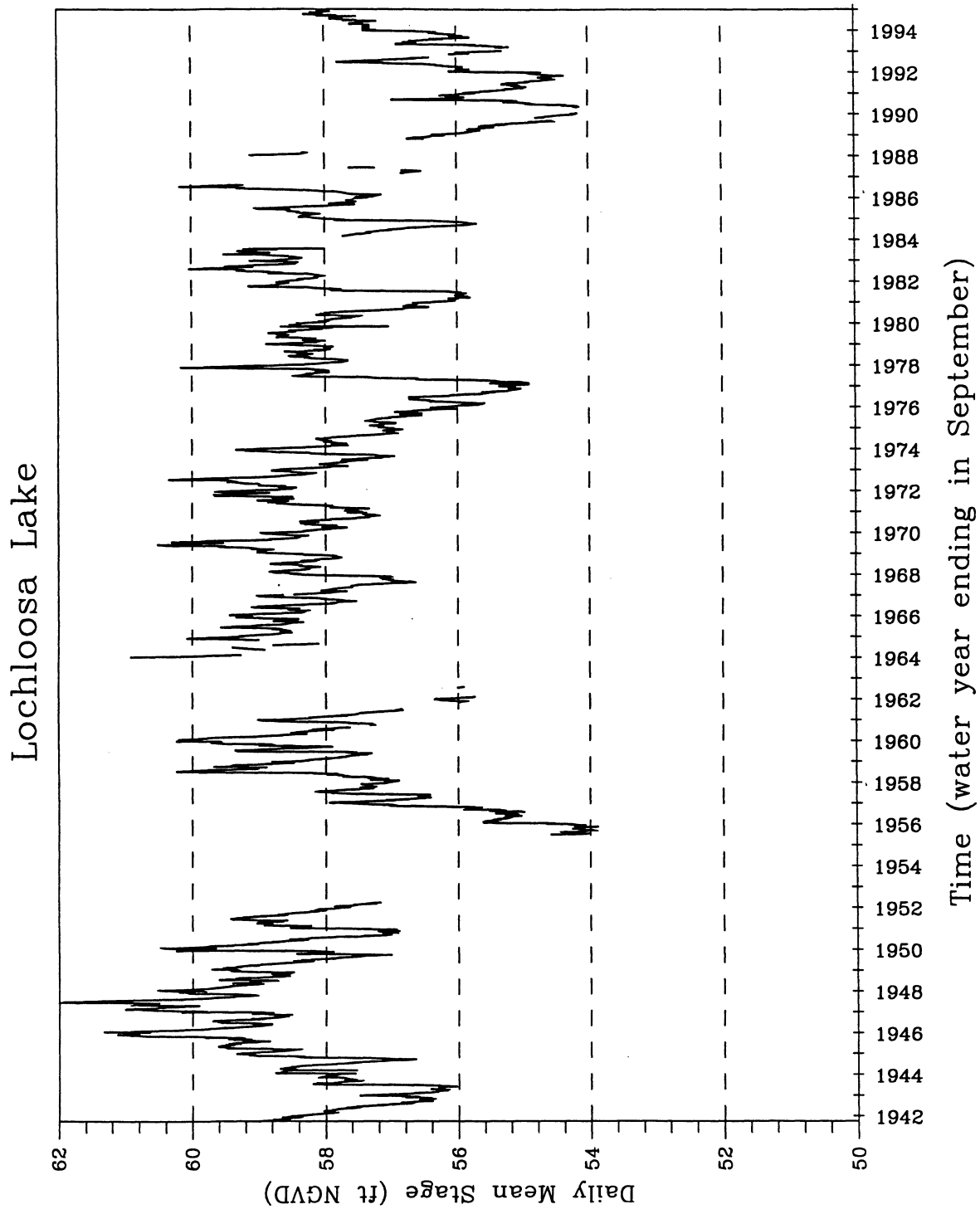


Figure 11. Long-term hydrograph for Lochloosa Lake (1942-1995). Modified from Adkins and Rao (1995).

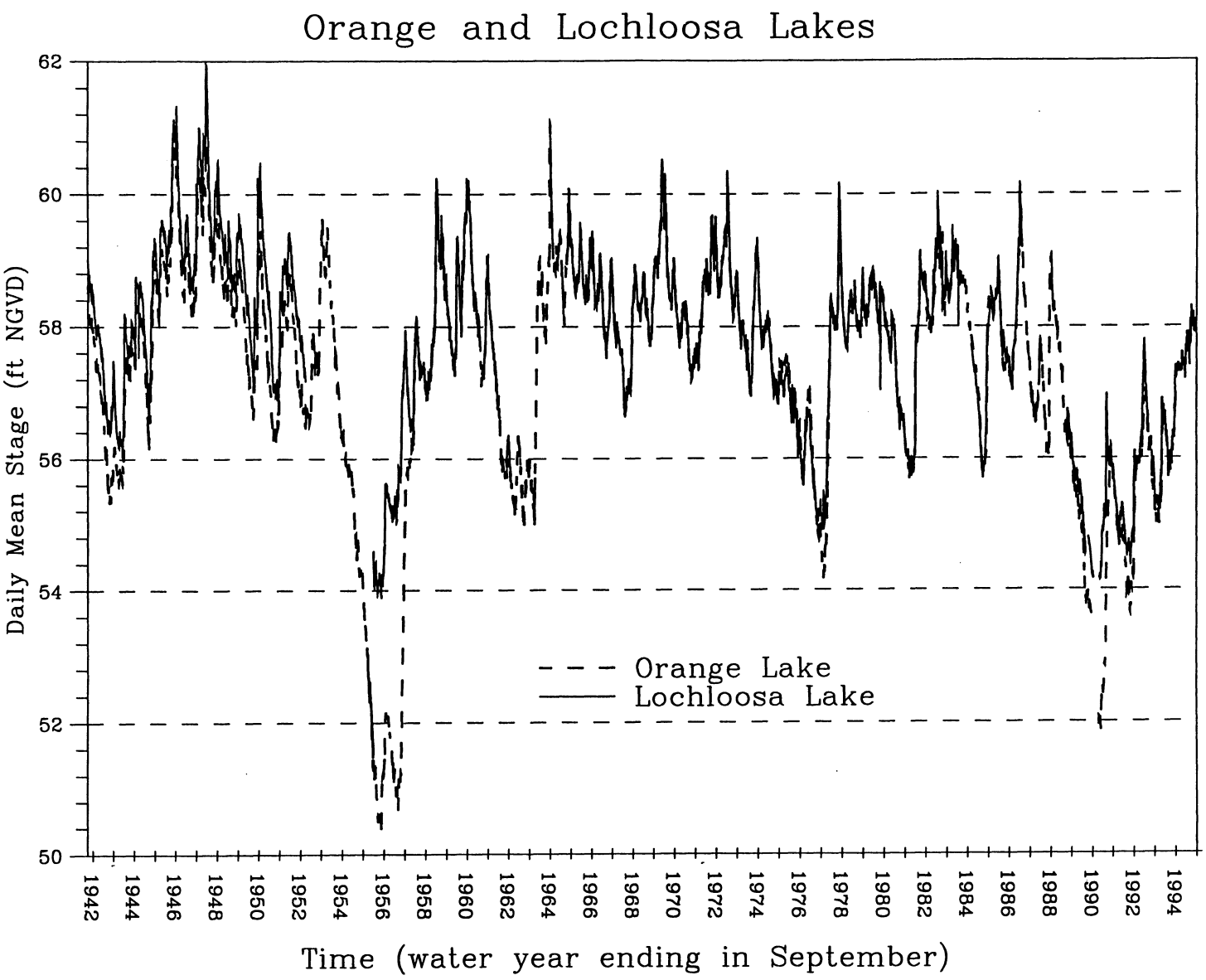


Figure 12. Comparison of historical elevations for Orange and Lochloosa lakes (1942-1995). Modified from Adkins and Rao (1995).

elevation, the two lakes become isolated from one another and their lake stages diverge rapidly, as Orange Lake continues to lose water through its sinkhole(s).

The surface area of Lochloosa Lake normally fluctuates between 7,000 acres (at 56 ft) and 9,500 acres (at 59 ft) (Robison *et al.* 1996). At median lake elevation (58.1 ft), lake area is about 9,000 acres. Lake area can decline to about 5500 acres at 54 ft. Additional morphometric features of Lochloosa Lake are summarized in Table 4.

6. Orange Creek Subbasin

The Orange Creek Subbasin has a drainage area of approximately 139 mi^2. The major drainage feature of this subbasin is Orange Creek. The creek provides the sole surface drainage outlet for all of the other subbasins, and connects them to the Ocklawaha River (Rodman Reservoir), east of the town of Orange Springs (Figure 5). Orange Creek has only two main tributaries, Lochloosa Slough and Little Orange Creek. Lochloosa Slough, a cypress/mixed swamp depression, drains lands to the southeast of Lochloosa Lake and provides an overflow outlet for the lake when the lake stage exceeds approximately 57.5 ft NGVD. Little Orange Creek drains lands in the extreme eastern portion of the subbasin and discharges to Orange Creek approximately 1 mile upstream of the confluence of Orange Creek with Rodman Reservoir.

Ecoregions And Subregions

The Orange Creek Basin lies entirely within the Southern Coastal Plain Ecoregion (Omernik 1987). The Southern Coastal Plain Ecoregion extends throughout the states of Alabama, Mississippi, Georgia, and Florida. It includes: 1) flat plains (10-50% covered by standing water); 2) southern mixed forest and southern floodplain forest; 3) land uses

of forest and woodland grazed, woodland and forest with some cropland and pasture, and swamp; and 4) wet soils (Omernik 1987).

Within Florida, the Southern Coastal Plain Ecoregion extends over the north and central parts of the state. In the Orange Creek Basin, it is represented by three subregions: (1) the Central Florida Ridges and Uplands, (2) the Eastern Florida Flatwoods, and (3) the Sea Island Flatwoods (Figure 13).

The Central Florida Ridges and Uplands Subregion is predominantly a sand hill karst area, characterized by flat or rolling plains, with sandy highlands and ridges (elevations between 50 and 200 feet) and numerous solution basins. From a statewide perspective, it is the principle recharge area of the Floridan aquifer. The soils in this subregion tend to be thick, acidic, sandy, and excessively to moderately drained (entisols and alfisols). The natural vegetation consists of forests of longleaf pine, turkey oak and wiregrass (Griffith et al. 1994). Three areas within the Orange Creek Basin belong to the Central Florida Ridges and Uplands Subregion: a northeastern area which includes the city of Gainesville, a southern area to the south and west of Orange Lake, and an eastern area north of Orange Creek and east of Highway 301 (Figure 13).

The Eastern Florida Flatwoods Subregion encompasses most of the central and northern portions of the Orange Creek Basin (Figure 13). Having originated from sequences of barrier islands and lagoons in Pliocene and Pleistocene time, this subregion is ribbed by sand ridges and some intervening swampy lowlands. The natural vegetation is characterized by pine flatwoods, grasslands of prairie type, freshwater marshes, and swamp forests. Soils (of sand, silt, and clay types) tend to be poorly drained (spodosols, entisols, histosols)(Griffith et al. 1994).

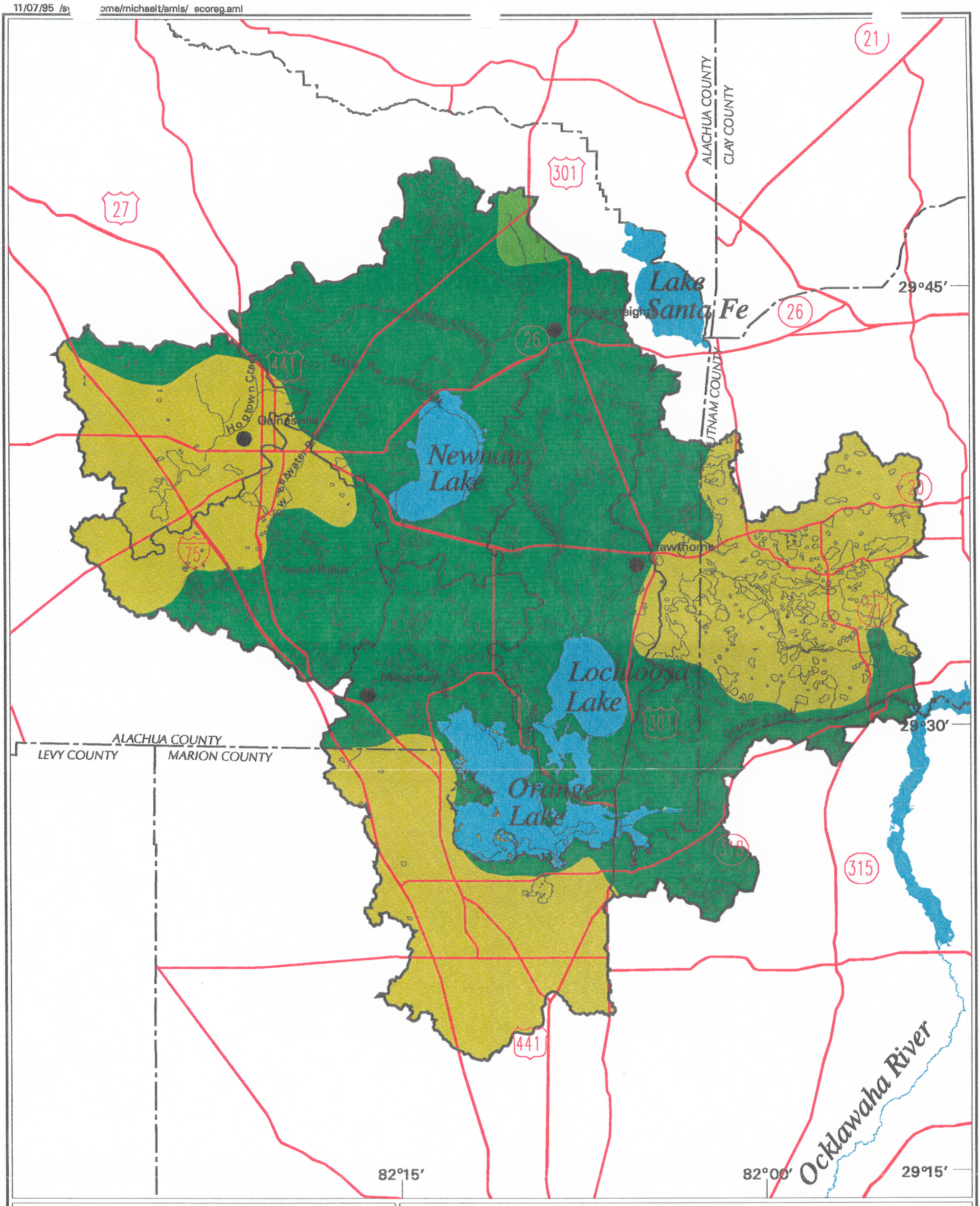
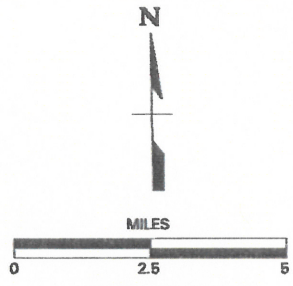


Figure 13. Ecoregions of the Orange Creek Basin

From: Griffith, et al. 1994. Basemap USGS 1:250,000.





Map produced using MAPPER.aml on March 06, 1995

SOUTHERN COASTAL PLAIN
- Sea Island Flatwoods
- Central Florida Ridges and Uplands
- Eastern Florida Flatwoods
- Water
- County boundary
- Major Road
- Orange Creek Basin Boundary
- Sub-Basin Boundaries

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The Sea Island Flatwoods Subregion is restricted to a very small area at the northernmost end of the Orange Creek Basin (Figure 13). In general, the area is characterized as a flat plain consisting of pine flatwoods with marshes, swamps, and lakes. Soils in this area are characterized generally as poorly drained spodosols, although ultisols, inceptisols, and entisols are also present (Griffith et al. 1994).

Wetland Vegetation

Figure 14 illustrates wetland coverage and distribution in the basin. Values for acreage and relative areal coverage of different wetlands vegetation types are summarized in Table 5. The wetlands vegetation map and data were generated from the District GIS wetland vegetation data base derived from photo-interpretation of 1:24,000 color infrared aerial photography (flight dates: 11/19/90 for Alachua and Putnam counties and 12/19/85 for Marion County). Basin coverage is restricted to lands within the SJRWMD (95.5% of the total basin area).

Roughly 27% of the Orange Creek Basin contains hydrographic features; 22% wetlands (forested, shrub, and herbaceous) and 5% open water (Table 5)[1]. Within the vegetated wetlands category, forested wetlands are the most abundant basin-wide (39,225 acres; 11% relative coverage). Herbaceous wetlands follow closely (30,013 acres; 8% relative coverage), and shrub wetlands are the least abundant (9,661 acres; 3% areal coverage) (Table 5). Forested wetlands are most prominent in Newnans Lake and Orange Creek subbasins and least abundant in Paynes Prairie and Hogtown Creek subbasins. Herbaceous wetlands reach their maximum expression in Paynes Prairie and Orange Lake subbasins, are moderately abundant in Orange Creek and Lochloosa Lake subbasins, and

[1] These values differ from the values obtained from the DLG-Hydrography data base (Table 3). Possible reasons for the discrepancy may be related, in part, to differences in basin coverage (the GIS wetlands vegetation data base excludes basin lands outside the District boundaries), to varying hydrologic conditions associated with surveying dates, or to scale-related differences in spatial resolution and mapping accuracy. Of the two databases, the District's GIS wetlands vegetation coverage is the most current and offers the highest accuracy and resolution (based on 1:24,000 scale rather than a 1:100,000 scale). For these reasons, the District wetlands vegetation database is the preferred source of hydrographic and wetlands data for the basin.

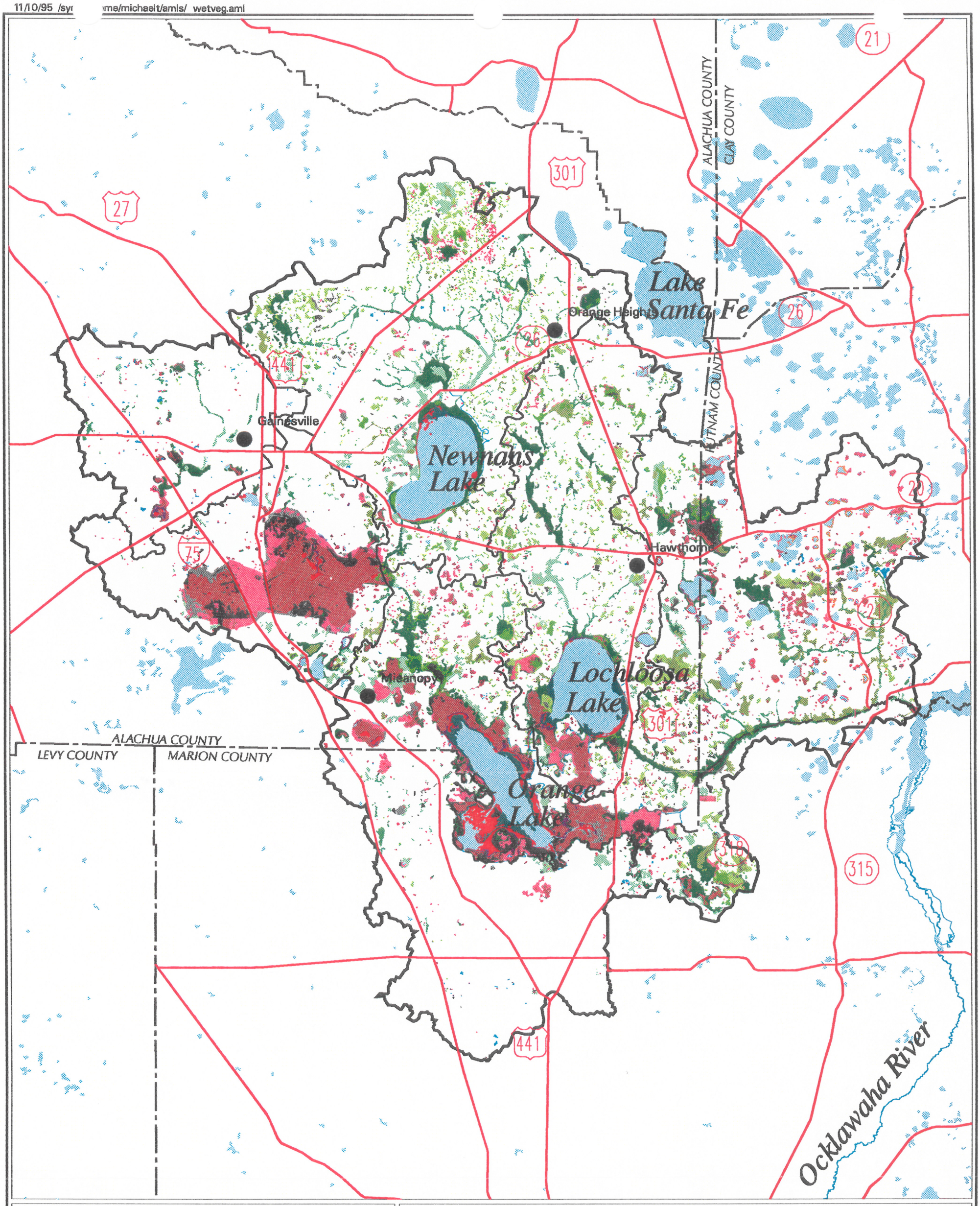


Figure 14. Orange Creek Basin Wetland Vegetation

Based on 1:24000 color infrared photography.
Alachua & Putnam Counties - 1990
Marion County - 1985-1986



N

MILES
0 0.2 0.4

SCALE 1:19325
ONE INCH REPRESENTS 0.3 MILES

Map produced using MAPPER.aml on March 06, 1996

FRESHWATER WETLANDS

FORESTED
- Cypress
- Hardwood swamp
- Bayhead
- Hydric hammock
- Bottomland hardwoods
- Forested depressions

SHRUB
- Shrub swamp
- Shrub bog
- Transitional shrub

HERBACEOUS
- Deep marsh
- Shallow marsh
- Wet prairie
- Floating marsh

TRANSITIONAL WETLANDS

HERBACEOUS
- Intermediate marsh

OTHER
- Uplands
- Freshwater flats & barren areas
- Water

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Table 5. Wetland vegetation acreage and relative coverage in the Orange Creek Basin. Areas calculated form the District GIS wetlands vegetation coverage for the Orange Creek Basin, derived from 1:24,000 color infrared photography.

		FORESTED							SHRUB				HERBACEAOUS					TOTAL	OTHER		
		BG	BH	BL	CY	HH	FD	HS	SS	TS	SB	SG	DM	SM	FF	WP	AB		W	BA	U
Hogtown Creek	Acres	1.0	3.0	210.7	20.3	197.2	0.0	444.3	195.3	30.8	52.9	0.0	25.5	262.5	79.1	148.1	0.0	1670.7	174.1	0.0	26142.6
	%	0.00%	0.01%	0.75%	0.07%	0.70%	0.00%	1.59%	0.70%	0.11%	0.19%	0.00%	0.09%	0.94%	0.28%	0.53%	0.00%	5.97%	0.62%	0.00%	93.41%
Paynes Prairie	Acres	53.5	325.0	92.9	51.7	481.8	28.8	413.1	2349.6	980.4	58.8	0.0	146.3	7361.1	107.9	2647.6	0.0	15098.5	513.4	0.0	25541.5
	%	0.13%	0.79%	0.23%	0.13%	1.17%	0.07%	1.00%	5.71%	2.38%	0.14%	0.00%	0.36%	17.89%	0.26%	6.43%	0.00%	36.69%	1.25%	0.00%	62.06%
Newnans Lake	Acres	88.9	717.7	1276.8	1039.4	2132.3	2744.4	2868.9	31.5	298.8	218.3	20.8	270.2	194.1	5.4	659.6	271.7	12838.9	5519.6	0.0	54943.5
	%	0.12%	0.98%	1.74%	1.42%	2.91%	3.74%	3.91%	0.04%	0.41%	0.30%	0.03%	0.37%	0.26%	0.01%	0.90%	0.37%	17.52%	7.53%	0.00%	74.96%
Lochloosa Lake	Acres	53.9	660.5	250.1	1133.6	1114.5	1954.9	2146.3	270.4	244.5	149.8	0.0	167.6	1886.2	122.0	1008.0	593.1	11755.4	5007.0	0.0	38379.1
	%	0.10%	1.20%	0.45%	2.06%	2.02%	3.55%	3.89%	0.49%	0.44%	0.27%	0.00%	0.30%	3.42%	0.22%	1.83%	1.08%	21.32%	9.08%	0.00%	69.60%
Orange Lake	Acres	0.0	381.9	236.4	898.5	1859.7	535.3	2022.9	1869.1	586.7	64.3	0.0	1580.7	5002.2	445.6	1625.0	1040.3	18148.7	4322.6	0.0	58879.0
	%	0.00%	0.47%	0.29%	1.10%	2.29%	0.66%	2.49%	2.30%	0.72%	0.08%	0.00%	1.94%	6.15%	0.55%	2.00%	1.28%	22.31%	5.31%	0.00%	72.38%
Orange Creek	Acres	1208.4	2223.6	1205.1	749.8	1358.1	2152.4	3887.2	1099.4	224.5	914.6	0.0	187.6	2018.1	57.5	2100.3	0.0	19386.6	3864.6	131.8	63890.2
	%	1.38%	2.55%	1.38%	0.86%	1.56%	2.47%	4.45%	1.26%	0.26%	1.05%	0.00%	0.21%	2.31%	0.07%	2.41%	0.00%	22.21%	4.43%	0.15%	73.21%
TOTAL BASIN	Acres	1405.6	4311.7	3272.1	3893.3	7143.5	7415.9	11782.8	5815.3	2365.8	1458.8	20.8	2377.8	16724.1	817.5	8188.7	1905.1	78898.7	19401.3	131.8	267775.8
	%	0.38%	1.18%	0.89%	1.06%	1.95%	2.03%	3.22%	1.59%	0.65%	0.40%	0.01%	0.65%	4.57%	0.22%	2.24%	0.52%	21.54%	5.30%	0.04%	73.12%

LEGEND

FORESTED WETLANDS		SHRUB WETLANDS		MARSH WETLANDS		OTHER	
BG	BAY GALL	SS	SHRUB SWAMP	DM	DEEP MARSH	W	WATER
BH	BAY HEAD	TS	TRANSITIONAL SHRUB	SM	SHALLOW MARSH	BA	BARREN
BL	BOTTOMLAND HARDWOODS	SB	SHRUB BOG	FF	FLOATING MARSH	U	UPLANDS
CY	CYPRESS	SG	SHRUB GALL	WP	WET PRAIRIE		
HH	HYDRIC HAMMOCK			AB	AQUATIC BEDS		
FD	FORESTED DEPRESSION						
HS	HARDWOOD SWAMP						

are scarce in Newnans Lake and Hogtown Creek subbasins. Shrub wetlands are prominent only in Paynes Prairie, Orange Lake, and Orange Creek subbasins. Further detail on the physiognomic composition of these vegetated wetland categories can be obtained from Table 5.

Fish And Wetland Wildlife Habitats

The Orange Creek Basin has been recognized for its exceptional ecological significance and the outstanding value of its sport fisheries. The high abundance and diversity of aquatic and wetland biological resources in the basin directly reflect the vast richness and complexity of habitats found in its numerous lake and wetland ecosystems. Floating and emergent marshes, wet prairies, forested wetlands, and open water habitats all provide refuge, feeding, nesting, and nursery areas for a large number of fishes, as well as aquatic and wetland invertebrates, reptiles, amphibians, and birds.

A number of wildlife species or subspecies which utilize aquatic, wetland, and upland habitats in the Orange Creek Basin are listed by the Florida Game and Fresh Water Fish Commission (FGFWFC) as threatened (T) or endangered (E), or as species of special concern (SSC) (Wood 1994). The species and subspecies which depend on, or are primarily found in, wetland or aquatic habitats and are known to occur in the Orange Creek Basin are listed below, along with a source for documentation of their occurrence within the Basin. Those species which occur regularly (more than 10 records) are marked with an asterisk.

Scientific Name	Common Name	Status	Habitat or Location and Source
Etheostoma olmstedi maculaticeps	southern tessellated darter	SSC	Orange Creek (Gilbert 1992)
**Rana capito aesopus*	Florida gopher frog	SSC	flatwood ponds
**Drymarchon corias couperi*	eastern indigo snake	T	bottomland forests (Moler 1985)
Ajaia ajaja	roseate spoonbill		Paynes Prairie (Austin et al. 1988)
**Aramus guarauna*	limpkin	SSC	Orange Lake, Lake Alice (Austin et al. 1988)
**Egretta caerulea*	little blue heron	SSC	Orange Lake (Runde et al. 1991)
**Egretta thula*	snowy egret	SSC	Orange Lake (Runde et al. 1991)
**Egretta tricolor*	tricolored heron	SSC	Orange Lake (Runde et al. 1991)
**Eudocimus albus*	white ibis	SSC	Paynes Prairie (Nesbitt et al. 1974) and Orange Lake (District staff 1996)
**Grus canadensis pratensis*	Florida sandhill crane	SSC	Paynes Prairie, Orange Lake (Nesbitt 1977)
**Haliaeetus leucocephalus*	bald eagle	T	Orange Lake, Lochloosa Lake, Newnans Lake, Paynes Prairie, (S. Nesbitt, FGFWFC, pers.com. 1996)
**Mycteria americana*	wood stork	E	River Styx (Nesbitt 1973)
Ursus americanus floridanus	Florida black bear	T	bottomland forest no recent record

River Styx is home to perhaps the oldest and most continuously successful wood stork (*Mycteria americana*) colony in northern Florida. For many years, 70-200 pairs of this federally endangered species have produced young every year with few exceptions (S. Nesbitt, FGFWFC, pers. com. 1995). Due its consistent success, the importance of this colony has increased in recent years because of the chronic failure of large south Florida colonies. The Orange Creek Basin wetlands also provide nesting habitat for the threatened Florida sandhill crane (*Grus canadensis pratensis*). In addition to concentrations of nesting cranes on Paynes Prairie (120-150 pairs), and around Orange Lake (30-50 pairs), there are numerous individual pairs scattered throughout the region in

smaller wet prairies (S. Nesbitt, FGFWFC, pers. com. 1996). Both Paynes Prairie and areas around Orange Lake are important wintering areas for migratory sandhill cranes; flocks of more than 1000 each use these two areas. The three large lakes in the Orange Creek Basin provide habitat for nesting bald eagles (*Haliaeetus leucocephalus)* (Wood et al. 1989). Recent (1995) surveys by FGFWFC staff reported at least 43 active bald eagle nests in the basin: 11 on Newnans Lake, 5 in Paynes Prairie, and 27 in Orange and Lochloosa lakes (S. Nesbitt, FGFWFC, pers. com. 1996).

One of the first protected rookeries for egrets was Bird Island, near the southwest shore of Orange Lake which was purchased by the Audubon Society in 1910. This colony was abandoned sometime during the last 20 years (F. McKay, pers. com. 1995). In 1995, SJRWD staff observed three separate active egret colonies in Orange Lake. The first was an extensive colony on Redbird Island. The second colony was on a low island in the northern part of the lake, and the third was near the beginning of the outflow area known as P-G Run. Three species designated by the FGFWFC as Species of Special Concern breed in these colonies: snowy egret (*Egretta thula*), tricolored heron (*Egretta tricolor*), and little blue heron (*Egretta caerulea*).

Wetlands and open water in the Orange Creek Basin are important for populations of other species that are not listed. Orange Lake supports populations of round-tailed muskrats (*Neofiber alleni*), least bitterns (*Ixobrychus exilis*), purple gallinules (*Porphyrula martinica*), moorhens (*Gallinula chloropus*), and wintering populations of ring-necked ducks (*Aythya collaris*) and American coots (*Fulica americana*). American alligators (*Alligator mississippiensis*) are abundant in the basin with the commercial harvest of alligators from the Orange Creek Basin generating approximately $44,100 annually (S. Nesbitt, FGFWFC, pers.com. 1996). River otters (*Lutra canadensis*) can be found in the River Styx and ospreys (*Pandion haliaetus*) are common in Orange, Lochloosa, and Newnans Lakes. Newnans Lake has many cormorants (*Phalacrocorax*

auritus) and anhingas (*Anhinga anhinga*), and in winter is used as a night refuge by thousands of gulls. Paynes Prairie is home to cotton rats (*Sigmodon hispidus*), marsh rabbits (*Silvilagus palustris*), raccoons (*Procyon lotor*), hawks, king rail (*Rallus elegans*), and cottonmouths (*Agkistrodon piscivorus*). Bottomland forests support golden mice (*Ochrotomys nuttalli*), cotton mice (*Peromyscus gossypinus*), owls, woodpeckers, warblers, and wood ducks (*Aix sponsa*).

Orange and Lochloosa lakes have a long-established reputation, both statewide and nationally, for their excellent sport fisheries, particularly of largemouth bass and black crappie. In the spring of 1979, sportfish expenditures on Lochloosa and Orange lakes were estimated to be $923,987 over a 16 week period (Delaney 1983). Past economic benefits to the local economy of the fisheries of these two lakes have been estimated at $11 million annually (Milon et al. 1986). Since the early 1990's, however, various local fish camps in the area have closed, in response to low lake levels and a perceived decline in the quality of the fisheries in the lakes. New economic analyses are needed to determine the current status of the sportfishing industry in Orange and Lochloosa lakes and to identify probable causes (e.g., reduced lake access, decline in sportfish populations) for the perceived declines in local sportfishing activities.

The exceptional richness of aquatic and wetland wildlife habitats and communities in the Orange Creek Basin has prompted the designation of several of its major waterbodies as Outstanding Florida Waters (Orange and Lochloosa lakes, Lochloosa Creek, River Styx, and Cross Creek) and the inclusion in the State CARL Land Acquisition Program of the Paynes Prairie, Lochloosa Wildlife, and Newnans Lake Project Areas. Additionally, in recognition of the basin's high fisheries potential, the Florida Game and Fresh Water Fish Commission has designated Orange, Lochloosa, and Newnans lakes as Fish Management Areas.

Sampling for sportfish in the Orange Creek Basin lakes has been undertaken primarily by the Florida Game and Fresh Water Fish Commission (FGFWFC) and reported in annual reports (FGFWFC 1967, 1974, 1975, 1976, 1978, 1979, 1980, 1981, 1983, 1984, 1985, 1986, 1988, 1989, 1990, 1992a,b, 1993, 1995; Estes et al. 1989,1990, 1993 a,b; see Appendix B for complete references). This information, as well as current sampling data from the FGFWFC and others, is being analyzed to determine historic trends in and the current status of the fishery in the Orange Creek Basin lakes. These analyses are being coordinated with the FGFWFC, and will be included in a revised version of this plan.

Land Cover/Land Use

Land cover/land use information for the Orange Creek Basin is summarized in Figure 15 and in Tables 6a, 6b, and 6c. The land cover/land use data were obtained from photo-interpretation and digitization of 1:24,000 black and white aerial photography for Alachua (1988), Putnam (1989) and Marion (1989) counties. Coding of the data follows the Florida Land Use Cover Classification Scheme (FLUCCS). Data retrievals were done by specifying item LUCODE2, which preferentially selects actual land cover information over primary land use. The land cover analysis presented here pertains only to that portion of the basin within District boundaries (95.5%). Data for the remaining 4.5% of the basin are not yet available.

Land cover in the Orange Creek Basin is primarily (85%) rural: 40% upland forests, 28% wetlands, 16% agriculture, 7% open water and 1% rangeland (Table 6, Figure 15). Urban land use accounts for most of the remaining 15% of the basin and is primarily associated with the city of Gainesville. Lower density urban development exists elsewhere in the basin, representing expansion from the town of Interlachen to the east and the city of Ocala to the south. Small towns located in the basin include Orange Heights, Hawthorne, Waldo, Micanopy, Reddick, and McIntosh (Figure 15).

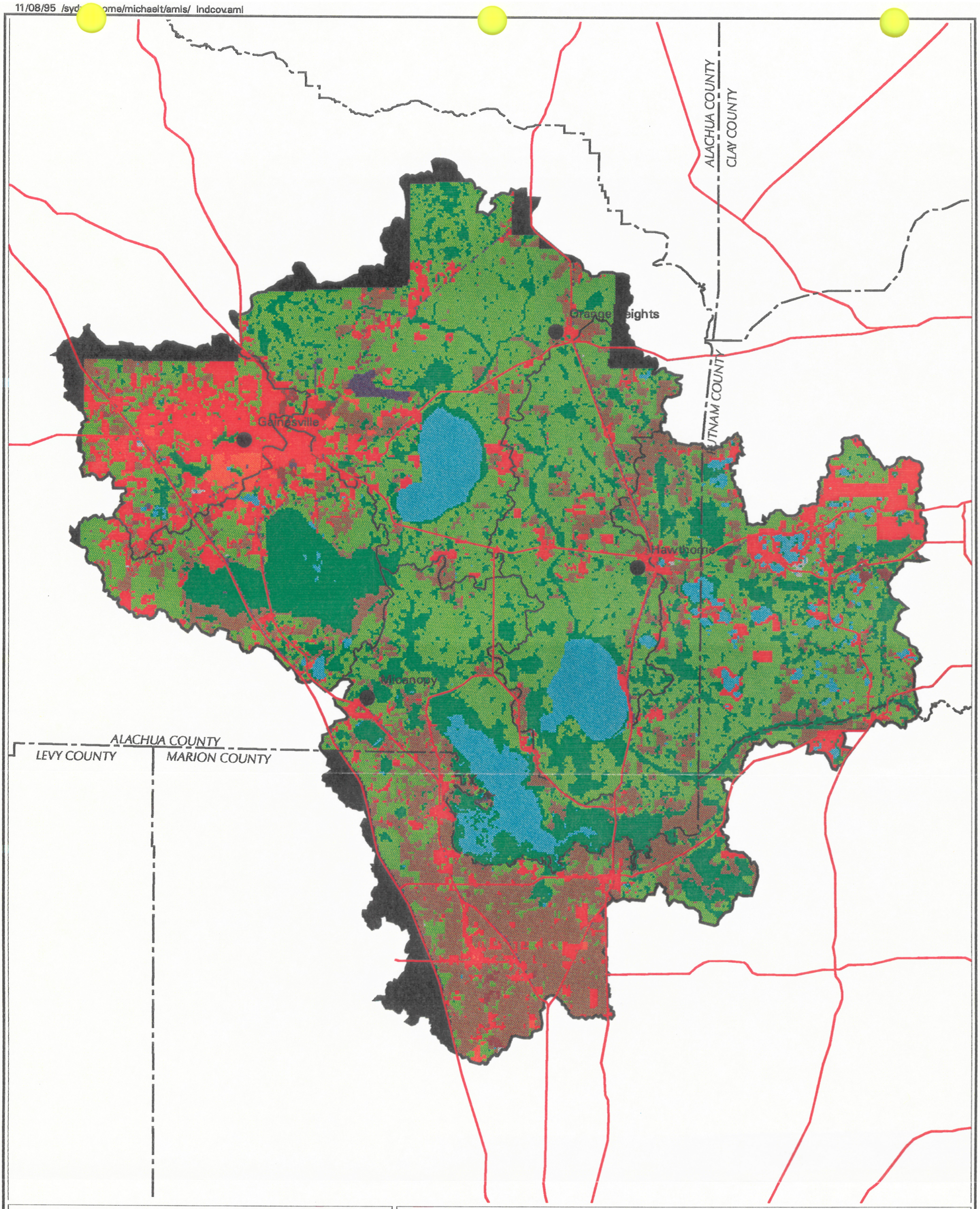


Figure 15. Land Cover in the Orange Creek Basin

From Land Use/Land Cover GIS data layer. Based on 1:24000 B&W Aerial Photography Marion and Putnam Counties 1989 Alachua County 1988.



N

MILES

0 2.5 5

SCALE 1:231898

ONE INCH REPRESENTS 3.66 MILES

Map produced using MAPPER.aml on March 06, 1995

- Urban
- Agricultural
- Rangeland
- Upland Forests
- Wetlands
- Water
- Barren Land
- Transportation, Communication, And Utilities
- (Data Not Available)

- Highways
- Orange Creek Basin boundary
- Sub-Basin boundary
- County boundary

The St. Johns River Water Management District prepares and uses this information for its own purposes and this information may not be suitable for other purposes. This information is provided "as is". Further documentation of this data can be obtained by contacting: St. Johns River Water Management District, Geographic Information Systems, Program Management, P.O. Box 1429, Palatka, Florida 32178-1429, (904)329-4176

Table 6. Land Cover in the Orange Creek Basin. Areas calculated from the District GIS land cover/land use data base, derived from 1:24,000 black and white aerial photography for Alachua (1988), Marion (1989), and Putnam (1989) counties. Data retrievals performed by specifying LUCODE2 (Florida Land Use Cover Classification Scheme).

Table 6a. AREA (acres)

	URBAN	AGR.	RANGELND	UPLAND FORESTS		WATER	WETLANDS			BARREN	TRANSP.	LANDCOVER	BASIN AREA	% AREA
				Natural	Plantation		Forested	Non-forested	Non-vegetat.			TOTAL	TOTAL	W/I BASIN
SUBBASIN	1000-1999	2000-2999	3000-3999	4100-4399	4400-4499	5000-5999	6100-6399	6400-6499	6500-6999	7000-7999	8000-8999			
Hogtown Creek	15681	2320	260	6913	402	249	988	517	0	64	609	28004	31699	88.34%
Paynes Prairie	7371	5787	312	10547	1201	746	1482	13010	12	20	665	41153	41266	99.72%
Lochloosa Lake	2740	6143	455	5808	22373	5843	7543	3802	0	11	421	55139	56305	97.93%
Orange Lake	7580	27408	536	12827	9932	7066	5008	10223	0	44	621	81245	87944	92.38%
Orange Creek	11637	13130	660	17097	20217	4283	14251	7158	0	173	157	88763	88763	100.00%
Newnans Lake	7600	4397	1235	9986	29966	6086	11775	858	0	0	1434	73338	79363	92.41%
Total	52610	59185	3459	63178	84092	24273	41047	35568	12	311	3907	367641	385340	95.41%
% of Total	14.31%	16.10%	0.94%	17.18%	22.87%	6.60%	11.16%	9.67%	0.00%	0.08%	1.06%	100.00%		

Table 6b. PERCENT AREA (%)

	URBAN	AGR.	RANGELND	UPLAND FORESTS		WATER	WETLANDS			BARREN	TRANSP.	LANDCOVER
				Natural	Plantation		Forested	Non-forested	Non-vegetat.			TOTAL
SUBBASIN	1000-1999	2000-2999	3000-3999	4100-4399	4400-4499	5000-5999	6100-6399	6400-6499	6500-6999	7000-7999	8000-8999	
Hogtown Creek	56.00%	8.28%	0.93%	24.69%	1.44%	0.89%	3.53%	1.84%	0.00%	0.23%	2.18%	100.00%
Paynes Prairie	17.91%	14.06%	0.76%	25.63%	2.92%	1.81%	3.60%	31.61%	0.03%	0.05%	1.62%	100.00%
Lochloosa Lake	4.97%	11.14%	0.83%	10.53%	40.58%	10.60%	13.68%	6.90%	0.00%	0.02%	0.76%	100.00%
Orange Lake	9.33%	33.74%	0.66%	15.79%	12.22%	8.70%	6.16%	12.58%	0.00%	0.05%	0.76%	100.00%
Orange Creek	13.11%	14.79%	0.74%	19.26%	22.78%	4.83%	16.05%	8.06%	0.00%	0.19%	0.18%	100.00%
Newnans Lake	10.36%	6.00%	1.68%	13.62%	40.86%	8.30%	16.06%	1.17%	0.00%	0.00%	1.96%	100.00%

Table 6c. PERCENT AREA (%) WITHIN URBAN

	RESIDENTIAL			COMMERCIAL	INDUSTRIAL	EXTRACTIVE	INSTITUT.	RECREAT.	OPEN LAND	URBAN
	low density	med. density	high density	& SERVICES						TOTAL
SUBBASIN	1100-1199	1200-1299	1300-1399	1400-1499	1500-1599	1600-1699	1700-1799	1800-1899	1900-1999	
Hogtown Creek	18.61%	44.67%	11.65%	8.82%	2.33%	0.04%	10.32%	2.54%	1.01%	100.00%
Paynes Prairie	33.13%	32.81%	8.30%	10.09%	3.36%	0.39%	6.74%	1.92%	3.27%	100.00%
Lochloosa Lake	77.96%	13.26%	0.93%	1.41%	0.50%	0.27%	1.07%	0.29%	4.32%	100.00%
Orange Lake	70.02%	13.98%	0.38%	3.65%	0.63%	5.71%	3.90%	0.50%	1.21%	100.00%
Orange Creek	54.20%	11.52%	0.00%	0.85%	1.15%	3.51%	0.17%	0.02%	28.59%	100.00%
Newnans Lake	50.49%	18.60%	3.02%	3.55%	5.73%	2.09%	8.23%	6.84%	1.44%	100.00%

Upland forests in the Orange Creek Basin consist mostly (57%)of commercial plantations or pineland forests (Table 7). These plantations are particularly widespread in the Lochloosa Lake, Newnans Lake, and Orange Creek subbasins (Table 7), where they jointly cover almost 73,000 acres (Table 6a). Natural mixed hardwood forests, on the other hand, are the dominant upland forest type in the Hogtown Creek, Orange Lake, and Paynes Prairie subbasins (Table 7).

Wetlands are the second most prominent land cover feature in the Orange Creek Basin. The composition and coverage of wetlands is analyzed with greater accuracy and detail in the section on wetland vegetation above, using the District's 1990 GIS wetland vegetation data base. The land cover/land use data base will therefore not be used as a source of wetland information for the basin.

Water Quality

Analyses of existing regional and local water quality data reveal that water quality in the Orange Creek Basin generally ranges from good to fair, with water quality problems and/or degrading water quality trends being present for specific waterbodies in or near the city of Gainesville (SJRWMD 1995a, FDEP 1994; Figure 16). Water quality in the major lakes and streams of the basin is summarized in Tables 8 and 9, respectively. More current water quality data obtained from the District's on-going water quality monitoring effort in the basin are presented in Table 10.

Based on current Trophic State Index (TSI) values, all of the major lakes listed in Table 8 are either mesotrophic or eutrophic. The TSI (Carlson 1977; modified by Huber et al. 1982) is a multi-parameter index used to indicate nutrient enrichment or productivity in standing water bodies. It is calculated from four water quality parameters: chlorophyll-*a*, Secchi depth, total phosphorus, and total nitrogen. Trophic State Index

Table 7. Upland forest composition in the Orange Creek Basin. Areas calculated from the District GIS land cover/land use database, derived from 1:24,000 black and white aerial photography for Alachua (1988), Marion (1989), and Putnam (1989) counties. Data retrieval performed by specifying LUCODE2 (Florida Land Use Cover Classification Scheme).

	UPLAND FORESTS					
	NATURAL		PLANTATION		TOTAL	
SUBBASIN	4100-4399		4400-4499			
	(acres)	(%)	(acres)	(%)	(acres)	(%)
Hogtown Creek	6913	94.50%	402	5.50%	7315	100.00%
Paynes Prairie	10547	89.78%	1201	10.22%	11748	100.00%
Lochloosa Lake	5808	20.61%	22373	79.39%	28181	100.00%
Orange Lake	12827	56.36%	9932	43.64%	22759	100.00%
Orange Creek	17097	45.82%	20217	54.18%	37314	100.00%
Newnans Lake	9986	24.99%	29966	75.01%	39952	100.00%
Total Basin	63178	42.90%	84092	57.10%	147270	100.00%

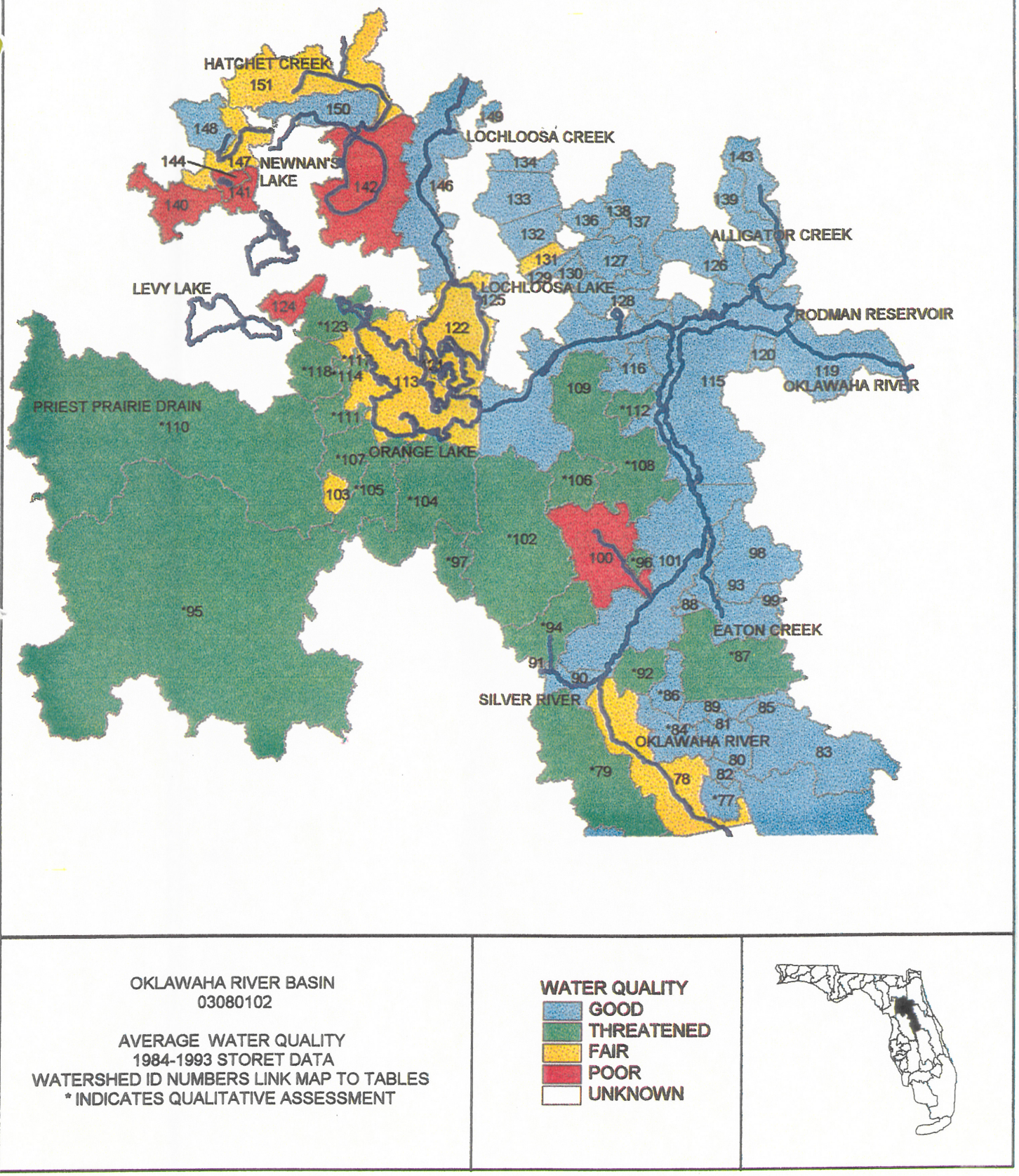


Figure 16 (from FDEP 1994; 305(b) technical appendix). Water Quality assessment for the lower Oklawaha River Basin. Water quality designations were determined for individual watersheds from quantitative hydrochemical data, and from qualitative nonpoint source surveys when quantitative data were not available. See FDEP (1994) for watershed identification and corresponding water quality data.

Table 8. Water quality data for selected lakes in the Orange Creek Basin. Compiled from State 305(b) Water Quality Assessment Reports (FDER 1988 and 1992a, and FDEP 1994). NA = data not available.

WATER QUALITY INDEX	GOOD	FAIR	POOR
WQI - STREAM	0-44	45-59	60-69
TSI - LAKE	0-59	60-69	70-100

WATER BODIES	DATA RECORDS			WATER CLARITY		DISSOLVED OXYGEN		TROPHIC STATUS			WATER QUALITY INDEX	
	No. OBS	BEG YR	END YR	TURB mg/l	SECCHI m	DO mg/l	DOsat %	TN mg/l	TP mg/l	CHL-a ug/l	TSI	WQI
LAKES												
Orange Lake	275	56	86	3.4	1.1	7.8	86	1.08	0.04	17	54	—
	127	89	93	13.0	.6	8.1	92	1.18	0.05	21	60	—
Lochloosa Lake	90	58	82	4.2	0.7	9.1	99	1.75	0.05	28	63	—
	122	89	93	14.0	0.7	8.6	100	1.38	0.06	15	61	—
Newnans Lake	106	57	82	7.6	0.6	9.1	97	1.87	0.11	53	70	—
	106	89	93	30.5	0.4	9.5	114	1.96	0.08	47	75	—
Kanapaha Lake	2	90	90	7.2	0.4	9.8	121	1.4	0.07	100	78	—
Lake Alice	2	90	90	8.4	0.6	19.2	254	1.37	1.18	76	73	—
Alachua Lake	6	73	82	NA	0.6	7.6	89	1.4	0.71	88	66	—
(Paynes Prairie)	3	82	83	NA	NA	NA	NA	1.04	0.16	NA	57	—
Bivens Arm	17	69	80	2.8	0.6	6.8	83	1.42	0.62	14	64	—
	3	92	92	11.4	0.3	11.6	124	2.11	0.13	52	80	—
Holden Pond	2	90	90	5.2	0.7	8.3	99	1.74	0.06	20	64	—

Table 9. Water quality data for selected streams in the Orange Creek Basin. Compiled from State 305(b) Water Quality Assessment Reports (FDER 1988 and 1992a, and FDEP 1994). NA = data not available.

WATER QUALITY INDEX	GOOD	FAIR	POOR
WQI - STREAM	0-44	45-59	60-69
TSI - LAKE	0-59	60-69	70-100

WATER BODIES	DATA RECORDS			WATER CLARITY		DISSOLVED OXYGEN		TROPHIC STATUS			WATER QUALITY INDEX	
	No. OBS	BEG YR	END YR	TURB mg/l	SECCHI m	DO mg/l	DOsat %	TN mg/l	TP mg/l	CHL-a ug/l	TSI	WQI
STREAMS												
Little Hatchet Crk.	18	79	81	NA	NA	8.0	75	NA	0.32	NA	---	27
Hatchet Creek	5	79	81	NA	NA	10.4	98	NA	0.23	NA	---	20
	4	93	93	5.9	NA	5.5	64	1.22	NA	16	---	51
Hogtown Creek	57	66	81	4.5	NA	8.1	72	.80	.69	NA	---	37
	5	92	92	3.0	NA	9.0	93	0.66	0.47	0	---	36
Sweetwater Branch	25	73	82	NA	NA	NA	NA	10.67	4.80	NA	---	90
Orange Creek	19	89	93	0.9	NA	7.0	78	0.62	0.06	2	---	23
Little Orange Crk.	3	92	93	1.0	NA	7.9	86	1.29	0.07	1	---	26
Cabbage Creek	9	84	86	NA	NA	8.2	86	0.52	0.04	0	---	10
Cross Creek	5	89	89	2.0	NA	5.2	53	0.95	0.03	19	---	49
Lochloosa Creek	9	70	74	12	NA	7.6	91	1.21	0.03	NA	---	33
	3	92	92	1.1	NA	5.3	53	1.62	0.02	2	---	36

Table 10. 1994-1995 water quality data for selected lakes and streams in the Orange Creek Basin. From District's monthly water quality monitoring program. Data are subject to revision (QA/QC pending). For location of sampling stations, see Appendix E.

WATER BODY	STATION NAME	DATA RECORDS		WATER CLARITY				DISS. OXYGEN		TROPHIC STATUS					
		No. samples	sampling period	TURBIDITY (NTU)		SECCHI (m)		(mg/l)		TN (mg/l)		TP (mg/l)		CHL-a (µ/l)	
				mean	SD	mean	SD	mean	SD	mean	SD	mean	SD	mean	SD
Lake Kanapaha	KANA	5	2/94 - 8/94	5.2	3.8	0.46	0.23	9.1	3.4	2.025	1.250	0.200	0.120	21.32	14.70
Hogtown Creek	HOG30	6	5/94 - 2/95	1.7	0.6	------	------	7.3	2.4	0.497	0.157	0.549	0.097	0.45	0.47
Sweetwater Branch	SWB331	10	2/94 - 1/95	1.0	0.3	------	------	8.6	1.0	5.584	4.237	1.362	0.990	0.75	0.39
Bivens Arm	OR908	8	2/94 - 1/95	27.0	8.2	0.28	0.13	9.9	1.5	2.118	0.367	0.186	0.034	76.86	18.40
Hatchet Creek	HAT26	9	2/94 - 1/95	2.8	2.2	------	------	6.4	2.7	1.225	0.272	0.160	0.139	6.45	18.03
Little Hatchet Crk	LHT26E	8	3/94 - 1/95	4.2	6.5	------	------	6.1	2.7	1.246	0.557	0.236	0.127	4.75	11.38
Newnans Lake	NEW	10	2/94 - 3/95	30.5	8.2	0.23	0.06	9.0	1.2	3.392	1.787	0.143	0.029	208.26	83.36
Prairie Creek	PC20	10	2/94 - 3/95	26.7	9.6	------	------	8.9	2.0	3.325	1.825	0.151	0.033	174.91	71.33
River Styx	STX346	10	2/94 - 3/95	1.5	1.0	0.95	0.21	3.3	2.4	1.629	0.183	0.126	0.082	1.22	0.84
Orange Lake	OLC	8	2/94 - 2/95	3.9	1.0	1.06	0.17	8.5	1.0	1.324	0.134	0.047	0.025	17.30	3.70
Lochloosa Creek	LOCH20	8	2/94 - 3/95	1.3	0.7	------	------	5.6	2.3	1.696	0.696	0.079	0.052	9.21	26.22
Lochloosa Lake	LOCHLS	10	2/94 - 3/95	11.4	3.4	0.44	0.04	8.3	1.6	2.012	0.759	0.069	0.017	63.39	31.82
Cross Creek	CCN325	10	2/94 - 3/95	7.3	3.8	------	------	4.2	3.3	2.057	0.354	0.096	0.025	35.23	19.45
Orange Creek	OR006	9	2/94 - 2/95	1.0	0.3	------	------	7.8	1.4	1.639	0.964	0.113	0.057	0.45	0.33
Little Orange Creek	LOCBCC	9	2/94 - 2/95	1.1	0.3	------	------	8.1	1.3	0.643	0.433	0.046	0.037	0.33	0.55

values may be interpreted according to the following table (Huber et al. 1982, FDEP 1994):

TSI	WQ RANK	TROPHIC STATE	SUPPORTS BENEFICIAL USES?
0-59	good	oligotrophic	yes
60-69	fair	mesotrophic	partially
70-100	poor	eutrophic	no

The TSI values reported in Table 8 show that Newnans Lake, Bivens Arm, and lakes Kanapaha and Alice are all highly eutrophic. Researchers believe that some of these lakes may be naturally eutrophic because they lie over phosphate-rich soils derived from the Hawthorn Formation (Putnam 1968, Brezonik & Shannon 1971, Canfield & Hoyer 1988). Cultural enrichment, however has been a major determining factor in the high trophic state of Lake Alice, which received treated effluent from the University of Florida waste water treatment plant for over two decades. Urban stormwater from the city of Gainesville has also likely contributed to eutrophication in Bivens Arm, where water quality has apparently declined over time (FDEP 1994; Table 8). A degrading water quality trend for Newnans Lake (Table 8) suggests that this lake has also experienced cultural eutrophication over time.

The significance of urban land use and of its potential impact on surface water quality in Newnans Lake is evident from the land cover/land use data presented in table 6. Although these data indicate that only 10% of the Newnans Lake subbasin is urban (comparable to a value of 9% for the Orange Lake subbasin), urban medium and high density residential uses are relatively more important in the Newnans Lake subbasin than in non-urban subbasins such as Orange Lake, Lochloosa Lake, or Orange Creek subbasins. Also, the Newnans Lake subbasin has the highest prevalence of industrial

available), incomplete data (lack of data for certain parameters), and exclusion of toxic pollutants as index categories, may be some of the reasons for misleading WQI values for some of the Orange Creek Basin streams.

Using the Nonpoint Source Pollution Screening (NPPS) model developed by the SJRWMD, four major areas representing 20% of the basin have significant existing and projected pollution loads to surface waters (Adamus & Bergman 1995; Figure 17). The largest of these areas (39,377 acres) corresponds to urban and suburban lands associated with the city of Gainesville. Hogtown Creek, Possum Creek, Lake Kanapaha, Sweetwater Branch, Little Hatchet Creek, Bivens Arm, Newnans Lake and Lake Alice are some of the waterbodies currently impacted by urban (nonpoint source) runoff. Point source discharges additionally affect Sweetwater Branch, which receives nutrient-rich effluent from the Gainesville Regional Utilities' Mainstreet Wastewater Treatment Plant. Based on future land use information, this urban/suburban area is expected to expand eastward toward Gumroot Swamp, just north of Newnans Lake.

The second largest water quality problem area (29,048 acres) is located in the southernmost tip of the Orange Creek Basin (Marion county), just south of Orange Lake. The land use is primarily agricultural (pastures and croplands) with scattered light residential development. A third problem area (1,807 acres) lies west of Orange Lake and consists primarily of pasture lands with some urban development. The smallest of the pollution load problem areas identified is the Cross Creek area, where low and medium density residential development accounts for about 30% of land use.

Recreation And Public Use

Orange and Lochloosa lakes have long been noted statewide and nationally for their excellent sport fisheries, particularly of largemouth bass and black crappie. Sport fishing in these lakes is year round, with a significant peak in the spring. In the mid

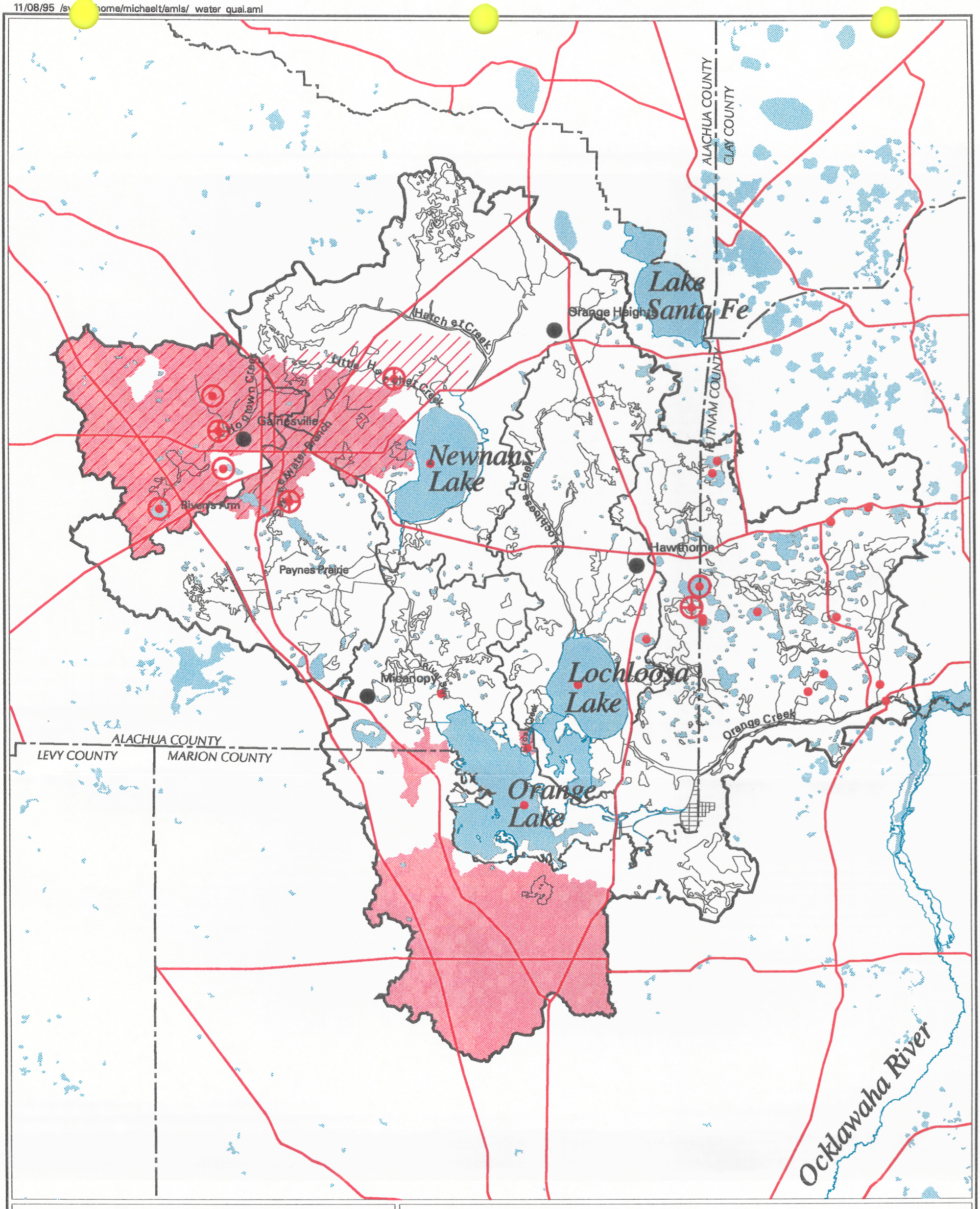
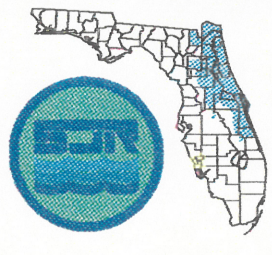


Figure 17. Potential Water Quality Problem Areas In the Orange Creek Basin

1995 SJRWMD District Water Management Plan

Based on the District-wide NPS Pollution load screening model developed by the SJRWMD for the Dist. Wat. Mgmt. Plan. Pollutants included in the model are total N, total P, BOD, s. solids, Zn, and Pb. For a description of the model, see Adamus & Bergman, 1993.



N

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SCALE 1:231898

ONE INCH REPRESENTS 3.66 MILES

Map produced using MAPPER.aml on March 06, 1995

- Potential stormwater runoff problem areas
- Areas with projected future loads equal to or greater than existing problem areas
- No Thresholds Tripped
- One Threshold Tripped
- More than one tripped

- Highways
- Orange Creek Basin boundary
- Sub-Basin boundary
- County boundary

The St. Johns River Water Management District prepares and uses this information for its own purposes and this information may not be suitable for other purposes. This information is provided "as is". Further documentation of this data can be obtained by contacting: St. Johns River Water Management District, Geographic Information Systems, Program Management, P.O. Box 1429, Palatka, Florida 32178-1429. (904)329-4176

1980's, the Orange Lake area alone contained some 60 acres of recreational area with 174 campsites, 15 boat ramps, and 287 marine slips. Numerous fish camps (10 on Orange Lake, 5 on Lochloosa) provided a variety of services including lodging, guides, boat ramps, boat and motor rental, tackle, and live bait (Allen 1986). Today, sportfishing facilities in the area are noticeably fewer. The observed decline in the local recreational fishing industry followed the 1990-91 drought, which caused the lakes (particularly Orange Lake) to experience extreme low water for an extended period of time (Figure 12).

Seasonal fishing is also popular in a number of other waterbodies in the basin. These include Newnans Lake (well known for its historically important black crappie fishery) and its tributaries (Hatchet Creek and Gumroot Swamp), Prairie Creek, Camps Canal and River Styx.

A variety of other recreational opportunities also exist within the Orange Creek Basin. The County Recreation and Open Space element (Alachua County Comprehensive Plan) summarizes the acreages and facilities available. General public uses of large tracts of conservation lands are noted weekly in the *Gainesville Sun*; highlights feature hikes and horseback rides at Paynes Prairie State Preserve and local guided walks at Bivens Arm Nature Park, Alfred Ring Nature Park, Hogtown Greenway, and Morningside Nature Center.

The Gum Root Swamp Conservation Area (jointly owned by the SJRWMD and the city of Gainesville) and the Prairie Creek Conservation Area (owned by the SJRWMD) provide passive recreational activities such as hiking, bank fishing, bird-watching, picnicking, canoeing, and nature study. Seasonal hunting is additionally allowed and encouraged at the Lochloosa Wildlife Management Area (recently acquired by the SJRWMD). Plans to expand this area's recreational opportunities to include hiking, bicycling, horseback riding, canoeing, boating, and bird-watching are underway.

Chronology Of Important Management Events

In the Orange Creek Basin, there is a long history of events that lead to the existing issues and problems. A chronology of natural resource events in the Orange Creek Basin is as follows.

pre-1871	Paynes Prairie existed as a shallow marsh/lake
1871	Alachua Sink closed naturally; Paynes Prairie became a lake
1881	Railroad bridge constructed across outlet to Orange Lake
1891	Alachua Sink opened; Paynes Prairie became a shallow marsh/lake
1926	U.S. Highway 301 constructed across outlet to Orange Lake
1927	Paynes Prairie de-watered to create Camps Ranch; Prairie Creek was diverted to Camps Canal and Orange Lake
	U.S. 441 completed across Paynes Prairie
1930s	Shands Dike and Canal constructed downstream from Orange Lake to provide farming access
1950	Sweetwater Canal dredged
1955	Orange Lake Watershed Association organized to address low water levels in Orange Lake
1957	Attempt to isolate sinkhole area in Orange Lake made by building a berm between the sinkhole area and the rest of the lake
	Alachua County Recreation and Water Conservation and Control Authority (ACRWCCA) created to study and implement lake level stabilization; replaced Orange Lake Watershed Association
1958	Dam of earth and concrete rubble placed across Orange Lake outlet to increase water levels
1960s	U.S. Highway 301 four-laned across outlet to Orange Lake

	U.S. Highway 441 four-laned across Paynes Prairie
1961	Paynes Prairie established as a wildlife sanctuary
1963	Orange Lake weir constructed by ACRWCCA to increase lake levels
1964	Attempt to plug sinkhole in Orange Lake made by filling in the sinkhole with debris
1964	I-75 completed across Paynes Prairie
1966	Dam constructed across Prairie Creek to control outflow from Newnans Lake
early 1970s	DNR bought Camps Ranch in order to restore Paynes Prairie
	Sweetwater Branch re-dredged
1973	Introduction of hydrilla into Orange Lake
1974	Paynes Prairie designated as a National Natural Landmark by U.S Department of Interior
1975	Flow to Paynes Prairie from Prairie Creek partially restored by breaching Camps Canal levee
	Introduction of hydrilla into Lochloosa Lake
1976	Newnans Lake dam altered to include removable boards for lake management purposes
1979	FDEP installed flashboard riser culverts in breach in Camps Canal levee
1988	FDEP replaced flashboard riser culverts in Camps Canal levee with gated culverts
1989	Orange Lake Dam Task Force formed to address lake levels in Orange Lake
	Boards removed from Newnans Lake dam for five months to increase lake level fluctuations

1990	Newnans Lake Task Force formed to develop a lake management and restoration plan
	Low-flow notch in Orange Lake Weir illegally obstructed
1991	Boards removed from Newnans Lake dam to increase lake level fluctuation
1994	SJRWMD Governing Board established Orange Creek Basin Advisory Council
	SJRWMD Governing Board passed Rule 40C-2.302, FAC, Reservation of Water From Use for Paynes Prairie State Preserve
1995	The Orange Creek Basin Advisory Council established the Orange Creek Basin Scientific Advisory Committee to assist the Council with technical issues.
1996	Orange Creek Basin Advisory Council approved the Orange Creek Basin Surface Water Management Plan at the March Council meeting.
	SJRWMD Governing Board approved Orange Creek Basin Surface Water Management Plan at the May Governing Board meeting.

Past And Current Studies In The Basin.

A list of studies related to the Orange Creek Basin that have been completed, are in progress, or are planned is included in Appendix B.

2.2. GOVERNMENTAL AND NON-GOVERNMENTAL INVOLVEMENT IN THE BASIN

Governmental Units With Jurisdiction Over The Orange Creek Basin

A listing of all federal, state, regional and local units of government having jurisdiction within the Orange Creek Basin is included below.

Federal Government

Environmental Protection Agency (EPA). EPA issues National Pollution Discharge Elimination System (NPDES) permits and air quality permits. EPA also issues permits, and reviews permits issued by the Florida Department of Environmental Protection for the treatment, disposal and storage of hazardous wastes. EPA also reviews U.S. Army Corps of Engineers (USACOE) permit activities, sets minimum water quality standards, and sets guidelines for state environmental programs. NPDES permit requirements in the Orange Creek Basin are described in more detail Appendix C.

U.S. Department of Agriculture. The following agencies with the Department of Agriculture are involved in management of lands within the OCB

- Forest Service promotes watershed management, wildlife habitat management, and reforestation programs.
- Natural Resources Conservation Service (formerly Soil Conservation Service) promotes the use of conservation practices to reduce runoff and soil losses, and thus improve water quality in waterways.
- Agriculture Stabilization and Conservation Service helps protect wetlands and solve water, woodland, and pollution problems on farms and ranches.

U.S. Department of Interior. The following agencies with the Department of Interior are involved in management of lands within the OCB:

- Fish and Wildlife Service (USFWS) is responsible for the protection and improvement of fish and wildlife habitat. USFWS also reviews USACOE permits for effects on fish and wildlife.
- Geological Survey (USGS) monitors lake levels, river and stream flow, lake water quality, and water use.

U.S. Department of the Army. Corps of Engineers (USACOE) is responsible for construction and maintenance of navigational channels in inland waters. USACOE and FDEP regulate dredge and fill permits in Florida waters, using a joint application, but separate authorities and programs. Further description of the Federal dredge and fill program is included in Appendix C.

U.S. Department of Commerce

- National Weather Service
- Bureau of Census

Florida State Government

Department of Transportation (FDOT). FDOT directs and coordinates construction activities regarding roadway and bridge design and related environmental studies.

Department of Environmental Protection (FDEP). DEP is the lead state agency involved in water quality, pollution control, and resource recovery programs. The department has permit jurisdiction over point and nonpoint source discharges, some management and storage of surface water (MSSW), some dredge and fill, some Environmental Resources permits, hazardous and solid wastes, drinking water systems, power plant siting, mines, activities forward of the Coastal Construction Control Line, and many construction activities in waters of the state. The Stormwater Management Section is responsible for waterbody restoration programs in Florida in conjunction with

EPA. The department also interacts closely with other state and federal agencies on water related matters.

Since the department consolidated with the Department of Natural Resources, FDEP assumed the responsibilities of that agency, including: administration of all state lands, including parks and aquatic preserves, acting as the enforcement agency for the Florida Endangered Species Act and the Oil Spill Prevention and Pollution Control Act; coordination of aquatic plant research and control in the state; issuing permits for transport of aquatic plants, herbicide spraying, and other plant control methods in aquatic environments.

Florida Game and Fresh Water Fish Commission. FGFWFC has regulatory authority and executive powers over game and nongame species of freshwater fish and wildlife. Its mission is to manage freshwater aquatic life and wild animal life and their habitats to perpetuate a diversity of species with densities and distributions that provide sustained ecological, recreational, scientific, educational, aesthetic, and economic benefits. The commission has a formal commenting role in the regulatory process relating to endangered species protection in wetland areas.

University of Florida-Institute of Food & Agricultural Sciences (IFAS). IFAS serves as a statewide organization dedicated to public education and research on agricultural issues, provides an educational partnership through local governments and the agricultural industry, and maintains an information resource base of consumer oriented materials.

Florida Department of Community Affairs (FDCA). FDCA, Bureau of Land and Water Management oversees local review of developments with regional impact and also promotes floodplain management through the National Flood Insurance Program. The department is responsible for review of local government comprehensive plans, and for providing technical assistance to local government and Regional Planning Councils.

Department of Agriculture and Consumer Services. This department regulates the purchase and use of restricted pesticides. The Bureau of Soil and Water Conservation provides support for 62 Soil and Water Conservation Districts within the state. These districts are primarily concerned with soil drainage and erosion control.

Department of Health and Rehabilitative Service (FDHRS). FDHRS responsibilities include permitting for public health functions of water supplies (primarily small to medium supplies), onsite sewage disposal, septic tank cleaning and waste disposal (in conjunction with FDEP), and solid waste control (secondary role).

Regional Government

Water Management Districts. The water management districts have responsibility for managing the quantity and quality of waters within their boundaries. The districts issue consumptive use permits to users wanting to withdraw and use surface or groundwater for any purpose other than individual household use. Included in the districts' responsibilities are the conservation of surface and groundwater, the regulation of dams and impoundments, the prevention of floods, soil erosion and excessive drainage, the conservation of water-related resources including wetlands, and issuance of permits: MSSW, stormwater, agricultural surface water management system, certain Wetland Resource Management (dredge and fill), and Environmental Resources permits.

- St. Johns River Water Management District (SJRWMD)
  The Orange Creek Basin is located almost entirely (95%) within the jurisdictional boundary of the SJRWMD. The District's services, programs, and activities related to the basin are described throughout the text of this plan. The regulatory program is described in Appendix C.
- Suwanee River Water Management District (SRWMD)
  Only small portions along the northern boundary of the OCB fall within the jurisdiction of the SRWMD.

- Southwest Florida Water Management District (SWFWMD)

  Only small portions along the southwestern boundary of the OCB fall within the jurisdiction of the SWFWMD.

Regional Planning Councils. The Regional Planning Councils are responsible for assisting local governments in developing comprehensive land use plans which will guide and control future development.

- Withlacoochee Regional Planning Council (Marion County)
- North Central Florida Regional Planning Council (Alachua County)
- Northeast Florida Regional Planning Council (Putnam County)

Basin Board. No boards located in the OCB.

Soil and Water Conservation Districts

- Alachua County Soil and Water Conservation District
- Marion County Soil and Water Conservation District
- Putnam County Soil and Water Conservation District

Water Authority

- Gainesville Regional Utilities

Local Government

- Alachua County. Alachua County administers the Stormwater Management and Surface Waters and Wetlands ordinances in the unincorporated areas of the County. These ordinances are further described in Appendix C.
  - City of Gainesville (administers the Stormwater Management Utility Program for the city).
  - City of Hawthorne
  - Town of Micanopy
- Marion County
  - Town of McIntosh
- Putnam County

Non-Governmental Organizations with Past and Current Activities in the Basin

Non-governmental organizations which currently are, or have in the past been actively and significantly involved in Orange Creek Basin issues are listed below.

Alachua Conservation Trust

Type/Focus: Nonprofit organization involved with the acquisition of environmentally sensitive lands with the purpose of conserving Florida's historic and natural resources.
Address: 22 S. Main St.
Gainesville, FL 32601
Phone: 904-375-4568
Contact: Lu-Anne Wilson
Activity Period: 1989-present.

Audubon Society - Alachua Chapter

Type/Focus: National conservation organization. The Alachua chapter (1000 members) promotes the conservation of natural resources and native biota of northern Florida.
Address: c/o John Wynn, President.
Rt. 1 Box 479
Waldo, FL 32694
Contact: Bob Simmons, John Wynn, and Gary Appelson
Phone: John Wynn: 904-468-1669
Bob Simmons: 904-392-7646
Activity Period: 1910-present.

Florida Defenders of the Environment

Type/Focus: Non-profit environmental organization created to monitor government agencies and represent the interest of the public and the ecosystem.
Address: 2606 NW 6th St
Gainesville, FL
Contact: Gary Appelson
Phone: 904-372-6965
Activity Period: 1991-present.

Friends of Cross Creek

Type/Focus: Environmental watch group focused on finding and pursuing alternatives to large-scale development of the Cross Creek Community area. Group no longer active.
Address: none
Contact: Bruce Delaney, Gainesville City Commissioner
200 E. University Ave.
P.O. Box 490
Gainesville, FL 32602-0490
Phone: 904-334-2006
Activity Period: 1981-1986.

Orange Lake Water Level Fund

Type/Focus: Local organization concerned with lake levels on Orange and Lochloosa lakes.
Address: c/o Wallace Wimberly
P.O. Box 26
Citra, FL 32113
Contact: Wallace Wimberly
Phone: wk 904-545-4271, hm 904-595-2491
Activity Period: 1992-present.

Save Our Lakes

Type/Focus: Lake restoration organization involved with the management and maintenance of Orange and Lochloosa lakes.
Address: c/o Ed Tanner
Rt. 3 Box 140B
Hawthorne, FL 32640
Contact: Win Boggs, Ed Tanner
Phone: Win Boggs: work 904-481-2114; hm 904-481-4502
Ed Tanner: 904-466-3802
Activity Period: Spring 1992 to present.

Sierra Club

Type/Focus: Non-profit National environmental organization focused on insuring that local environmental issues are addressed in a manner consistent with the goal of protecting and preservation of natural systems.
Address: Sierra Club c/o David Auth
425 N E 7th St.
Gainesville, FL 32601
Contact: Judy Hancock, David Auth

Phone: Judy Hancock: 904-752-5886;
David Auth: wk 904-392-1721, home 371-1991
Activity Period: 1968-present.

Fishing Organizations

E.G.: BASS Florida Federation
Cross Creek Bass Club
Gainesville Bassmasters, etc.)

Descriptions of these organizations will be included in a later revision of this plan.

2.3 STATE AND LOCAL GOVERNMENT WATERSHED PROTECTION

In 1990, the Florida Preservation 2000 Act (P-2000) was passed which established a trust fund for public acquisition of environmentally sensitive lands. The major recipient of P-2000 funding is the Conservation and Recreation Lands (CARL) Program, established in 1979 by the Florida Legislature. Under the CARL Program, areas state-wide that are considered either as environmentally endangered lands or as other lands in the public interest, are identified and ranked for acquisition on an annual basis. The Alachua Conservation Trust, a nonprofit organization for the protection of environmentally sensitive land, has been instrumental in the process of selection, designation, and/or acquisition of a number of CARL lands in the Orange Creek Basin.

The 1995 CARL Priority Ranking is divided into four categories: (1) Substantially Complete Projects, (2) Bargain/Shared Acquisitions, (3) Priority Projects, and (4) Mega-Multiparcel Projects. Of the 25 CARL projects located within the SJRWMD, 3 are within the Orange Creek Basin. The first, Paynes Prairie (3,462 acres), is ranked No. 3 and is categorized as Substantially Complete. The second, Lochloosa Wildlife Conservation Area (33,793 acres), is ranked No. 20 and is a Shared Acquisition); and the third, Newnans Lake (12,957 acres) is ranked No. 36, and is a Priority Project. P-2000 funds have already been expended by the SJRWMD toward the purchase of the Gumroot Swamp Conservation Area (372 acre parcel of hardwood swamp, acquired in 1993) and the Lochloosa Wildlife Conservation Area (10,333 acres of uplands and wetlands, acquired in 1994). Other properties acquired by the District (with ad valorem/local funds) consist of forested wetlands in the Prairie Creek Conservation Area: the Rosenberg/Lewis property (157 acres, acquired in 1989) and the Newman/Briera property (46 acres, acquired in 1991) (Figure 18).

The city of Gainesville has further contributed to the protection of Gumroot Swamp (within the Newnans Lake CARL area) by acquiring Gumroot Park, a 369 acre parcel of contiguous land featuring mixed hardwood hammocks, pine flatwoods, xeric scrub communities, and open pasture. Other city of Gainesville properties include Morningside

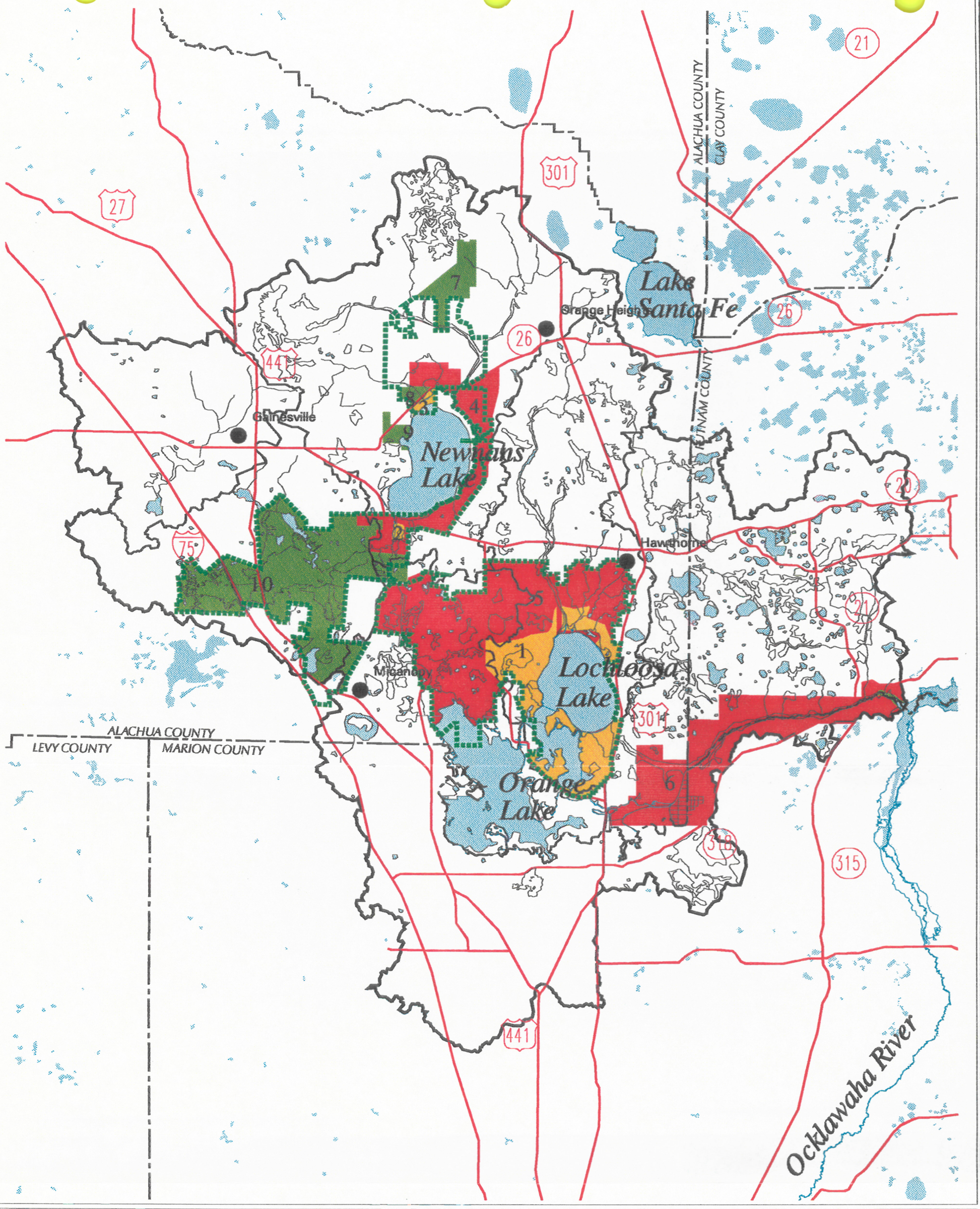


Figure 18.
SJRWMD 1995 Acquisition Plan for the Orange Creek Basin

The land acquisition boundaries have been transferred into the GIS from the best available information provided to SJRWMD from a variety of sources, using USGS 1:24000 topographic maps.



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ONE INCH REPRESENTS 3.8 MILES

Map produced using MAPPER.aml on March 06, 1995

- District Owned Lands
  1. Lochloosa Wildlife Conservation Area*
  2. Prairie Creek Conservation Area
  3. Gumroot Swamp Conservation Area

  * 1995 less-than-fee acquisition of 17,000 acres within the Lochloosa Wildlife CARL Project Area not included.
- Potential Acquisitions
  4. Newnans Lake CARL Project
  5. Lochloosa Wildlife CARL Project
  6. Orange Creek Run Project Area
- Other Areas
  7. Austin Carey Forest Regional Preserve
  8. Gumroot Park (City of Gainesville)
  9. State of Florida
  10. Paynes Prairie State Preserve

- Water
- Highways
- Orange Creek Basin boundary
- Sub-Basin boundary
- County boundary
- CARL boundary

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Nature Center (256 acres) and Austin Carey Forest Regional Preserve (2152 acres). Paynes Prairie State Preserve (also a CARL project area) was acquired by the FDEP in the 1970's and is currently the largest contiguous tract of land (18,036 acres) held in public trust in the OCB today.

Currently the SJRWMD owns 11,230 acres (in fee-simple title) of environmentally sensitive lands in the Orange Creek Basin (Figure 18). Most of these lands (10,333 acres) are within the CARL Lochloosa Wildlife project area. Protection of this CARL area was expanded in 1995 with less-than-fee acquisition (from Georgia-Pacific) of an additional 16,994 acres. This innovative form of land acquisition, also referred to as a "conservation easement", amounts to the purchase of development rights at a fraction of the full market value of the property. Under this agreement, Georgia-Pacific will be allowed to continue silvicultural activities under restricted conditions (thereby leaving the property on the local tax rolls) but the land will be protected from residential or commercial development in perpetuity and will be open for recreational use by the public.

The SJRMWD has identified an additional 30,000 or more acres for potential acquisition (Figure 18; SJRWMD 1995b). At the present time, future District land acquisitions are focused on further expanding protection in the CARL Lochloosa Wildlife Project Area by either purchasing land or buying development rights for several smaller parcels in the area. . Future District acquisitions in the OCB will target lands within the Prairie Creek-Newnans Lake Project Area and, eventually, within the Orange Creek Run Project Area.

The majority of District lands are managed in cooperation with other agencies. While the overriding management objective is for ecological resource protection and restoration, the use of District land for suitable public recreation and environmental education is extremely important. Close to 90% of District lands are open to the public. Active restoration and construction projects are often closed for public safety and security reasons.

3

3. ISSUES, GOALS, STRATEGIES, PROGRAMS AND PROJECTS

Public concerns, past task forces, and the current Orange Creek Basin Advisory Council have provided a substantial foundation for the identification of issues and concerns within the Orange Creek Basin. This plan builds upon these sources to provide a consolidated, yet comprehensive analysis of basin-wide issues related to surface water management.

Eleven individual issues have been identified for the Orange Creek Basin. These issues are organized under seven general themes or issue topics. Issue topics and their respective issues are organized the following way:

- ***Hydrology***
  - Issue 1. Altered hydrologic regimes
  - Issue 2. Extreme low lake levels
- ***Aquatic Plant Management***
  - Issue 3. Control of exotics
  - Issue 4. Protection and restoration of native aquatic plant populations
  - Issue 5. Management of floating vegetation
- ***Water Quality***
  - Issue 6. Sources of pollution in the OCB
  - Issue 7. Lake trophic conditions and trends
- ***Lake Sediments***
  - Issue 8. Organic sediment accumulation in lakes
- ***Fish and Wetland Wildlife Habitats and Communities***
  - Issue 9. Management and enhancement of fish and wetland wildlife habitats
- ***Future Protection of the Basin***

Issue 10. Land conservation and restoration

- ***Public Outreach***

  Issue 11. Public awareness and participation

The sections that follow individually address issues 1 through 11. For each issue, information presented includes (a) issue background, (b) goals to address the issue, (c) strategies to achieve these issue-specific goals, and (d) programs and projects needed to implement the strategies for goal achievement.

There are 6 types of programs in the plan, which are defined as follows:

- Diagnostic Program: projects in which information and data are collected to better understand the functioning of particular ecosystem components and their interrelationships.

- Feasibility Program: projects designed to test and investigate potential restoration and management techniques and approaches.

- Restoration and Management Program: demonstration and full-scale projects designed to restore or better manage ecosystems or ecosystem components.

- Public Outreach Program: projects enhancing public awareness and education on basin issues and disseminating information on the basin.

- Interagency Coordination Program: Projects aimed at coordinating and enhancing multi-agency efforts affecting water resources in the basin.

- Regulatory Program: Projects in which surface water regulatory programs of various governmental agencies are evaluated, assessing present and new regulatory needs.

Achievement of the goals for this surface water management plan directly depends on the success of the restoration and management program. All programs are dependent on at least one other program and all are necessary for the restoration and management

program. Additionally, service-oriented programs such as Public Outreach and Interagency Coordination programs provide support to all programs.

Each program is comprised of one or more projects which are related to the purpose of that program. The projects comprising each of the six programs are shown in Figures 19 through 24. Projects each have an associated project number or code for cross-referencing within the plan and for project management purposes. The terminal letter in the code indicates the program to which the project is assigned. There are a total of 36 projects in the plan, broken down as follows:

- Diagnostic Program (OCB-100-D series): 10 projects
- Feasibility Program (OCB-200-F series): 6 projects
- Restoration and Management Program (OCB-300-RM Series): 7 projects
- Regulatory Program (OCB-400-RG series): 3 projects.
- Interagency Coordination Program (OCB-500-I series): 4 projects
- Public Outreach Program (OCB-600-P series): 6 projects

Each project has one or more elements associated with that project. Elements can be contractual efforts, District in-house analyses, local and state agency efforts, etc. Projects and their constituent elements are summarized in figures 19-24. The status of each project element (completed, in progress, or planned) is indicated with symbols explained in the figure legends. Planned elements are further ranked according to first (top), second, and third priority. First priority ranking is reserved for those elements likely to be initiated in fiscal years 95-96 or 96-97.

Individual issues and their associated goals, strategies, programs and projects are described below in sections 3.1 through 3.7 and summarized in Figures 25 through 35. Some projects have widespread linkage to all issues (e.g., projects within the Interagency Coordination and Public Outreach programs) and are listed only under the most relevant issues. Projects and their elements are described in more detail in Chapter 4 (Project Descriptions).

Figure 19

DIAGNOSTIC PROGRAM

WATER QUALITY AND HYDROLOGIC MONITORING IN THE OCB (OCB-101-D)

- ◆ District water quality monitoring in the OCB
- ◆ Review and analysis of historical and current water quality conditions in the OCB
- ◆ Inflow, outflow, and lake level monitoring in the OCB
- ● Sinkhole discharge monitoring in Orange Lake
- ● Volunteer stormwater monitoring of tributaries in the OCB (see project OCB-602-P, Public Outreach Program)
- ○ Toxic pollutant screening survey in the OCB

SEDIMENT DEPOSITION AND SEDIMENT NUTRIENT CHARACTERIZATION IN OCB LAKES (OCB-102-D)

- ★ Effects of short-term drawdown on sediments and nutrients of Newnans Lake (Phase I & II)
- ◆ Sediment and water quality reconnaissance of Newnans Lake
- ◆ Historical sediment and nutrient accumulation rates and past water quality in Orange Lake (Phase I and II)
- ● Historical sediment and nutrient accumulation rates and past water quality in Newnans Lake
- ○ Internal nutrient loading in Newnans Lake
- ○ Wind resuspension analysis in Newnans Lake

HYDROLOGIC MODELLING IN THE OCB (OCB-103-D)

- ◆ Effects of surface water management alternatives on wetlands and lake levels in the OCB

LAKE BASIN PHYSICAL CHARACTERISTICS (OCB-104-D)

- ◆ Bathymetry and sediment thickness survey of Orange Lake
- ◆ Newnans Lake outlet stream profile survey
- ◆ Orange Lake outlet stream profile survey

EXTERNAL NUTRIENT BUDGETS FOR WATERBODIES IN THE OCB (OCB-105-D)

- ◆ External Nutrient Budgets for Orange Creek Basin lakes
- ● Pollution sources in Orange, Lochloosa, and Newnans lakes

ASSESSMENT OF VEGETATIVE COMMUNITIES IN PAYNES PRAIRIE (OCB-110-D)

- ◆ Vegetative communities in Paynes Prairie and relationships with environmental factors

Project Element Status

★ Completed	● Planned - first priority
◆ In progress	○ Planned - second priority
	⊙ Planned - third priority

ASSESSMENT OF FLOATING AND EMERGENT WETLAND HABITATS IN OCB LAKES (OCB-106-D)

- ★ Wetlands mapping/inventory in the OCB
- ◆ Historical analysis of wetland vegetation in Orange, Lochloosa and Newnans lakes
- ◆ Characterization of floating and emergent vegetation in Orange Lake
- ◆ Formation of floating mats in Orange Lake and causes for historical changes
- ○ Role of floating and emergent vegetation in the nutrient dynamics of Orange Lake

PHYTOPLANKTON ASSESSMENTS IN OCB LAKES (OCB-107-D)

- ◆ Phytoplankton survey for Orange, Lochloosa, and Newnans lakes

FISH AND WETLAND WILDLIFE ASSESSMENTS IN THE OCB (OCB-108-D)

- ● Fish and wetland wildlife population and habitat analyses in Orange, Lochloosa, and Newnans lakes
- ● Inventory of T&E, SSC, and rare species in the OCB

ECONOMIC ASSESSMENTS IN THE OCB (OCB-109-D)

- ● Analyses of economic benefits from recreational and commercial uses in the OCB

Figure 20

FEASIBILITY PROGRAM

FEASIBILITY OF FLOATING AND EMERGENT MARSH REMEDIATION IN OCB LAKES (OCB-201-F)

◆ Feasibility of floating and emergent vegetation management in Orange and Lochloosa lakes

IMPROVEMENTS TO LAKE ACCESS IN ORANGE AND LOCHLOOSA LAKES (OCB-202-F)

★ Feasibility study of Cross Creek dredging

◆ Lake access needs

ORANGE LAKE WEIR MODIFICATION (OCB-203-F)

● Orange Lake weir modification; evaluation of management alternatives

ORANGE LAKE SINKHOLE INTERVENTION ANALYSIS (OCB-204-F)

★ High resolution seismic reflection surveys in Orange Lake

★ Engineering feasibility study, Orange Lake sinkhole remediation

◆ Karst geology and groundwater analyses in Orange Lake

● Orange Lake sinkhole intervention; evaluation of management alternatives

WATER MANAGEMENT ALTERNATIVES FOR PAYNES PRAIRIE (OCB-205-F)

★ Preliminary assessment of options for management of Sweetwater Branch surface flow into Paynes Prairie

◆ Paynes Prairie vegetation succession model

● Surface water and vegetation management options for Paynes Prairie

FEASIBILITY ASSESSMENT FOR THE RESTORATION OF OCB LAKES (OCB-206-F)

★ FGFWFC feasibility assessment of drawdown for restoring Newnans Lake (KBN Engineering)

⊙ Project elements will be developed as diagnostic projects are completed

Project Element Status

★ Completed
◆ In progress
● Planned - first priority
⊙ Planned - second priority
⊙ Planned - third priority

Figure 21

RESTORATION AND MANAGEMENT PROGRAM

AQUATIC PLANT MANAGEMENT IN THE OCB (OCB-301-RM)

- ◆ Aquatic vegetation monitoring in Orange, Lochloosa, and Newnans lakes
- ◆ Vegetation management in OCB lakes
- ◆ Enhancement of aquatic weed control in OCB lakes

LAKE LITTORAL ZONE RESTORATION IN THE OCB (OCB-302-RM)

- ◆ Native aquatic plant revegetation in OCB lakes (littoral planting effort by the FGFWFC currently underway at Newnans Lake)

WETLAND/WATER RESOURCE PROTECTION THROUGH NEW LAND ACQUISITION IN THE OCB (OCB-303-RM)

- ◆ Assessment of potential land acquisition in the OCB

LAND MANAGEMENT ON PUBLIC LANDS OF THE OCB (OCB-304-RM)

- ◆ Land management on District properties

OUTSTANDING FLORIDA WATERS DESIGNATION REVIEW FOR THE OCB (OCB-305-RM)

- ⊙ Expansion of OFW designations in the OCB

RESTORATION AND MANAGEMENT OF WATERBODIES IN THE OCB (OCB-306-RM)

- ⊙ Project elements will be developed as diagnostic and feasibility projects are completed.

URBAN STORMWATER ASSESSMENT AND REMEDIATION IN THE OCB (OCB-307-RM)

- ◆ Local government stormwater retrofitting assistance

Project Element Status

★ Completed
◆ In progress
● Planned - first priority
⊙ Planned - second priority
⊙ Planned - third priority

Figure 22

REGULATORY PROGRAM

MINIMUM FLOWS AND LEVELS (OCB-401-RG)
◆ Minimum flows and levels in the OCB

LOCAL GOVERNMENT ENVIRONMENTAL PROTECTION ORDINANCE ASSISTANCE (OCB-402-RG)
⊙ Remediation of nonpoint source and unregulated point source pollutant loading into waterbodies of the OCB

SURFACE WATER PERMIT REVIEW (OCB-403-RG)
◆ OCB Surface water permit review

Project Element Status

★ Completed
◆ In progress
● Planned - first priority
⊙ Planned - second priority
⊙ Planned - third priority

Figure 23

INTERAGENCY COORDINATION PROGRAM

OCB PLAN REVIEW (OCB-501-I)

◆ Revision of the Orange Creek Basin Surface Water Management Plan

COMPREHENSIVE PLAN REVIEW (OCB-502-I)

◆ Local government comprehensive plan review.

INTER-GOVERNMENTAL BASIN COORDINATION (OCB-504-I)

◆ Regional intergovernmental forums.

FUND PROCUREMENT COORDINATION (OCB-503-I)

◆ Fund procurement coordination for OCB-Plan implementation

Project Element Status

★ Completed
◆ In progress
● Planned - first priority
⊙ Planned - second priority
⊙ Planned - third priority

Figure 24

PUBLIC OUTREACH PROGRAM

BASIN AND SUBBASIN TASK FORCES AND ADVISORY COUNCILS (OCB-601-P)

- ◆ Orange Creek Basin Advisory Council and Scientific Advisory Committee
- ◆ Subbasin task forces or working groups

CITIZEN VOLUNTEER ACTIVITIES (OCB-602-P)

- ◆ Habitat cleanups
- ◆ Volunteer monitoring in the OCB

LOCAL GOVERNMENT COMMISSION UPDATES (OCB-603-P)

- ● City and County Commission meeting updates

PUBLIC EDUCATION AND AWARENESS (OCB-604-P)

- ◆Adult awareness program
- ● School education and awareness program

BASIN AND SUBBASIN WORKSHOPS (OCB-605-P)

- ◆ Presentations at scientific meetings
- ◆ Presentations to local citizen groups

EDUCATIONAL AND INFORMATIONAL SUPPORT MATERIAL (OCB-606-P)

- ◆ Fact sheet for the OCB
- ◆ Portable display for the OCB
- ● White (fact) sheets for the OCB

Project Element Status

- ★ Completed
- ◆ In progress
- ● Planned - first priority
- ⊙ Planned - second priority
- ⊙ Planned - third priority

3.1 HYDROLOGY

The major hydrologic concerns for the Orange Creek Basin can be grouped under two issues: 1) altered hydrologic regimes and 2) extreme low lake levels.

ISSUE # 1. ALTERED HYDROLOGIC REGIMES

Background

Robison *et al.* (1996) cited three types of hydrologic conditions that are required for the conservation of lake and wetland resources: 1) high water levels caused by temporary and seasonal floods; 2) maintenance of suitable average level; and 3) low water levels due to mild droughts and infrequent extensive droughts. The mechanisms of action by which the different water level fluctuation regimes affect biological functions are numerous. They include processes involving organic matter transport and decomposition, sediment oxidation and consolidation, conservation of hydric soils, seed dispersal/germination of wetland species, and availability of nesting, refugia, and foraging habitat for fish and wetland wildlife.

Through their modifying effect on natural water level fluctuations, water control structures at the outlets of natural lakes can impact the physical and biological processes on which the integrity of lake ecosystems depend. Some hydrologic and ecological consequences of dam construction at the outlet of a lake may be:

- Increase in the median lake surface water.
- Increase in lake levels during frequent and infrequent lows. This condition could be viewed as desirable by boaters and lake users since it allows for improved lake access and navigability during times of low water. However,

higher frequent and infrequent lows can result in less sediment exposure time during low water periods and impair sediment oxidation and consolidation.

- Decrease in hydraulic flushing (or increase in the hydraulic residence time) of the lake which can favor the accumulation of unconsolidated organic sediments and their associated nutrients on the lake bottom. Loss of rooted aquatic plants and of fish spawning habitat can ensue. Under temporary low water conditions, lakes with unconsolidated bottom sediments can experience sharp increases in turbidity (either wind-induced or biogenic) and high internal nutrient loading from the sediments. Once clear-water conditions are re-established, massive algal blooms can occur very rapidly.
- Disruption of wetland seedling germination processes which depend on low water conditions; this can curtail the natural rejuvenation processes of wetland forests.
- Changes in the distribution, abundance, and composition of littoral and floodplain wetland plant communities, which may affect the availability and quality of fish and wetland wildlife habitats and alter physical lake processes such as lake hydrodynamics and sediment and nutrient transport (Junk 1973).
- Disruption of the seasonal dynamics of fish populations, with a subsequent decline in fisheries.
- Curtailment, through impairment of the natural flood pulse (*sensu* Junk et al. 1989), of landscape/habitat heterogeneity, biological diversity, and ultimately, ecosystem stability and resilience.

The hydrologic model for the Orange Creek Basin (Robison *et al.* 1996) indicates that although the weir at the outlet of Orange Lake has a negligible effect on the range of the lake's water levels fluctuations (Table F-1, appendix F)[1], the weir significantly

[1] The reduced effect of the Orange Lake weir on the range of lake level fluctuations results from sinkhole-related seepage in the lake, which tend to offset the effects of the weir (Robison *et al.*, 1996).

impacts other aspects of the lake's hydrology, as described in bullets 1 through 3 (above). The Orange Lake weir: a) increases the lake's median elevation by one foot (from 56.7 ft to 57.7 ft; Table F-2); b) increases lake elevation during frequent lows by about 0.7 ft (Tables F-3a and F-3b); and c) increases the hydraulic residence time of the lake by about 20% (Table F-4). Modelling results also show that the weir increases the amount of time the lake remains at or above a given elevation. Stage frequency data show that without the weir, the lake remains at or above 56 ft about 70% of the time. This number rises to over 80% with the weir in place (Table F-2).

Such modifying effects of the weir on the hydrology of Orange lake may help explain the wetland vegetation changes which seem to have taken place in the lake over the last three decades. Some of these changes include the conversion of areas of shallow marsh to shrub swamp and transitional shrub, the accumulation and compaction of floating mats of vegetation, and the loss of open water habitat. Hinkle (1994a) reported a 72% increase in emergent marshes in Orange Lake since the construction of the weir on U.S. 301. Efforts to quantify historical changes in the abundance and physiognomic structure of Orange Lake's floating and emergent marsh vegetation and to relate these changes to major historical events (e.g., construction of the railroad levee and of US 301, installation of the weir at US 301) are currently underway by District staff.

Man-made hydrologic modifications have also affected other aquatic and wetland ecosystems of the Orange Creek Basin. Paynes Prairie, which historically was fed by Newnans Lake via Prairie Creek, was extensively drained and isolated from its tributary in the early 1920's to allow for cattle operations. These and other more recent interventions (e.g. construction of highways I-75 and U.S. 441 and the channelization and diversion of Sweetwater Branch flow into Alachua Sink) have impacted the natural hydrology of Paynes Prairie and altered the dynamics of its natural aquatic and wetland communities (FDNR 1986).

Hydrologic modelling (based on SSARR 50-year simulations, Robison *et al.* 1996) shows that placement of the weir at the outlet of Newnans Lake (Prairie Creek dam at SR 20; built in 1967) results in hydrologic changes of similar nature to those experienced in Orange Lake. The magnitude of these changes, however, tends to be somewhat greater for Newnans Lake, where bottom seepage is not a significant factor.

In 1991, the flashboards at Prairie Creek dam were removed. In the absence of the dam, sediment and nutrient conditions in Newnans Lake should improve, in response to hydrological changes which would favor sediment exposure, oxidation, and consolidation, and promote sediment and nutrient flushing during storm events (Gottgens & Crisman 1993). A firmer bottom substrate and lower algal concentrations in the lake (in response to lower dissolved nutrient concentrations in the water column) should in turn favor the establishment of native aquatic plant populations (submersed and emergent). Also, greater water level fluctuations in the absence of the dam should favor the rejuvenation of the floodplain wetlands (primarily the cypress fringe community) and the upper littoral zone of the lake, given that these areas would be exposed more frequently and for a longer period of time during infrequent low water events. Following discussion of the potential beneficial effects associated with dam removal in Newnans Lake, the Orange Creek Basin Advisory Council voted unanimously, in April 1994, to recommend to the Florida Game and Fresh Water Fish Commission and to the Florida Department of Transportation (FDOT) that Prairie Creek dam not be rebuilt during the forthcoming expansion of the highway (SR-20). FDOT will remove the dam when SR-20 is widened (Permits #4-001-0070AG; 12-001-0018AG).

Hydrological impairment of surface waterbodies can also result from certain kinds of land use activities, even in the absence of weirs, levees, and other water control structures. For example, silvicultural activities can alter surface drainage patterns and

impact hydrological conditions in waterbodies downstream. Because silviculture is an important form of land use in the Orange Creek Basin (it occupies 40% of the Lochloosa Lake subbasin and 23% of the whole basin; Table 6), its potential effects on surface water drainage patterns need to be assessed.

Basin management goal for altered hydrologic regimes

The major goal associated with this priority issue is to restore and maintain, to the extent practicable, desirable, and allowable by flood control requirements, the natural hydrology of waterbodies in the basin such that physical and biological processes that affect the ecological function of these waterbodies are sustained.

Basin management strategies for addressing the issue of altered hydrologic regimes

Several strategies have been identified to achieve the goal specified above:

- Assess the hydrologic impacts of existing and proposed water control structures in the Orange Creek Basin.
- To the extent practicable and desirable, restore hydrologically impaired waterbodies through (a) removal or modification of water control structures and artificial drainage systems, (b) land use modification and implementation of best management practices (BMPs), and (c) land acquisition.
- Enhance public awareness (local residents and lake users) on the need and value of natural water level fluctuations and on the benefits of restoring natural surface drainage in areas impacted by artificial drainage systems.

Projects to implement strategies for addressing the issue of altered hydrologic regimes

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 25, page 96). Project elements are ranked by status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority,

⊙ planned-second priority, and ⊙ planned-third priority.

Diagnostic Program

Project OCB-101-D. *Water quality and hydrologic monitoring in the Orange Creek Basin*

- ◆ Inflow, outflow, and lake level monitoring in the OCB

  Ongoing District contractual effort aimed at establishing and maintaining a streamflow gaging and lake level recording network for major waterbodies in the Orange Creek Basin. The hydrologic data generated by this monitoring effort are needed to update the data base used to run the District's hydrologic model for the basin and to identify water level/flow management and restoration needs for individual waterbodies (Projects OCB-306-RM and OCB-401-RG).

- ● Sinkhole discharge monitoring in Orange Lake

  Planned District contractual effort aimed at quantifying (through field determinations) the seepage loss from the Orange Lake Heagy Burry Park sinkhole complex at varying lake elevations. This information will be utilized to assess the potential impacts of sinkhole intervention on the hydrology of Orange Lake and connecting waterbodies.

Project OCB-102-D. *Sediment deposition and sediment nutrient characterization in OCB lakes*

- ◆ Sediment and water quality reconnaissance of Newnans Lake

  Ongoing District effort aimed at monitoring changes in sediment stratigraphy and physical characteristics in Newnans Lake and changes in water quality both in Newnans Lake and in its inflow (Hatchet Creek) and outflow (Prairie Creek) during an 18-month period (1991-1993) immediately prior to and following the removal of the flashboards at Prairie Creek dam. Sampling has been completed under contract with King Engineering Associates, Inc. (Tampa) and analysis of data is currently underway by District scientists.

The results of this effort, together with detailed hydrologic data for the corresponding time period, will contribute toward the understanding of the effects of Prairie Creek dam on sediment characteristics and water quality in Newnans Lake.

- ◆ Historical sediment and nutrient accumulation rates and past water quality in Orange Lake

  District contractual effort currently underway (Phase I) aimed at utilizing paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Orange Lake, to determine the timing of these changes, and to investigate their possible causes. This information will shed light on the possible effects of past hydrologic interventions in Orange Lake (e.g., sinkhole discharge control and Orange Lake weir construction) on sediment and nutrient accumulation and on lake water quality.

- ● Historical sediment and nutrient accumulation rates and past water quality in Newnans Lake

  Planned District contractual effort aimed at using paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Newnans Lake, to determine the timing of these changes, and to investigate their possible causes. The information obtained from this diagnostic effort may be used to determine past effects of the dam at the lake's outlet on sediment and nutrient accumulation and on water quality in the lake.

Project OCB-103-D. *Hydrologic modelling in the OCB*

- ◆ Effects of surface water management alternatives on wetlands and lake levels in the OCB

  Addresses, through the use of a predictive model, the effects of various water management alternatives on lake levels, flood regimes, and wetland vegetation composition and coverage. The ecological consequences of management alternatives that affect naturally occurring hydrologic regimes (e.g. Orange Lake sinkhole discharge control and Orange Lake weir modification) are evaluated, and corresponding recommendations are made.

  Completed draft report: Robison, C.P., C. Ware, G.B. Hall, & R. Hupalo. 1996. Water management alternatives: effects on lake levels and wetlands in the Orange Creek Basin.

Project OCB-104-D. *Lake basin physical characteristics*

- ◆ Bathymetry and sediment thickness survey in Orange Lake

  District contractual effort currently underway aimed at mapping the bathymetry and sediment thickness of Orange Lake. The data generated with this survey are needed to fill in a major gap (between 55 ft and 60 ft elevations) in existing bathymetric information for the lake. A complete bathymetric map of the lake is needed to evaluate the effects of varying lake levels on lake volume and lake area. The new bathymetric data will be used to update the data base utilized to develop the District's hydrologic model for the basin.

- Newnans Lake outlet stream profile survey

  District contractual work currently underway aimed at describing the profile of Prairie Creek from State Road 20 to Newnans Lake. The profile data obtained from this survey are needed to evaluate the current outflow potential of Newnans Lake at varying lake elevations and to identify outlet channel hydraulic impediments.

- Orange Lake outlet stream profile survey

  District contractual work currently underway aimed at describing the profile of Orange Creek/Shands Canal, downstream from Orange Lake weir at U.S. Highway 301. Information derived from this survey will be used to identify hydraulic impediments to Orange Lake outflow downstream of the U.S. 301 weir. The profile data from this survey are needed for the minimum flows and levels analyses of Orange Lake and Orange Creek (Project OCB-401-RG), and the Orange Lake weir modification feasibility analyses (Project OCB-203-F).

Project OCB-106-D. *Assessment of floating and emergent wetland habitats in OCB lakes*

- Formation of floating mats in Orange Lake and causes for historical changes

  Planned District contractual effort aimed at identifying the mechanisms of formation of floating vegetation mats in Orange Lake. If changes in the abundance and structure of floating mats are documented in the historical analyses of wetland vegetation (see above), then the probable causes for these changes will also be addressed. The information gained from this effort will help determine the role of lake level fluctuations in floating mat formation/breakup and will help assess the potential effects of proposed hydrologic modifications in Orange Lake (sinkhole discharge control and weir modification) on floating vegetation dynamics.

Project OCB-110-D. *Assessment of vegetative communities in Paynes Prairie*

- Vegetative communities in Paynes Prairie and relationships with environmental factors

  Ongoing multi-agency effort (Gainesville Regional Utilities, FDEP, SJRWMD, City of Gainesville Public Works) currently underway aimed at establishing cause/effect relationships between altered surface hydrology and increased nutrient inflows in the northern portion of Paynes Prairie and changes in terrestrial and wetland vegetation assemblages. Information obtained from this diagnostic effort is needed to identify surface water and vegetation management options leading to the rehabilitation of terrestrial and wetland vegetative communities the prairie (Project OCB-205-F).

Feasibility Program

Project OCB-203-F. *Orange Lake weir modification.*

- Orange Lake weir modification; evaluation of management alternatives

  Planned effort to identify structural and operational modifications to the U.S. 301 weir, as well as to other downstream structures (e.g. U.S. 301 and railroad levees; Shands Canal) with the purpose of restoring, to the extent practicable and desirable, Orange Lake's natural outflow regime and providing minimum flows for Orange Creek.

Project OCB-204-F. *Orange Lake sinkhole intervention analysis*

- ◆ Karst geology and groundwater analyses in Orange Lake

  District contractual effort currently underway aimed at assessing the possible groundwater and geologic effects of sinkhole discharge control in the Heagy-Burry Park area of Orange Lake. This feasibility assessment is part of a larger effort to determine the potential environmental impacts of sinkhole intervention at Orange Lake.

- Orange Lake sinkhole intervention; evaluation of management alternatives

  Planned District in-house effort to evaluate management alternatives related to sinkhole discharge control at the Heagy-Burry Park area of Orange Lake and to assess the potential environmental impacts from these alternatives. This assessment relies on the results of other feasibility efforts under this project (OCB-204-F) as well as on information from a number of diagnostic efforts addressing water quality, hydrology, sediment characteristics, and wetland habitats in Orange Lake (projects OCB-101-D, OCB-102-D, OCB-103-D, OCB-106D, and OCB-108-D).

Project OCB-205-F. *Water management alternatives for Paynes Prairie*

- ★ Preliminary assessment of options for management of Sweetwater Branch surface flow into Paynes Prairie

  Completed report by Best, G.R., R.D.Peters, Jr., R.E. Borer, and F.F. Gaines III. 1995. Preliminary Assessment of Options for Management of Sweetwater Branch Surface Flow into Paynes Prairie, Alachua County, Florida. Center for Wetlands and Water Resources, University of Florida, Gainesville, FL.

  Project aimed at evaluating various options for the management of Sweetwater Branch inflow into Paynes Prairie State Preserve, with the purpose of restoring sheet flow to the northern portion of the Prairie and enhancing water quality of surface waters in the Prairie (including Alachua Lake/Sink and the Floridan aquifer). A multifunctional wetland treatment system constructed in the impacted area of the prairie along Sweetwater Branch was identified as the recommended option.

◆ Paynes Prairie vegetation succession model

Ongoing contractual effort by the University of Florida for the FDEP entitled: GIS-based Succession Model for Prairie Creek Pourpoint Basin, Paynes Prairie State Preserve.

This investigation assesses water volume alternatives for distribution through the Camps Canal culvert system and develops vegetation succession models to show the effects that changing water regimes, water quality, and sediment conditions have on wet prairie and wetland vegetation assemblages.

● Surface water and vegetation management options for Paynes Prairie

Planned multi-agency effort (Gainesville Regional Utilities, FDEP, SJRWMD, City of Gainesville Public Works) aimed at identifying surface water and vegetation management options leading to water quality and hydrologic improvements in Paynes Prairie and to the rehabilitation of terrestrial and wetland vegetative communities in the northern portion of the prairie. Completion of the diagnostic effort "Vegetative communities in Paynes Prairie and relationships with environmental factors" (project OCB-110-D) is required for this effort.

Project OCB-206-F. *Feasibility assessment for the restoration of OCB lakes*

★ FGFWFC feasibility assessment of drawdown for restoring Newnans Lake (KBN Engineering)

Completed report: KBN Engineering and Applied Sciences, Inc. 1993. Assessing the Feasibility of Restoring Newnans Lake. Phase A: Conceptual Engineering Report. Prepared for the Florida Game and Fresh Water Fish Commission, Gainesville, FL.

Project aimed at evaluating various drawdown alternatives for Newnans Lake with the purpose of restoring lake sediments and fisheries habitat. A mechanical drawdown alternative involving a 9-month holddown duration was considered the preferred option, based on an evaluation of conceptual engineering plans, potential environmental impacts, and cost estimates. The cost of a 9-month mechanical drawdown alternative was estimated at $9-12 million.

○ Additional project elements addressing feasibility assessments for restoring lakes in the Orange Creek Basin will be developed as other feasibility and diagnostic projects are completed.

Restoration/Management Program

Project OCB-303-RM. *Wetland/Water resource protection through new land acquisition in the OCB*

◆ Assessment of potential land acquisition in the OCB

Ongoing District effort to augment water and wetland resource protection in the Orange Creek Basin through land acquisition. Acquisition of properties within the Prairie Creek-Newnans Lake and Lochloosa Lake Wildlife CARL project areas represent a major milestone in the

effort to protect high quality existing water resources in the basin. Additional land acquisition will allow for the restoration of natural surface drainage patterns in lands affected by agricultural or silvicultural development and for the restoration of natural hydrologic regimes of receiving waterbodies.

Project OCB-304-RM. *Land management of public lands in the OCB*

- Land management in District properties

Ongoing District effort to develop conceptual management plans for District properties, many of which are done in cooperation with other agencies such as FDEP, FGFWFC, the Division of Forestry, and local governments. Through the implementation of the land management plans, the District seeks to fulfill its overriding management objective of ecological resource protection and restoration, and in particular, the objective of maintaining (through preservation or restoration) natural land drainage patterns on the District lands.

Project OCB-306-RM. *Restoration of waterbodies in the OCB*

- Additional project elements addressing restoration efforts in waterbodies of the Orange Creek Basin will be developed as feasibility and diagnostic projects are completed.

Regulatory Program

Project OCB-401-RG. *Minimum flows and levels*

- Minimum flows and levels in the OCB

Ongoing effort to set environmentally based minimum flows and levels for Paynes Prairie, Orange Creek, and Orange, Lochloosa, and Newnans lakes (by FY 1995/1996). The minimum flows and levels determinations will assess the hydrologic requirements of functional lake and wetland ecosystems and will help identify hydrologic goals for these water bodies and their associated wetlands. Adoption of the minimum flows and levels rule for the OCB waterbodies will ensure that consumptive uses of these surface waters do not cause significant harm to water resources and associated natural systems.

Project OCB-403-RG. *Surface water permit review*

- Orange Creek Basin surface water permit review

Multi-agency effort to assess the compliance status of surface water related permits (MSSW, Stormwater, WRM, CUP, Ag. Disch, ERP, NPDES) and to evaluate the need for enhanced enforcement actions and/or new permit requirements which will improve water quality and hydrologic conditions in surface waterbodies of the basin.

Interagency Coordination Program

Project OCB-502-I. *Comprehensive Plan review*

- Local government comprehensive plan review

Ongoing intergovernmental coordination effort aimed at assisting local governments in the preparation and revision of comprehensive plans and at encouraging incorporation of OCB-Plan objectives into these comprehensive plans. The protection of water resources and of natural hydrologic regimes is an important goal of the comprehensive plan review effort.

Project OCB-504-I. *Intergovernmental basin coordination*

- Regional intergovernmental forum

Ongoing District initiative to periodically hold county-based intergovernmental forums (involving state, regional, and local government agencies) aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to facilitate coordination among cooperating agencies and to ensure the timely notification of government proposed actions which could potentially affect surface water management decisions in the Orange Creek Basin (e.g., hydrologic modifications associated with road and bridge constructions). Intergovernmental forums for Alachua County (sponsored by SJRWMD and SRWMD) were initiated in November 1995.

Public Outreach Program

Project OCB-601-P. *Basin and subbasin task forces and advisory councils*

- Orange Creek Basin Advisory Council and Scientific Advisory Committee

Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. The protection of natural aquatic systems and the restoration of altered hydrologic functions are among the many issues addressed by the OCB Advisory Council and its Scientific Advisory Committee.

Project OCB-603-P. *Local government commission updates*

- City and county commission meeting updates

Planned District outreach effort to keep abreast of the major subject items discussed at city and county commission meetings which pertain to basin surface water management and protection

issues such as stormwater management needs, flood control needs, and aquatic resources protection.

Project OCB-604-P. *Public education and awareness programs*

- Adult awareness program

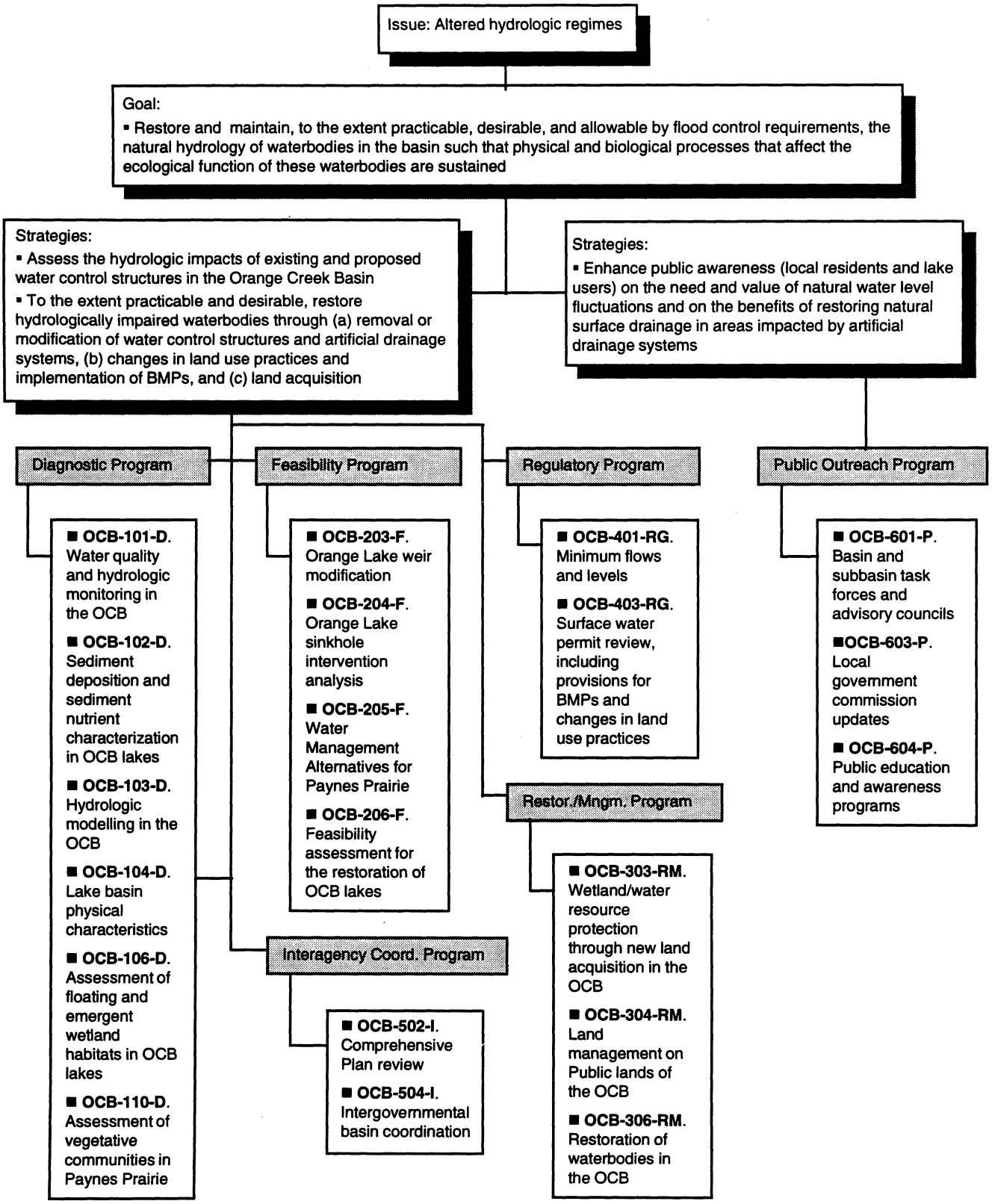
  Ongoing District effort aimed at identifying public (adult) education needs with the goal of enhancing awareness of basin issues and/or problems. Several efforts concerning the preparation of informational support material (e.g. fact sheets, portable displays) are currently underway. Increased awareness on the need for natural water level fluctuations to maintain lake and wetland ecosystem benefits is an important objective within these efforts.

- School education and awareness program

  Planned District effort aimed at evaluating informational needs for local school programs (elementary through highschool) with the goal of increasing the awareness among the resident school population of the need and the means to manage and protect water resources in the Orange Creek Basin. Increased awareness of the values and benefits of naturally occurring water level fluctuations will be an important goal of the school education and awareness program.

Elements within projects OCB-605-P *(Basin and subbasin workshops)* and OCB-606-P *(Educational and informational support material)* provide the basic tools for achieving the outreach goals delineated in the Public Education and Awareness Project (OCB-604-P).

Figure 25. Issue No. 1: Altered Hydrologic Regimes.



ISSUE # 2. EXTREME LOW LAKE LEVELS

Background

Low water conditions in lakes of the Orange Creek Basin occur, on average, at the following time intervals and durations (Robison *et al.* 1996):

Frequent lows: once every five years, for 180 days;
Infrequent lows: once every fifty years, for 360 days.

Using the historical (50-year) lake stage records (Figures 9, 10, and 11), and lake stage threshold elevations corresponding to frequent and infrequent droughts (Table 11), past low water occurrences on Orange, Lochloosa, and Newnans lakes are categorized as follows: [2]

Orange Lake

- two infrequent lows; <52.5 ft (1956, 1990)
- six frequent lows; 52.5-55.7 ft (1943, 1962, 1963, 1977, 1981, 1992)

Lochloosa Lake

- two infrequent lows; <54.2 ft (1956, 1990)
- six frequent lows; 54.2-56.1 ft (1943, 1962-63, 1977, 1981, 1985, 1992)

Newnans Lake

- three infrequent lows <64.7 (1956,1961,1981)
- two frequent lows; at 64.7 ft; (1949,1963, 1976, 1989)

[2] All infrequent lows begin as frequent lows. However, for the purposes of identifying and counting drought events, only those frequent lows that are not associated with infrequent low events will be recognized as such.

Table 11. Threshold lake stage elevations for various hydrologic events on Newnans, Orange, and Lochloosa Lakes. Values represent average stages for the duration of the hydrologic event. Based on SSARR 50-year simulations under existing conditions, with Newnans Lake weir removed (Robison *et al.* 1996).

Hydrologic Event	Recurrence interval/duration	Newnans Lake	Orange Lake	Lochloosa Lake
Infrequent high	1:5 yrs, 30 days	68.3	59.0	59.7
Frequent high	1:2 yrs, 60 days	67.5	58.5	59.0
Average water level	1:2 yrs, 180 days	65.3	57.3	57.6
Frequent low	1:5 yrs, 180 days	64.7	55.7	56.1
Infrequent low	1:50 yrs, 360 days	64.7	52.5	54.2

The term "extreme low lake levels", as used in this report, refers to infrequent lows of extreme magnitude and duration; i.e., lows that significantly exceed the threshold lake elevations specified in Table 11 and that last significantly longer than 360 days.

Although low water levels caused by periodic droughts are important for the maintenance of aquatic and wetland resources and for the long-term health of lakes and wetlands, extreme low water caused by prolonged infrequent droughts may have undesirable environmental effects (particularly in shallow lake systems). A prolonged drastic reduction in water depth and lake volume can result in the temporary loss of vast areas of fish habitat and refugia, higher water temperatures, lower dissolved oxygen concentrations, and enhanced aquatic weed problems. Fish and wetland wildlife populations could, therefore, be subjected to significant environmental stress. Other consequences of extreme low water conditions may be enhanced water turbidity and internal nutrient loading, due to wind-induced resuspension of bottom sediments. Propeller dredging by boaters during low water can also be a cause of enhanced turbidity and loss of rooted aquatic vegetation.

Extreme low lake levels may also restrict recreational and/or commercial use of the waterbodies. Past drought events in the Orange Creek Basin (e.g. 1956, 1978, and 1991) have caused major disruptions to lake users, including resident and nonresident boaters, anglers, and local fishcamp businesses. Public outcry during extreme drought events has been particularly strong on Orange Lake, which, because of its sinkhole and its characteristic lake bottom morphometry, typically experiences infrequent extreme natural drawdowns (e.g. in 1956 and 1990-91). Attempts to counteract the undesirable effects of these extended infrequent lows have led to the construction of Prairie Creek and Orange Lake dams, to the partially successful attempts at plugging and isolating the Orange Lake

sinkhole (in the 1950's and 1960's), and in 1990, to the unauthorized filling of the low-flow notch on Orange Lake weir.

It is difficult to determine the degree to which lake managers can intervene in natural hydrologic changes in a waterbody to limit extreme low water levels without causing long-term impacts to the health of the aquatic ecosystem. Any measures intended to prevent or correct the undesirable consequences of prolonged extreme low lake levels must be consistent with the general goal of maintaining, to the extent practicable and desirable, natural water level fluctuations and their related ecosystem benefits.

Basin management goals for extreme low lake levels

The major goals associated with this priority issue are to: (1) determine the effects of extreme low water levels (extended infrequent low water periods) on the ecological functions and recreational opportunities of OCB lakes, (2) identify desirable lake low water frequencies and duration characteristics, balancing ecological and recreational needs, and (3) implement lake level management measures designed to attain desirable low water frequencies and durations.

Basin management strategies for addressing extreme low lake levels

Strategies aimed at addressing undesirable consequences of extended infrequent low lake levels are listed below:

- Evaluate positive and negative effects of extended infrequent low lake levels on lake and wetland ecosystem components and processes.

- Assess the consequences of extended infrequent low lake levels on the access, recreational use, and local economy of Orange, Lochloosa, and Newnans lakes.

If negative consequences of extended infrequent lows are found to be significant:

- Develop and evaluate water resource management alternatives (lake low water frequencies and durations) aimed at minimizing negative consequences of extreme low lake levels.
- Implement water resource management measures to address the issue of extended infrequent lows, balancing ecological, recreational, and economic needs.

Projects to implement the strategies for addressing the issue of extreme low lake levels

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 26, page 109). Project elements are ranked by status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority,

o planned-second priority, and ⊙ planned-third priority.

Diagnostic Program

Project OCB-101-D. *Water quality and hydrologic monitoring in the Orange Creek Basin.*

◆ Inflow, outflow, and lake level monitoring in the OCB.

Ongoing District contractual effort aimed at establishing and maintaining a streamflow gaging and lake level recording network for major waterbodies in the Orange Creek Basin. The hydrologic data generated by this monitoring effort are needed to update the data base used to run the District's hydrologic model for the basin and to identify water level/flow management and restoration needs for individual waterbodies (Projects OCB-306-RM and OCB-401-RG).

- Sinkhole discharge monitoring in Orange Lake

  Planned District contractual effort aimed at quantifying (through field determinations) seepage loss from the Orange Lake Heagy Burry Park Sinkhole complex at varying lake elevations. This information will be utilized to verify modeled seepage loss and to evaluate the potential impacts of sinkhole discharge control on groundwater recharge and lake levels (Project OCB-204-F).

Project OCB-102-D. *Sediment deposition and sediment nutrient characterization in OCB lakes.*

★ Effects of short-term drawdown on sediments and nutrients of Newnans Lake (Phase I & II)

Completed contractual project by Gottgens & Crisman (1992a,b) for the SJRWMD designed to empirically evaluate the impact of a short-term drawdown on the retention, oxidation and compaction, and deposition and redistribution of organic sediments and particulate nutrients in Newnans Lake.

These studies determined that during the 1989 Newnans Lake drawdown, only a small amount of organic sediments and nutrients were flushed and little oxidation of exposed sediments occurred. The lack of flushing was attributed to the fact that the lake levels were unusually low prior to the initiation of the drawdown, so that only about 20% of the lake water was removed. Organic sediments were variably redistributed in the lake, however there was no consistent transfer of sediments from littoral to profundal zones. It was recommended that short-term drawdowns be initiated when lake levels are high and wind speeds are greater than normal.

◆ Sediment and water quality reconnaissance of Newnans Lake

Ongoing District effort aimed at monitoring changes in sediment stratigraphy and physical characteristics in Newnans Lake and changes in water quality both in Newnans Lake and in its inflow (Hatchet Creek) and outflow (Prairie Creek) during an 18-month period (1991-1993) immediately prior to and following the removal of the flashboards at Prairie Creek dam. Sampling has been completed under contract with King Engineering Associates, Inc. (Tampa) and analysis of data is currently underway by District scientists.

This effort will provide information on changes in water quality and sediment characteristics in Newnans Lake during a naturally occurring low water period

◆ Historical sediment and nutrient accumulation rates and past water quality in Orange Lake

District contractual effort currently underway aimed at utilizing paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Orange Lake, to determine the timing of these changes, and to investigate their possible causes. This information will shed light on the relationships between past drought events (extreme low lake levels) and changes in sediment and nutrient accumulation rates and lake water quality and will provide data needed to predict long-term limnological effects of sinkhole intervention and/or weir modification.

Project OCB-103-D. *Hydrologic modelling in the OCB*

- Effects of surface water management alternatives on wetlands and lake levels in the OCB

  Addresses, through the use of a predictive model, the effects of various water management alternatives on lake levels, flood regimes, and wetland vegetation composition and coverage. The ecological consequences of management alternatives that affect the frequency and duration of low lake levels (such as sinkhole intervention alternatives) are evaluated, and corresponding recommendations are made.

  Completed draft report by Robison, C.P., C. Ware, G.B. Hall, & R. Hupalo. 1996. Water management alternatives: effects on lake levels and wetlands in the Orange Creek Basin.

Project OCB-104-D. *Lake basin physical characteristics*

- Bathymetry and sediment thickness survey in Orange Lake

  District contractual effort currently underway aimed at mapping the bathymetry and sediment thickness of Orange Lake. This survey will provide missing bathymetric data for the lake and will generate a map of muck depth and thickness throughout the lake. This bathymetric and sediment thickness information is needed to identify the needs for sediment restoration in Orange Lake and to predict the potential lake-wide effects of hydrologic management alternatives (e.g. sinkhole discharge control and Orange Lake weir modification) on organic sediment distribution and accumulation.

- Newnans Lake outlet stream profile survey

  District contractual work currently underway aimed at describing the profile of Prairie Creek from State Road 20 to Newnans Lake. The profile data obtained from this survey are needed to evaluate the current outflow potential of Newnans Lake at varying lake elevations and to identify outlet channel hydraulic impediments.

- Orange Lake outlet stream profile

  District contractual work currently underway aimed at describing the profile of Orange Creek/Shands Canal, downstream from Orange Lake weir at U.S. Highway 301. Information derived from this survey will be used to identify (a) hydraulic impediments to Orange Lake outflow downstream of the 301 weir and (b) stream channel restoration needs for meeting minimum flows in Orange Creek(as determined by the Minimum Flows and Levels Project OCB-401-RG).

Project OCB-106-D. *Assessment of floating and emergent wetland habitats in OCB lakes*

- ◆ Historical analysis of wetland vegetation in Orange, Lochloosa, and Newnans lakes

  Ongoing District effort aimed at evaluating historical abundance, composition, and distribution of wetland vegetation (floating and emergent) in Orange, Lochloosa, and Newnans lakes, based on historic photographic and cartographic records. Correlation of vegetational changes with historic lake elevations will provide insight into the effects of extended droughts (infrequent low lake levels) on lake and wetland plant communities.

- ◆ Formation of floating mats in Orange Lake and causes for historical changes

  Planned District contractual effort aimed at identifying the mechanisms of formation of floating vegetation mats in Orange Lake. If changes in the abundance and structure of floating mats are documented in the historical analyses of wetland vegetation (see above), then the probable causes for these changes will also be addressed. The information gained from this effort will help determine the role of lake level fluctuations in floating mat formation/breakup and will help assess the potential effects of proposed hydrologic modifications in Orange Lake (sinkhole discharge control and weir modification) on floating vegetation dynamics.

Project OCB-109-D. *Economic assessments in the OCB*

- ● Analyses of economic benefits from recreational and commercial uses in the OCB

  Planned District contractual effort to assess economic benefits from recreational and commercial uses in the Orange Creek Basin. Such economic analyses will first be done for the Orange Lake-Lochloosa Lake area, to assess the economic impacts on lake recreational fisheries during and following the 1990-91 drought. These analyses will also provide baseline data by which to measure restoration and management progress toward the goal of enhancing recreational opportunities and the economic benefits from recreation.

Feasibility Program

Project OCB-202-F. *Improvements to lake access in Orange and Lochloosa lakes*

- ★ Feasibility study of Cross Creek dredging

  District in-house effort (completed in 1992) performed at the request of the Alachua County Public Works Department, to assess the feasibility of dredging Cross Creek to allow for navigation during drought conditions. The purpose of the study was to evaluate dredging alternatives and the costs associated with them. The study investigated the effects of dredging Cross Creek to provide minimum depths of 1, 2, or 3 feet, based on the lowest elevations reached in the 1990-91 drought. It concluded that there would be no effects on either Lochloosa or Orange Lakes during normal years but that during drought years, low lake levels

on Lochloosa Lake would be even lower. This effect would be slightly augmented if the Orange Lake weir were removed. The 2-foot minimum dredging option would lower the amount of time Cross Creek is unusable from 13% to 4% of the time. Dredging costs were estimated between $110,000 (for the 1-foot minimum) and $390,000 (for the 3-foot minimum).

◆ Lake access needs

Ongoing District in-house effort to assess lake access problems and needs in relation to water levels in Orange and Lochloosa lakes. Evaluation of lake access needs includes feasibility analyses for dredging access channels from the lake to public boat ramps and fish camps, to provide for navigation during low water periods.

Project OCB-203-F. *Orange Lake weir modification*

● Orange Lake weir modification; evaluation of management alternatives

Planned effort to identify structural and operational modifications to the U.S. 301 weir, as well as to other downstream structures (e.g. U.S. 301 and railroad levees; Shands Canal) with the purpose of restoring, to the extent practicable and desirable, Orange Lake's natural outflow regime and providing minimum flows for Orange Creek. Analysis of the hydrologic improvements to the Orange Lake outlet will be done in conjunction with the Orange Lake sinkhole intervention analysis (see project OCB-204-F) and will address the issue of extended infrequent low lake levels.

Project OCB-204-F. *Orange Lake sinkhole intervention analysis*

★ High resolution seismic reflection surveys in Orange Lake

Completed report by Kindinger, J.L., J.B. Davis, and J.G. Flocks. 1994. High-resolution single-channel seismic reflection surveys of Orange Lake and other selected sites, north central Florida. Draft report submitted to St. Johns River Water Management District as part of a U.S. Geological Survey/St. Johns River Water Management District joint funding agreement.

This survey maps subsidence features on the bottom of Orange Lake and confirms the existence of two major collapsed sinkholes along the southwestern shore of the lake which provide a conduit for exchange between the lake and subsurface aquifer. These results are an important first step in the task of addressing other sinkhole issues on Orange Lake.

★ Engineering feasibility study, Orange Lake sinkhole remediation

Completed report by Bromwell & Carrier, Inc. 1994. Feasibility study, Orange Lake sinkhole remediation, Orange Lake, Florida. Draft Report prepared for the St. Johns River Water Management District, Palatka, Florida.

This study evaluated the feasibility of various engineering alternatives for reducing or controlling water losses through the Heagy Burry sinkhole(s) at Orange Lake. A coffer dam built east of the sinkhole was identified as the isolation method most likely to succeed. If filling were selected, compaction grouting was recommended. It was also recommended that detailed studies be done to evaluate the impacts of flow reduction to the Floridan aquifer

system (including geophysical, geotechnical, environmental, geohydrological, and bathymetric surveys along with hydrological modelling) prior to the selection of the remediation method and to its final design.

- Karst geology and groundwater analyses in Orange Lake

  District contractual effort currently underway aimed at assessing the possible groundwater and geologic effects of sinkhole discharge control in Orange Lake's Heagy-Burry Park area. This feasibility assessment is part of a larger effort to determine the potential environmental impacts of sinkhole intervention at the Heagy-Burry Park sinkhole complex in Orange Lake.

- Orange Lake sinkhole intervention; evaluation of management alternatives

  Planned District effort to evaluate the potential environmental impacts of proposed sinkhole discharge control alternatives intended to prevent the occurrence of undesirable extreme low lake levels in Orange Lake. This assessment relies on the results of other feasibility efforts under this project (OCB-204-F) as well as on information from a number of diagnostic efforts addressing water quality, hydrology, sediment characteristics, and wetland habitats in Orange Lake (projects OCB-101-D, OCB-102-D, OCB-103-D, OCB-106D, and OCB-108-D).

Restoration/Management Program

Project OCB-306-RM. *Restoration of waterbodies in the OCB*

- Project elements addressing restoration efforts in waterbodies of the Orange Creek Basin will be developed as feasibility and diagnostic projects are completed.

Regulatory Program

Project OCB-401-RG. *Minimum flows and levels*

- Minimum flows and levels in the OCB

  Ongoing effort to set environmentally based minimum flows and levels for Paynes Prairie, Orange Creek, and Orange, Lochloosa, and Newnans lakes (by FY 1995/1996). The minimum flows and levels determinations will assess the hydrologic requirements of functional lake and wetland ecosystems and will help identify hydrologic goals for these water bodies and their associated wetlands. Adoption of the minimum flows and levels rule for the OCB waterbodies will ensure that consumptive uses of these surface waters do not cause significant harm to water resources and associated natural systems.

Interagency Coordination Program

Project OCB-504-I. *Intergovernmental basin coordination*

- Regional intergovernmental forum

Ongoing District initiative to periodically hold county-based intergovernmental forums (involving state, regional, and local government agencies) aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to facilitate coordination among cooperating agencies and to ensure the timely notification of government proposed actions which could potentially affect surface water management decisions in the Orange Creek Basin. The identification and implementation of sound management alternatives to address the issue of extreme low lake levels in Orange Lake relies on coordinated and effective multi-agency cooperation. Intergovernmental forums for Alachua County (sponsored by SJRWMD and SRWMD) were initiated in November 1995.

Public Outreach Program

Project OCB-601-P. *Basin and subbasin task forces and advisory councils*

- Orange Creek Basin Advisory Council and Scientific Advisory Committee

Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee (OCB SAC) provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. The analysis of lake management alternatives aimed at preventing the negative impacts of extreme (infrequent) low lake levels in Orange Lake is the first assigned task for the OCB SAC.

Project OCB-604-P. *Public education and awareness programs*

- OCB diagnostic public opinion poll

Planned District contractual effort aimed at identifying, through a systematic and unbiased public opinion poll, educational and informational needs for the Orange Creek Basin. The poll will address multiple basin issues, including the issue of extreme low lake levels.

- Adult awareness program

Ongoing District effort aimed at identifying public (adult) education needs with the goal of enhancing awareness of basin issues and/or problems. Several efforts concerning the preparation of informational support material (e.g. fact sheets, portable displays) are currently

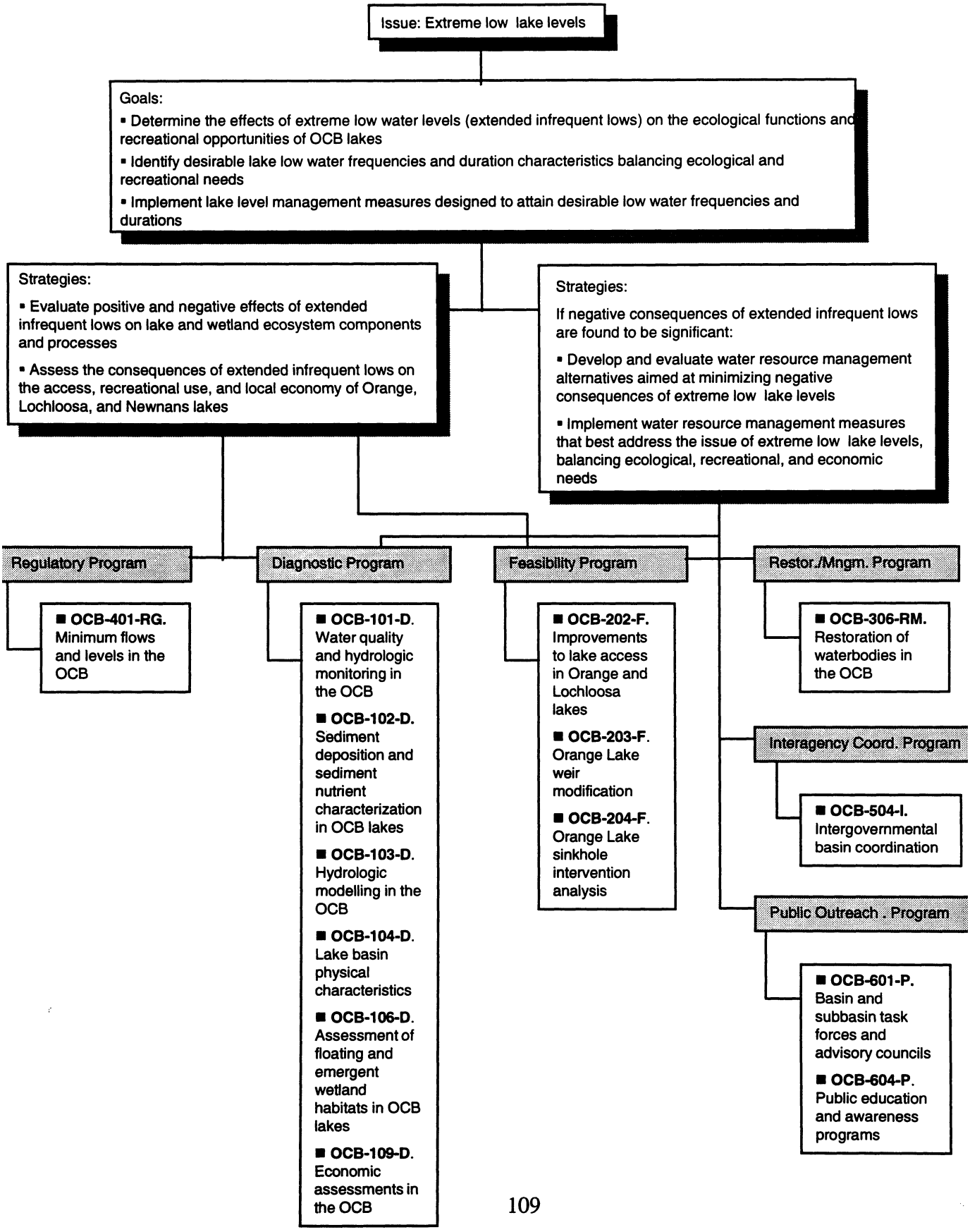
underway. Educational efforts aimed at enhancing public understanding of the values and benefits of naturally occurring low water periods will be pursued.

- School education and awareness program

  Planned District effort aimed at evaluating informational needs for local school programs (elementary through highschool) with the goal of increasing the awareness among the resident school population of issues and/or problems afflicting water resources in the Orange Creek Basin and of the public's role in solving or improving these problems. Increased awareness of the ecological function of naturally occurring water level fluctuations and of the values and benefits of extended low water periods will be an important goals of the school education and awareness program.

Elements within projects OCB-605-P (*Basin and subbasin workshops)* and OCB-606-P *(Educational and informational support material)* provide the basic tools for achieving the outreach goals delineated in the Public Education and Awareness Project (OCB-604-P).

Figure 26. Issue No. 2: Extreme Low Lake Levels.



3.2 AQUATIC PLANT MANAGEMENT

The spread of exotic weeds (particularly hydrilla), the loss of native aquatic plant populations, and the apparent changes in the abundance, distribution, and vegetative composition of floating mats are the three primary aquatic plant management issues in the Orange Creek Basin. These issues are addressed below as priority issues 3, 4, and 5, respectively.

ISSUE # 3. CONTROL OF EXOTICS.

Background

The five most troublesome invasive exotic plants infesting Florida waterways are hydrilla(*Hydrilla verticillata)*, torpedo grass (*Panicum repens*), water-lettuce (*Pistia stratiotes*), alligator-weed (*Alternanthera philoxeroides)*, and water-hyacinth (*Eichhornia crassipes*) (Schardt & Schmitz 1990). The advent of modern contact herbicides has largely made the control of water-hyacinth and water-lettuce possible. Alligator-weed has also been successfully controlled (since the late 1970's) with the help of biological (insect) control agents (Cofrancesco 1991).

Hydrilla, however, remains as the leading aquatic weed problem in Florida, invading lakes and waterways so quickly that current funding for management can no longer match its ability to spread. It has been estimated that an annual budget of $15 million would be necessary to adequately manage the nearly 100,000 acres of hydrilla present in Florida's public waters today (Hulon 1995). The total annual state budget for hydrilla management (statewide) was under $4.5 million for FY 1994-95 and currently is $8.1 million for FY 1995-96.

Hydrilla is an extremely aggressive plant that easily out-competes and displaces native species of submersed aquatic vegetation. It has unique photosynthetic capabilities (e.g. C4 metabolism and a low light compensation point), several forms of vegetative reproduction (stem fragmentation, stolons, turions, subterranean tubers, and aerial winter-buds), it tolerates a wide range of water quality conditions, and it easily shades out existing submersed plants given its ability to form a dense canopy near the surface of the water (Haller & Sutton 1975, Bowes et al. 1977, 1979, Cook & Luond 1982, Langeland 1990, Schmitz et al. 1993).

Hydrilla in the Orange Creek Basin.

Hydrilla was introduced into the Orange Creek Basin in the early 1970s. Peak infestation occurred on Orange Lake in 1977, where it covered up to 90% (8,000 acres) of the lake's open water (Hinkle 1994a). Today it continues to be the most troublesome aquatic weed in the basin.

Since its first appearance in Orange Lake (1970's), hydrilla has largely replaced littoral populations of southern naiad (*Najas guadalupensis*), bladderwort (*Utricularia* spp.), and coontail (*Ceratophyllum demersum*), and has become the dominant species present within the spatterdock communities (Shireman et al. 1983). Its adaptation to low light levels has also allowed it to spread to deeper areas of the lake which were originally devoid of aquatic vegetation. It has been estimated that prior to the introduction of hydrilla in Orange Lake, at least 50% of the entire lake area was devoid of aquatic vegetation (Shireman et al. 1983). In 1977, hydrilla formed dense continuous surface mats throughout most of Orange Lake which covered more than 80% of total lake area and which caused a dramatic decline in total angler effort and sportfishing revenues (Colle *et al.*, 1987).

The Florida Department of Environmental Protection and the U.S. Army Corps of Engineers are responsible for the management of hydrilla and other exotic aquatic weeds in state waters of the Orange Creek Basin (by way of legislative and congressional mandates). The program is administered through a cooperative agreement between the Department and the Corps of Engineers, with the Department subcontracting control operations to the St. Johns River Water Management District (Hinkle 1994a).

Between 1974 and 1994, the state has spent approximately 5.4 million on hydrilla control on Orange and Lochloosa lakes ($2.8 million and $2.6 million, respectively). Using 1994 herbicide application costs, these expenses translate to about $7.5 million for both lakes (Hinkle, personal communication). On Orange Lake alone, annual expenditures from 1991 to 1994 averaged around $490,000. The majority of these costs reflected the use of fluridone for whole-lake treatments of hydrilla. Recent budget cuts in the state-wide hydrilla management program, however, resulted in the suspension of fluridone treatments on Orange and Lochloosa lakes during FY 1994-95. Funding for hydrilla management in Orange Creek Basin lakes has increased to $842,500 (for Orange Lake) and $100,000 (for Lochloosa Lake) for FY 1995-96.

Impacts of hydrilla.

In addition to invading open water habitats and displacing native aquatic plant populations, excessive growth of hydrilla in lakes can lead to undesirable changes in the structure and abundance of invertebrate and fish assemblages (Colle & Shireman 1980, Scott and Osborne 1981, Maceina & Shireman 1985, Colle et al. 1987), water quality (Canfield et al. 1983b, Schmitz & Osborne 1984, Canfield & Hoyer 1992), and lake hydrodynamics and sedimentation patterns (Joyce et al. 1992). However, in moderate abundances (20 to 40% aerial coverage) hydrilla could potentially enhance fish and invertebrate populations by increasing the availability of submersed habitat (Durocher et

al. 1984, Wiley et al. 1984, Watkins et al. 1983). For more detail on the potential impacts and benefits of hydrilla, see Appendix G.

Hydrilla Control.

At present, chemical treatment with fluridone (Sonar®) is the principal method used for the large-scale management of hydrilla, due to its low toxicity, relatively low cost ($300-$620 per treated acre), and high effectiveness at very low concentrations (as low as 5-15 ppb (D. Schilling, personal communication, Hinkle 1994a). Drawbacks of the use of fluridone, however, include potential impact on nontarget native plant species, low effectiveness in shallow muck-bottomed lakes due to chemical sequestration by organic sediments, low performance predictability, and limited effectiveness on the parts of plant which are not actively growing (unsprouted subterranean turions) (see Appendix G for more detail).

For small treatment areas (near-shore plots or boat trails) or areas with a short hydraulic residence time (e.g. around the Orange Lake sinkhole area), contact herbicides such as Diquat and Endothall are usually the preferred form of chemical control.

Non-chemical methods for aquatic weed control include mechanical harvesting and biological control. Mechanical harvesting has the advantage of providing immediate and localized control of plant growth and of allowing for the removal of nutrients from the system (if off-site disposal of harvested material is employed). Nutrient removal through harvesting can be particularly important in eutrophic waterbodies (Mericas et al. 1990). Mechanical harvesting, however, can have several disadvantages. It may result in: (a) enhanced growth and dispersal of the plants due to their fragmentation during the harvesting process (Sabol 1987, Serafy et al. 1994), (b) death (in the form of by-catch) of substantial numbers of small fish (Haller et al. 1980, Serafy et al. 1994), and c) problems

related to the disposal of harvested plants (e.g. shortage of adequate disposal sites, high disposal costs). Additionally, mechanical harvesting in highly productive sub-tropical climates can be expensive and labor intensive and is unlikely to be a cost-effective control method in large lakes (Hinkle 1994a). Results of a 1977 experimental hydrilla harvest on Orange Lake (by the U.S. Corps of Engineers) indicated that mechanical harvesting of hydrilla was successful and cost competitive for maintaining boat access channels during a growing season, as long as harvested material was at least partially disposed of in the lake (McGehee 1979). On site disposal however, reduces the overall effectiveness of this method as a nutrient reduction tool and increases the likelihood of plant regrowth from the disposed fragmented material.

Biological control of hydrilla using host-specific organisms (insects or pathogens) is a promising technique for aquatic plant control since it can provide long-term management with minimal expense and with minimum impact to non-target species. Although several insects (weevils and flies) and pathogens have been identified as potential control agents (Center et al. 1991), further research and field testing is still needed before these organisms can be used in large-scale aquatic plant control programs.

Chinese grass carp (*Ctenopharyngodon idella*) provide an additional tool to lake managers for the control of undesirable aquatic plants, including hydrilla. However, unlike other biocontrol agents such as insects and pathogens, grass carp are not host-specific and can potentially eliminate all existing aquatic vegetation in a lake. Such an outcome could result in major ecosystem impacts to the water body (e.g. increase the potential for extensive algal blooms). Furthermore, optimal stocking densities for grass carp have been very difficult to determine and reliable methods for their removal are not yet available.

Given the uncertainties associated with the use of grass carp for aquatic weed control, lake managers are cautious when considering the introduction of grass carp into large lakes. At the 1994 National Grass Carp Symposium in Gainesville, Florida, the consensus of lake managers was to recommend not utilizing grass carp in Orange or Lochloosa lakes unless stocking rates and harvesting methods for this species are first improved and made reliable through further research.

The key to more effective control of hydrilla may lie in the development and implementation of an integrated hydrilla management program, in which a combination of chemical, biological, and/or physical control methods are utilized to manage hydrilla populations at maintenance control[1] levels. Further research is still needed, however, to identify ways of improving the efficacy and predictability of fluridone.

Ultimately, the success of any aquatic plant management program largely depends on the availability of sufficient and dedicated funding. Although funding for the past several years has been adequate to manage floating vegetation problems in both Orange and Lochloosa lakes, it has not been sufficient for maintenance control of hydrilla on these lakes (Hinkle 1994a).

Even though hydrilla is regarded as the major exotic aquatic weed afflicting Florida waters today, the need to control other species of nuisance exotic plants must not be overlooked. Wild taro (*Colocasia esculenta*) and torpedo grass (*Panicum repens*), for example, have been spreading rapidly in some wetland areas of the Orange Creek Basin and could develop into major aquatic plant management problems if they are not brought under control (Hinkle 1994a). Problems with the spread of exotic ornamentals in Hogtown Creek and Paynes Prairie subbasins also need to be addressed. Additionally,

[1] "Maintenance control" is defined by the Florida Statutes (F.S. §369.22) as "a method for the control of nonindigenous aquatic plants in which control techniques are utilized in a coordinated manner on a continuous basis in order to maintain the plant population at the lowest feasible level as determined by the department" (of Environmental Protection).

maintenance control efforts targeting water-hyacinth (*Eichhornia crassipes*) and water-lettuce (*Pistia stratiotes*) need to be continued.

Basin management goal for the control of exotics

The main goal for the control of exotics in waterbodies of the Orange Creek Basin is to improve and expand existing aquatic plant management techniques, preferably within the framework of an integrated aquatic plant management program, with the purpose of achieving maintenance control of all exotic species (including hydrilla).

Basin management strategies for addressing the control of exotics

Strategies aimed at improving and expanding existing aquatic plant management techniques and programs, with the purpose of achieving overall maintenance control of exotic species in the Orange Creek Basin include:

- Continue and enhance the effort of hydrilla control in the OCB as recommended by FDEP, with improvements in herbicide application techniques/schedules aimed at minimizing the impact on non-target native plants, enhancing tuber control, and augmenting overall herbicide efficacy.
- Assess the feasibility of further supplementing existing chemical control practices with alternative methods of aquatic weed management (e.g. biological control and harvesting methods) with the goal of developing and ultimately implementing an integrated aquatic plant management program for exotic species in the basin.
- Procure additional and alternative sources of funding to meet the long-term needs of exotic aquatic plant management in the Orange Creek Basin.

Projects to implement the strategies for addressing the control of exotics

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 27, p.122). Project elements are ranked by status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority,

⭘ planned-second priority, and ⊙ planned-third priority.

Diagnostic Program

Project OCB-101-D. *Water quality and hydrologic monitoring in the Orange Creek Basin.*

- ◆ District water quality monitoring in the OCB

  Ongoing District basinwide water quality sampling effort aimed at monitoring surface water quality on a monthly basis at 26 sites. The information generated by the water quality monitoring effort is useful for determining the proper timing of herbicide applications and for describing changes in water quality following the implementation of aquatic weed control measures (chemical and mechanical).

Project OCB-102-D. *Sediment deposition and sediment nutrient characterization in OCB lakes*

- ◆ Historical sediment and nutrient accumulation rates and past water quality in Orange Lake

  District contractual effort currently underway (Phase I) aimed at utilizing paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Orange Lake, to determine the timing of these changes, and to investigate their possible causes. Phase II of the study will provide information needed to assess the impacts of hydrilla and its management on historical patterns of sediment nutrient accumulation and water quality in Orange Lake. This information will be important for predicting long-term environmental effects of hydrilla management actions.

Project OCB-104-D. *Lake basin physical characteristics*

- ◆ Bathymetry and sediment thickness survey in Orange Lake

  District contractual effort currently underway aimed at mapping the bathymetry and sediment thickness of Orange Lake. This survey will provide missing bathymetric data for the lake and

will generate a map of muck depth and thickness throughout the lake. This information is needed to determine the relationship between muck depth and plant cover, and in particular, to assess the potential effects of hydrilla management actions on lake sediment characteristics (muck depth).

Project OCB-106-D. *Assessment of floating and emergent wetland habitats in OCB lakes*

- Characterization of floating and emergent vegetation in Orange Lake

  District in-house effort currently underway aimed at describing in detail (based on field surveys) the current species composition and the ecological characteristics of floating and emergent marsh vegetation in Orange Lake. This work will provide important baseline information needed to evaluate the current status of exotic weeds in littoral and sublittoral habitats.

Feasibility Program

Project OCB-206-D. *Feasibility assessment for the restoration of OCB lakes*

- Feasibility assessments needed for enhancing exotic weed control in the OCB will be developed as diagnostic projects are completed.

Restoration/Management Program

Project OCB-301-RM. *Aquatic plant management in OCB lakes*

- Aquatic vegetation monitoring on Orange, Lochloosa, and Newnans lakes

  Ongoing FDEP/SJRWMD effort to monitor aquatic plant populations in Orange, Lochloosa, and Newnans lakes as part of the state's aquatic plant management program. Results of these surveys are needed to identify annual aquatic weed treatment needs, particularly with regard to exotics such as hydrilla, water-hyacinth, water-lettuce, torpedo grass, and alligator-weed.

- Vegetation management in OCB lakes

  Ongoing joint FDEP/SJRWMD effort to implement aquatic weed control measures in OCB lakes. Chemical control operations are rendered by the District under contract with FDEP and in accordance with FDEP's aquatic plant management program goals and specifications. These include fluridone and contact herbicide applications for hydrilla control (whole lake treatments and boat trails) as well as herbicide applications for other exotic weeds. Emergency short-term actions intended to deal with the removal of nuisance vegetation (e.g. dislodged floating islands that cause access problems) are currently being undertaken by the District.

- Enhancement of aquatic weed control in OCB lakes

Ongoing multiagency effort (FDEP, SJRWMD, IFAS) aimed at reassessing and enhancing, on a periodic basis, the performance of aquatic weed control measures currently employed in the basin. The final goal of this effort is to identify aquatic plant management practices (preferably ones that integrate chemical, biological, and physical techniques) which best provide for improved hydrilla control, for the continued maintenance control of traditional aquatic weeds, and for the future control of newly established exotic weeds.

Project OCB-304-RM. *Land management on public lands of the OCB*

- Land management on District properties

Ongoing District effort to develop and implement, in cooperation with other agencies, sound, ecosystem-based management plans for District properties. The overriding management objective is for ecological resource protection and restoration. The control of exotic vegetation (terrestrial and aquatic) is a major element of these land management plans.

Regulatory Program

(no projects are pertinent to this issue)

Interagency Coordination Program

Project OCB-503-I. *Fund procurement coordination*

- Fund procurement coordination for OCB Plan implementation

Ongoing multiagency effort to procure funding from federal, state, regional and local governmental sources for the implementation of various components of the OCB Surface Water Management Plan. Efforts to expand funding sources for aquatic plant management statewide (in particular for hydrilla management in the Orange Creek Basin and elsewhere) are currently underway.

Project OCB-504-I. *Intergovernmental basin coordination*

- Regional intergovernmental forum

Ongoing District initiative to periodically hold county-based intergovernmental forums (involving state, regional, and local government agencies) aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to facilitate coordination among cooperating agencies and to ensure the timely notification of government proposed actions which could potentially affect surface water management decisions in the Orange Creek Basin. Close coordination is needed between FDEP, SJRWMD, and county and city governments to facilitate implementation of cooperative measures for exotic weed control

in the Orange Creek Basin. Intergovernmental forums for Alachua County (sponsored by SJRWMD and SRWMD) were initiated in November 1995.

Public Outreach Program

Project OCB-601-P. *Basin and subbasin task forces and advisory councils*

- Orange Creek Basin Advisory Council and Scientific Advisory Committee

Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. The need to improve aquatic weed management capabilities in the Orange Creek Basin, particularly with regards to exotics such as hydrilla, is among the main issues recognized by the OCB Advisory Council and its Scientific Advisory Committee.

- Subbasin task forces or working groups

Task forces or working groups which specifically address the issue of exotic weed management in the Orange Creek Basin. These task forces will be created on an "as-needed" basis by request of the public or of the OCB Advisory Council.

Project OCB-604-P. *Public education and awareness programs*

- Adult awareness program

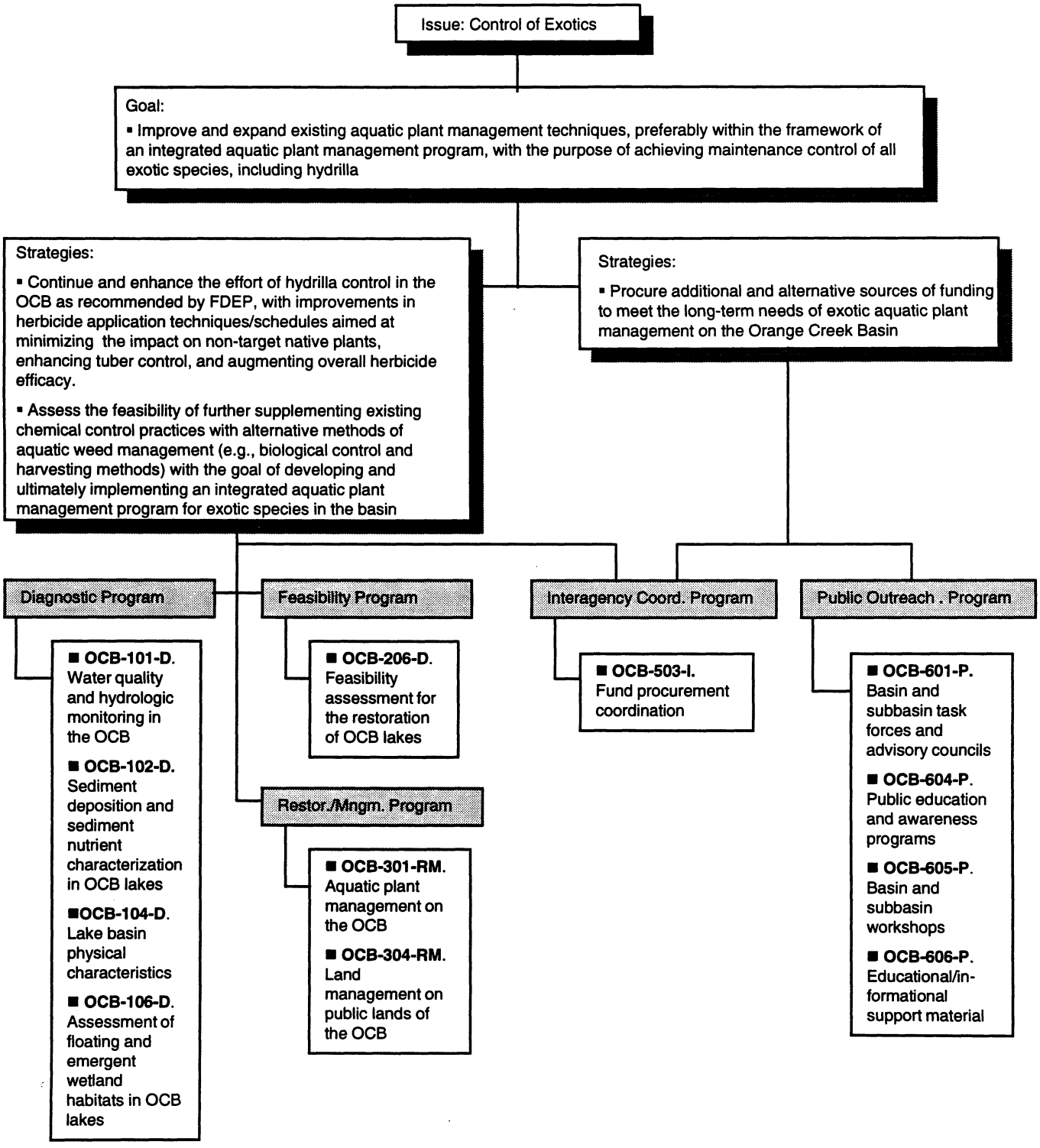
Ongoing District effort aimed at identifying public (adult) education needs with the goal of enhancing awareness of basin issues and/or problems. Several efforts concerning the preparation of informational support material (e.g. fact sheets, portable displays) are currently underway. Increased awareness on the potential threat exotic aquatic plants represent to the ecological well-being of lakes and wetlands and on ways the public can prevent the spread of exotic species in recreational waterbodies is an important goal of the adult awareness program. Additionally, educational efforts aimed at enhancing public understanding of the values and benefits of currently employed aquatic weed control measures are needed.

- School education and awareness program

Planned District effort aimed at evaluating informational needs for local school programs (elementary through highschool) with the goal of increasing the awareness among the resident school population of issues and/or problems afflicting water resources in the Orange Creek Basin and of the public's role in solving or improving these problems. Increased awareness of the potential threat exotic aquatic plants represent to the ecological well-being of lakes and wetlands and on ways the public can prevent the spread of exotic species in recreational waterbodies is an important goal of the school education and awareness program.

Elements within projects OCB-605-P (*Basin and subbasin workshops)* and OCB-606-P *(Educational and informational support material)* provide the basic tools for achieving the outreach goals delineated in the Public Education and Awareness Project (OCB-604-P).

Figure 27. Issue No. 3: Control of Exotics.



ISSUE # 4. PROTECTION AND RESTORATION OF NATIVE AQUATIC PLANT POPULATIONS

Background

Naturally diverse assemblages of submersed, floating, and emergent vegetation provide multi-functional habitat (nesting, foraging, refuge habitats) for numerous fish and wetland wildlife species. Anecdotal accounts and direct observation of Orange Creek Basin lakes through time indicate that native aquatic plant populations have declined noticeably over the last few decades. Possible causes for these declines include:

1. Invasion of hydrilla. Since its introduction into Orange Lake in the mid 1970's, hydrilla has spread at the expense of native littoral submersed species such as coontail (*Ceratophyllum demersum*), bladderwort (*Utricularia* spp.) and southern naiad (*Najas guadalupensis*) (Shireman et al. 1983). Hydrilla has the potential to outcompete and displace native species of submersed aquatic vegetation because of its ability to adapt to low light levels, its high reproductive capacity, its tolerance to wide-ranging water quality and organic pollution, and its ability to quickly produce a dense canopy near the surface of the water that shades out other existing submersed vegetation (Haller and Sutton 1975, Bowes et al. 1979, Cook and Luond 1982, Schmitz et al. 1993). Hydrilla also produces allelopathic compounds known to inhibit growth of native species such as coontail (Kulshreshtha and Gopal 1983). Aquatic vegetation monitoring on Orange Lake has shown, however, that recolonization of sites by native submersed plants does occur once hydrilla populations are removed (Hinkle 1995).

2. Non-target effects of herbicide treatments. Mortality of spatterdock (*Nuphar luteum*) has occurred following lake-wide applications of fluridone to hydrilla beds (about 60 acres of spatterdock were lost in Lochloosa Lake following the 1993 and 1994 hydrilla fluridone treatments; Hinkle 1994b). Other plants which are also susceptible to Fluridone include the native submersed species coontail, bladderwort, and southern naiad (Elanco Products Company 1988).

3. Muck accumulation in lakes. Enhanced accumulation of flocculent, organic sediments (muck) (caused by excessive nutrient loading, lake level stabilization, and aquatic and wetland plant proliferation) generally reduces the capacity of the sediments to adequately function as a substratum for the attachment of rooted aquatic plants (Benton et al. 1988). Increased muck accumulation over the last few decades in Newnans Lake has been suggested by Gottgens & Crisman (1993). Cursory sampling of sediments during the course of fisheries and water quality investigations indicate that muck accumulation problems may also exist in other Orange Creek Basin lakes (e.g. Orange Lake, Bivens Arm).

4. Accumulation/transformation of floating and emergent mats of vegetation. The issue that floating and emergent marshes in Orange Lake have increased relative to historic levels has been raised at Orange Creek Basin Advisory Council meetings. Loss of open water due to an increase in the coverage and density of floating and emergent vegetation may lead to declines in submersed native aquatic plant populations. Populations of native emergent wetland species could also be negatively affected by changes in the structure and physiognomy of emergent and floating vegetation. A quantitative analysis of historical changes in the abundance and structure of the floating and emergent marsh vegetation of Orange Lake is currently underway by the District.

5. Algal blooms. Light attenuation resulting from sustained phytoplankton blooms (e.g. Newnans Lake and Bivens Arm) can prevent growth of submersed vegetation and cause the decline of native submersed plant populations, especially in lakes with high color (such as most in the OCB).

Given the diverse array of possible causes for the reduction in native aquatic plant populations, effective restoration of native vegetation will require consideration of a variety of interrelated lake management issues (e.g. hydrology, sediment quality, nutrient loading, exotic weeds, and floating vegetation). Revegetation programs alone will not lead to successful re-establishment of native plant populations unless environmental conditions (e.g sediment quality, hydroperiod, water quality) are conducive or favorable for the survival and reproduction of the reintroduced plants.

Basin management goals for the protection and restoration of native aquatic plant populations

The major goal for the protection and restoration native aquatic plant populations is to protect and maintain existing stands of native aquatic vegetation and to reestablish healthy, self-maintained populations of native aquatic plants.

Basin management strategies for addressing the protection and restoration of native aquatic plant populations

The following strategies will be employed to attain the above goals:

- Assess current and historical populations of native aquatic plants and diagnose the causes for recent declines.

- Implement restoration and management measures aimed at reestablishing former populations of native aquatic plants and at preventing further loss of existing populations.

Projects to implement the strategies for addressing the protection and restoration of native aquatic plant populations

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 28, p.134).. Project elements are ranked by status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority, ◎ planned-second priority, and ⊙ planned-third priority.

Diagnostic Program

Project OCB-101-D. *Water quality and hydrologic monitoring in the Orange Creek Basin*

- ◆ District water quality monitoring in the OCB

  Ongoing District basinwide water quality sampling effort aimed at monitoring surface water quality on a monthly basis at 26 sites. This water quality information can provide insight into understanding the current distribution (presence or absence) of native aquatic plant species in a waterbody.

- ◆ Review and analysis of historical and current water quality conditions in the OCB

  Ongoing District project to be continued in FY 1995-96. Completion of this project is critical for the documentation of long-term water quality changes in waterbodies of the Orange Creek Basin. This information may contribute to a better understanding of the causes for temporal changes in the abundance and distribution of native aquatic plant species.

Project OCB-102-D. *Sediment deposition and sediment nutrient characterization in OCB lakes*

★ Effects of short-term drawdown on sediments and nutrients of Newnans Lake (Phase I & II)

Completed contractual efforts by Gottgens & Crisman (1992a,b) for the SJRWMD designed to empirically evaluate the impact of a short-term drawdown on the retention, oxidation and compaction, and deposition and redistribution of organic sediments and particulate nutrients in Newnans Lake. Understanding these sediment processes and how they are affected by different water level management alternatives is important in the design of littoral revegetation plans for Newnans Lake. A brief summary of the results of these studies' are included in section 3.1, Issue No. 2 (extreme low lake levels).

◆ Sediment and water quality reconnaissance of Newnans Lake

Ongoing District effort aimed at monitoring changes in sediment stratigraphy and physical characteristics in Newnans Lake and changes in water quality both in Newnans Lake and in its inflow (Hatchet Creek) and outflow (Prairie Creek) during an 18-month period (1991-1993) immediately prior to and following the removal of the flashboards at Prairie Creek dam. Sampling has been completed under contract with King Engineering Associates, Inc. (Tampa) and analysis of data is currently underway by District scientists.

This effort will provide data on water quality and sediment characteristics of the lake that may be used to explain observed patterns of distribution and abundance of native aquatic plants in the 18-month study period.

◆ Historical sediment and nutrient accumulation rates and past water quality in Orange Lake

District contractual effort currently underway (Phase I) aimed at utilizing paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Orange Lake, to determine the timing of these changes, and to investigate their possible causes. Knowledge on past and current sediment characteristics and accumulation rates and water quality can lead to a better understanding of the possible causes leading to a decline in native aquatic plant populations over the last few decades.

● Historical sediment and nutrient accumulation rates and past water quality in Newnans Lake

Planned District contractual effort aimed at using paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Newnans Lake, to determine the timing of these changes, and to investigate their possible causes. The information obtained from this diagnostic effort may be used to identify possible causes for past changes in the abundance and distribution of native aquatic plant populations in Newnans Lake.

Project OCB-104-D. *Lake basin physical characteristics*

- Bathymetry and sediment thickness survey in Orange Lake

District contractual effort currently underway aimed at mapping the bathymetry and sediment thickness of Orange Lake. This survey will provide missing bathymetric data for the lake and will generate a map of muck depth and thickness throughout the lake. This information is needed to characterize the quality of the lake's sediments as a substratum for rooted aquatic plants and will identify needs for sediment restoration as it pertains to the goal of enhancing native aquatic plant populations.

Project OCB-106-D. *Assessment of floating and emergent wetland habitats in OCB lakes*

- Historical analysis of wetland vegetation in Orange, Lochloosa, and Newnans lakes

District in-house effort currently underway aimed at evaluating historical changes in the abundance, composition, and distribution of floating and emergent vegetation in Orange, Lochloosa, and Newnans lakes and at relating these changes with past human intervention in the basin. The analyses are based on historic and current photographic and cartographic records and on interviews with local residents. This assessment will contribute substantially to documenting historical changes in the abundance and structure of native aquatic plant populations and to quantifying the magnitude of these changes.

- Characterization of floating and emergent vegetation in Orange Lake

District in-house effort currently underway aimed at describing in detail (based on field surveys) the current species composition and the ecological characteristics of floating and emergent marsh vegetation in Orange Lake. This work will provide valuable field-based information on the current abundance, structure, and distribution of native aquatic plant populations in Orange Lake.

- Formation of floating mats in Orange Lake and causes for historic changes

Planned District contractual effort aimed at identifying the probable mechanisms of formation of floating vegetation mats in Orange Lake. If changes in the abundance and structure of floating mats are documented in the historical analyses of wetland vegetation (see above), then the probable causes for these changes will also be addressed. The information gained from this effort will contribute to the understanding of the factors involved in determining the presence and abundance of native aquatic plant species in floating vegetation mats of Orange Lake.

Project OCB-107-D. *Phytoplankton assessments in OCB lakes*

- Phytoplankton survey for Orange, Lochloosa, and Newnans lakes

Ongoing District contractual effort to characterize phytoplankton assemblages (species composition, abundance, and biomass) in Orange, Lochloosa, and Newnans lakes during a two-year time period. This survey will contribute

Information obtained from this project, in conjunction with Chlorophyll-a data from the District's monthly water quality sampling program will be used to evaluate the trophic condition of the lakes and their potential for trophic transformation (from a macrophyte dominated system to an algal dominated system, or vice versa). Assessment of the potential for trophic transformation has important implications concerning the management of native aquatic plant populations; i.e.: (1) the protection of native aquatic plants in mesotrophic/eutrophic, macrophyte-dominated lakes (e.g. Orange Lake) and (2) the restoration of native plants in hyper-eutrophic algal-dominated lakes (e.g. Newnans Lake, Bivens Arm).

Project OCB-108-D. *Fish and wetland wildlife assessments in the OCB*

- Fish and wetland wildlife population and habitat analysis in Orange, Lochloosa, and Newnans lakes

Planned joint SJRWMD/FGFWFC effort to assess, based on field surveys, the current status of fish and wetland wildlife habitats and populations in Orange, Lochloosa, and Newnans lakes. The importance of native aquatic plants as habitats for fish and wetland wildlife will be evaluated.

Feasibility Program

Project OCB-201-F. *Feasibility of floating and emergent marsh remediation in OCB Lakes*

- Feasibility of floating and emergent vegetation management in Orange and Lochloosa lakes

Ongoing multi-agency (SJRWMD/FDEP/FGFWFC) effort to evaluate the feasibility for the large-scale removal of floating and emergent vegetation on Orange and Lochloosa lakes. Removal/management methods being tested include mechanical harvesting, burning, and herbiciding. Future continuation of this effort is contingent upon the completion of diagnostic efforts (projects OCB-106-D and OCB-108-D) which would determine if the current abundance and structure of floating and emergent vegetation in Orange and Lochloosa lakes is detrimental to the health and the function of the lake's aquatic and wetland ecosystems. The removal of nuisance native wetland species such as cattail (*Typha* sp.) is a component of this feasibility survey.

Project OCB-205-F. *Water management alternatives for Paynes Prairie*

- Paynes Prairie vegetation succession model

Ongoing contractual effort by the University of Florida for the FDEP entitled: GIS-based Succession Model for Prairie Creek Pourpoint Basin, Paynes Prairie State Preserve. Principal Investigator: Gregg White.

This investigation assesses water volume alternatives for distribution through the Camps Canal culvert system and develops vegetation succession models to show the effects that changing

water regimes, water quality, and sediment conditions have on wet prairie and wetland vegetation assemblages. The effects of hydrologic disturbance and external nutrient and sediment loading on native wetland plant communities will be determined with the model.

Project OCB-206-F. *Feasibility assessment for the restoration of OCB lakes*

★ FGFWFC feasibility assessment of drawdown for restoring Newnans Lake (KBN Engineering)

Completed report: KBN Engineering and Applied Sciences, Inc. 1993. Assessing the Feasibility of Restoring Newnans Lake. Phase A: Conceptual Engineering Report. Prepared for the Florida Game and Fresh Water Fish Commission, Gainesville, FL.

Project aimed at evaluating various drawdown alternatives for Newnans Lake with the purpose of restoring lake sediments and fisheries habitat. A mechanical drawdown alternative involving a 9-month holddown duration was considered the preferred option, based on an evaluation of conceptual engineering plans, potential environmental impacts, and cost estimates. The cost of a 9-month mechanical drawdown alternative was estimated at $9-12 million. When used as a lake sediment restoration tool, drawdowns in Newnans lake could contribute to the recovery of native aquatic plant populations and to the success of current native replanting efforts in the lake.

- Other feasibility assessments needed for identifying management strategies to protect and restore native aquatic plant populations in the OCB will be developed as diagnostic projects are completed.

Restoration/Management Program

Project OCB-301-RM. *Aquatic plant management in the OCB*

◆ Aquatic vegetation monitoring on Orange, Lochloosa, and Newnans lakes

Ongoing FDEP/SJRWMD effort to monitor aquatic plant populations in Orange, Lochloosa, and Newnans lakes as part of the state's aquatic plant management program. These surveys are needed to identify on an annual basis, aquatic weed management needs for the lakes and to develop strategies for herbicide applications (see project element below). The aquatic vegetation surveys regularly provide updated information on the status of native aquatic plant populations and allow for follow-up evaluations to assess non-target native plant mortality resulting from herbicide applications.

◆ Vegetation management in OCB lakes

Ongoing joint FDEP/SJRWMD effort to implement aquatic weed control measures in OCB lakes. Chemical control operations are rendered by the District under contract with FDEP and in accordance with FDEP's aquatic plant management program goals and specifications. Aquatic weed management in OCB lakes is implemented in tandem with the aquatic vegetation monitoring (see above). Protection and enhancement of non-nuisance native aquatic plant populations is an important goal for vegetation management in OCB lakes.

- Enhancement of aquatic weed control in OCB lakes

  Ongoing multiagency effort (FDEP, SJRWMD, IFAS) aimed at reassessing and enhancing, on a periodic basis, the performance of aquatic weed control measures currently employed in the basin. The final goal of this effort is to identify aquatic plant management practices (preferably ones that integrate chemical, biological, and physical techniques) which best provide for improved hydrilla control, for the continued maintenance control of traditional aquatic weeds, and for the future control of newly established exotic weeds. A reduction in non-target mortality of aquatic plants (including native species) associated with chemical control methods is a working goal of this effort.

Project OCB-302-RM. *Lake littoral zone restoration in the OCB*

- Native aquatic plant revegetation in OCB lakes

  Ongoing FGFWFC effort to re-establish, through littoral revegetation techniques, native aquatic plant populations in Newnans Lake with the purpose of restoring lost or threatened fish and wetland wildlife habitats and improving water quality and shoreline erosion problems. Past efforts to plant bulrush (*Scirpus californicus*) and maidencane (*Panicum hemitomon*) along Newnans Lake shoreline have been relatively successful.

Project OCB-304-RM. *Land management on public lands of the OCB*

- Land management on District properties

  Ongoing District effort to develop and implement, in cooperation with other agencies, sound, ecosystem-based management plans for District properties. The overriding management objective is for ecological resource protection and restoration. Protection and enhancement of native aquatic and terrestrial plant populations is an important goal of these land management efforts.

Project OCB-306-RM. *Restoration of waterbodies in the OCB*

- Additional restoration efforts aimed at protecting and restoring native aquatic plant populations in OCB lakes will be developed as diagnostic and feasibility projects are completed.

Regulatory Program

(no projects are pertinent to this issue)

Interagency Coordination Program

Project OCB-503-I. *Fund procurement coordination*

- Fund procurement coordination for OCB-Plan implementation

Ongoing multiagency effort to procure funding from federal, state, regional and local governmental sources for the implementation of various components of the OCB Surface Water Management Plan. Efforts to expand funding sources for aquatic plant management statewide are currently underway. Increased funding would benefit basin efforts to protect and restore native aquatic plant populations in OCB lakes.

Project OCB-504-I. *Intergovernmental basin coordination*

- Regional intergovernmental forum

Ongoing District initiative to periodically hold county-based intergovernmental forums (involving state, regional, and local government agencies) aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to facilitate coordination among cooperating agencies and to ensure the timely notification of government proposed actions which could potentially affect surface water management decisions in the Orange Creek Basin. Close coordination and effective communication is needed among FDEP, SJRWMD, and FGFWFC to facilitate implementation of cooperative measures for the protection and restoration of native aquatic plant populations in waterbodies of the Orange Creek Basin. Intergovernmental forums for Alachua County (sponsored by SJRWMD and SRWMD) were initiated in November 1995.

Public Outreach Program

Project OCB-601-P. *Basin and subbasin task forces and advisory councils*

- Orange Creek Basin Advisory Council and Scientific Advisory Committee

Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. Among the issues addressed by the OCB Advisory Council (and the OCB SAC) is the protection and restoration of native aquatic plant populations.

- Subbasin task forces or working groups

Task forces or working groups which specifically address the issue of protection and restoration of native aquatic plants in the Orange Creek Basin. Such task forces will be created on an "as-needed" basis by request of the public or of the OCB Advisory Council.

Project OCB-604-P. *Public education and awareness programs*

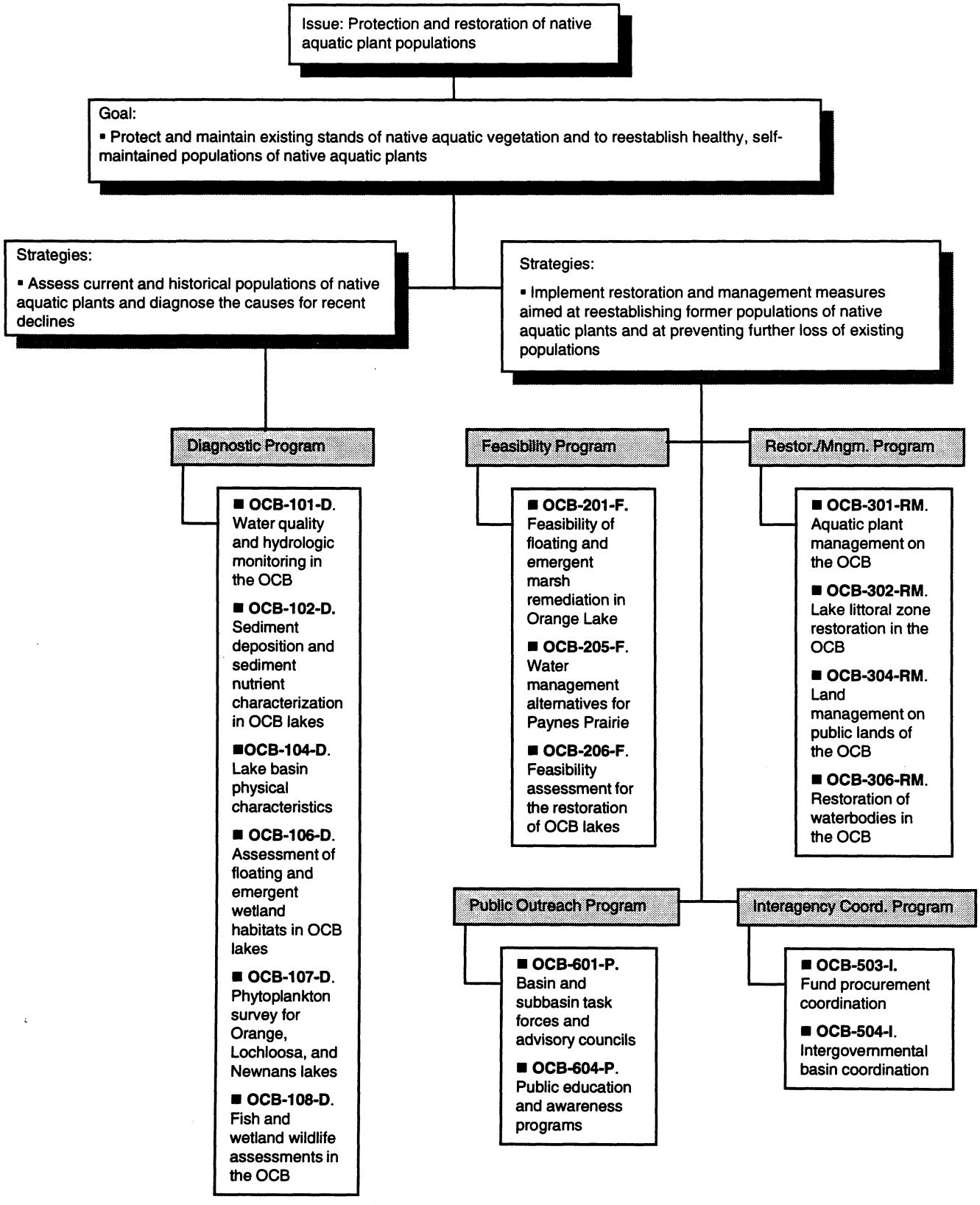
- ◆ Adult awareness program

  Ongoing District effort aimed at identifying public (adult) education needs with the goal of enhancing awareness of basin issues and/or problems. Several efforts concerning the preparation of informational support material (e.g. fact sheets, portable displays) are currently underway. Increased awareness of the value of native aquatic plant species as fish and wetland wildlife habitats and on the need to protect and restore lost or threatened native aquatic plant populations is needed.

- ● School education and awareness program

  Planned District effort aimed at evaluating informational needs for local school programs (elementary through highschool) with the goal of increasing the awareness among the resident school population of issues and/or problems afflicting water resources in the Orange Creek Basin and of the public's role in solving or improving these problems. Increased awareness of the value of native aquatic plant species as fish and wetland wildlife habitats and on the need to protect and restore lost or threatened native aquatic plant populations is needed.

Figure 28. Issue No. 4: Protection and Restoration of Native Aquatic Plant Populations.



ISSUE #5. MANAGEMENT OF FLOATING VEGETATION

Background

Floating mats of vegetation (also referred to as sudds or floating tussocks) are a common natural phenomenon in wetlands throughout the world, in temperate climates (Cypert 1972, Duever & Riopelle 1983, Hogg & Wein 1987) as well as in subtropical (Gleason et al. 1980) and tropical (Junk 1970, Ellery et al. 1990) regions. In this document, the term "floating vegetation" includes free-floating mobile mats of vegetation (islands) as well as larger, less mobile mats that tend to be associated with littoral or sublittoral rooted marsh vegetation.

Characteristics of floating vegetation (e.g. origin, floristic composition, and ecological dynamics) can vary significantly from one wetland type to another, depending largely on water depth and fluctuation regimes. In the tropical riverine wetlands of the Amazon and Orinoco rivers, floating mats are in a constant state of formation and dissolution, driven by marked seasonal rise and fall of water levels (Junk 1970, Lasi 1993). In hydrologically more stable wetland systems such as bog/fen wetlands or other peatlands, floating mats function as intermediate stages in the process of "terrestrialization" of aquatic systems (Duever & Riopelle 1983, Mallik 1989, Haraguchi 1991). Floating vegetation in Florida's large shallow subtropical lakes seem to fall somewhere in between the above two examples which delimit the continuum of ecological dynamics and temporal stability.

Floating vegetation is an important component of natural lake and wetland ecosystems. Mats provide valuable habitat for fish and aquatic invertebrates (Junk 1973, Lasi 1993), they function as major sources/sinks of organic matter and nutrients (Howard-

Williams & Junk 1977, Hamilton & Lewis 1987), and in some cases, can even function as a mode of dispersal for aquatic organisms (Oliver & McKaye 1982).

Under shallow and hydrologically stable conditions, however, floating mats tend to continuously form, grow, and accumulate. Excessive growth and accumulation of floating vegetation is a common occurrence in waterbodies that are hydrologically and/or nutrient enriched and can negatively impact in-lake processes and lead to serious lake management problems. Negative consequences of excessive floating mat growth and accumulation in lakes include:

- alteration of lake hydrodynamics; impeded exchange of water in shallow littoral areas (Hujik 1994)
- reduced value of mat as habitat for aquatic organisms, due to poor water circulation and low dissolved oxygen concentrations
- entrapment of dissolved materials due to biological uptake by the root mass, or physical retention of suspended particulates (including planktonic organisms)(Hamilton et al. 1990, Engle & Melack 1990)
- increased organic matter loading (production and deposition) which, combined with high evapotranspiration rates, can eventually lead to silting and drying up of the waterbody (Trivedy et al. 1978, Haraguchi 1991)
- Displacement of valuable emergent and submersed species of plants
- interference with lake access and other recreational uses.

In Florida, notable examples of lakes long known for harboring large floating mats of vegetation are Lake Washington, Lake Hell'n Blazes, and Orange Lake (Reid 1952). Reid (1952) characterized Orange Lake floating islands as typically containing a diverse assemblage of aquatic plant species. He reported that islands were not dominated by any species in particular, although pickerel weed (*Pontederia cordata*) and arrowhead

(*Sagittaria lancifolia*) were the most frequently encountered. He also found that islands dominated by twig rush (*Cladium jamaicensis*), smartweed (*Polygonum* spp.), or spatterdock (*Nuphar luteum*), were common and often also supported elder (*Sambucus canadensis*), willow (*Salix caroliniana*), and myrtle (*Myrica cerifera*). A preliminary survey of the vegetation of Orange Lake by SJRWMD personnel indicated that at the present time much of the pickerelweed, arrowhead, elder, and willow are emergent rather than floating, and that some floating mats are dominated by pennywort (*Hydrocotyle* sp.), burhead sedge (*Scirpus cubensis*), maidencane (*Panicum hemitomon*), and frog's bit (*Limnobium spongia*); the last three species were not mentioned by Reid (1952).

Anecdotal evidence also suggests that the abundance, floristic composition and dynamics of floating mats in Orange Lake may have changed from historical conditions. Some long-time residents believe that floating islands on Orange Lake have expanded over the last 40 to 50 years, and that they seem to be increasingly dominated by cattail and/or woody vegetation (C. Solomon, personal communication). Aquatic vegetation surveys carried out on Orange Lake by FDEP show that emergent vegetation (both floating and rooted) has increased from 34% coverage to 58% coverage between 1964 and 1991 and that cattails alone increased by 700-acres during the 1990-1991 drought period (Hinkle 1994a). Efforts to quantify changes in the abundance and physiognomic structure of Orange Lake's floating and emergent marsh vegetation (using historic and current aerial photography and field surveys) are currently underway by the District staff.

If diagnostic analyses confirm that floating mats in Orange Lake have indeed expanded and/or undergone transformation over the course of the last century, then the causes of these changes need to be investigated. Some factors that could potentially cause changes in floating vegetation abundance and composition on Orange Lake may include: (1) the occurrence of extended periods of low water (W. Haller, personal communication), (2) the stabilization of water levels (Haraguchi 1991, Snyder 1994,

Hujik 1994), (3) physical impediments to the passage and export of floating island material to downstream areas (for example, the Orange Lake weir, U.S. highway 301, and the railroad levee), (4) interactions between floating species and hydrilla or spadderdock, that may stabilize small floating islands and allow them to expand; and (5) increased nutrient levels which stimulate growth of exotic and native mat-forming species.

A better understanding of the mechanisms involved in floating vegetation expansion and disintegration is needed before the causes of accumulation/transformation of these vegetative formations can be identified, and the need for corrective management measures can be examined.

Basin management goals for the management of floating vegetation

The primary goals associated with floating vegetation management in the OCB are to: (1) determine if floating vegetation in OCB lakes represent a surface water management problem, and if so, (2) identify and implement management measures to best address this problem.

The strategies and projects to achieve these goals will initially pertain to the Orange/Lochloosa lakes system, where floating vegetation is not only a common feature of the landscape but where it is also perceived by many as a major potential aquatic plant management problem. As knowledge is gained from the Orange/Lochloosa lakes experience, floating vegetation management activities will expand to include other areas of the Orange Creek Basin.

Basin management strategies for the management of floating vegetation

Strategies for achieving the above goals for floating vegetation management in OCB lakes include:

- Assess the current and past status (abundance, distribution, species composition) of floating vegetation and of its role in lake ecosystem functions.
- Determine when floating vegetation is a significant lake management problem; *i.e.*, when and how it adversely affects lake and wetland ecosystem processes and interferes with human lake uses.

For those cases in which floating vegetation is a significant problem, additional strategies include:

- Identify the causes of the floating vegetation problem(s).
- Devise and implement water resource management measures for correcting and/or preventing existing and potential floating vegetation problems.

Dislocated floating islands that represent a threat to native aquatic vegetation stands and/or interfere with normal lake access and existing recreational uses on the lake may need to be removed expeditiously, using the best and most practical technology.

Projects to implement the strategies for addressing the issue of floating vegetation management

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 29, p.147). Project elements are ranked by status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority,

o planned-second priority, and ⊙ planned-third priority.

Diagnostic Program

Project OCB-101-D. *Water quality and hydrologic monitoring in the Orange Creek Basin*

- ◆ District water quality monitoring in the OCB

  Ongoing District basinwide water quality sampling effort aimed at monitoring surface water quality on a monthly basis at 26 sites. Water quality data generated by this effort are needed to supplement other efforts involving floating and emergent vegetation assessments (diagnostic efforts under OCB-106-D as well as feasibility and restoration/management efforts under projects OCB-201-F and OCB-301-RM).

- ◆ Review and analysis of historical and current water quality conditions in the OCB

  Ongoing District project to be continued in FY 1995-96. Completion of this project is critical for the documentation of long-term water quality changes in waterbodies of the Orange Creek Basin. This information will be used in the analysis of historical wetland vegetation in Orange, Lochloosa, and Newnans lakes (OCB-106-D).

Project OCB-102-D. *Sediment deposition and sediment nutrient characterization in OCB lakes*

- ◆ Historical sediment and nutrient accumulation rates and past water quality in Orange Lake

  District contractual effort currently underway (Phase I) aimed at utilizing paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Orange Lake, to determine the timing of these changes, and to investigate their possible causes. Information from phase II of this study, together with that from other diagnostic efforts concerning wetland

habitats in Orange Lake (OCB-106-D) will contribute to the understanding of the history of floating and emergent vegetation on Orange Lake and to its role as a source of organic matter and nutrient loading in the lake.

Project OCB-103-D. *Hydrologic modeling in the OCB*

- ◆ Effects of surface water management alternatives on wetlands and lake levels in the OCB

Addresses, through the use of a predictive model, the effects of various water management alternatives on lake levels, flood regimes, and wetland vegetation composition and coverage. The model may be used to assist in the evaluation of the effects of hydrologic modifications on floating mat formation and accumulation in Orange Lake.

Completed draft report: Robison, C.P., C. Ware, G.B. Hall, & R. Hupalo. 1996. Water Management Alternatives: effects on lake levels and wetlands in the Orange Creek Basin.

Project OCB-104-D. *Lake basin physical characteristics*

- ◆ Bathymetry and sediment thickness survey in Orange Lake

District contractual effort currently underway aimed at mapping the bathymetry and sediment thickness of Orange Lake. This survey will provide missing bathymetric data for the lake and will generate a map of muck depth and thickness throughout the lake. This information will contribute to : (1) the understanding of the relationship between floating and emergent vegetation and water depth and sediment muck thickness and (2) the identification of lake management alternatives for alleviating floating vegetation and organic sediment problems in the lake.

- ◆ Orange Lake outlet stream profile survey

District contractual work currently underway aimed at describing the profile of Orange Creek/Shands Canal, downstream from Orange Lake weir at U.S. Highway 301. Information from this survey will be used to identify (1) hydraulic impediments to Orange Lake outflow (downstream of the U.S. 301 weir) and (2) channel restoration needs for allowing enhanced passage and export of floating mat material from Orange Lake (OCB-201-F).

Project OCB-106-D. *Assessment of floating and emergent wetland habitats in OCB lakes*

- ★ Wetlands mapping/inventory in the OCB

Completed District in-house effort to generate a wetlands database on GIS for the Orange Creek Basin based on aerial 1:24,000 color infrared photography from 1990-1991. This database provides recent quantitative information on composition, aerial coverage, and distribution of wetland vegetation types in the basin. The District wetlands database supports other diagnostic efforts within project OCB-106-D: (a) historical analysis of wetland vegetation in Orange, Lochloosa, and Newnans lakes and (b) characterization of floating and emergent vegetation in Orange Lake.

- Historical analysis of wetland vegetation in Orange, Lochloosa and Newnans lakes

  District in-house effort currently underway aimed at evaluating historical changes in the abundance, composition, and distribution of floating and emergent vegetation in Orange, Lochloosa, and Newnans lakes and at relating these changes with past human intervention in the basin. The analyses are based on historic and current photographic and cartographic records and on interviews with local residents.

  Changes in the distribution, aerial coverage, and floristic composition of floating mats in Orange Lake will be documented and the probable causes for these changes will be addressed, in conjunction with other diagnostic efforts within this project (formation of floating mats in Orange Lake and causes for historical changes).

- Characterization of floating and emergent vegetation in Orange Lake

  District in-house effort currently underway aimed at describing in detail (based on field on field surveys) the current species composition and the ecological characteristics of floating and emergent marsh vegetation in Orange Lake. Results of this study include a preliminary typological classification of floating and emergent vegetation assemblages and cursory observations on the value of these plant assemblages as habitat for wildlife. This project will generate important baseline information needed to complete other floating vegetation studies under this project as well as other projects (OCB-108-D, OCB-201-F, OCB-301-RM, OCB-302-RM).

- Formation of floating mats in Orange Lake and causes for historic changes

  Planned District contractual effort aimed at identifying the probable mechanisms of formation of floating vegetation mats in Orange Lake. If changes in the abundance and structure of floating mats are documented in the historical analyses of wetland vegetation (see above), then the probable causes for these changes will also be addressed. The information gained from this effort will contribute to the identification of management measures aimed at preventing the excessive formation and/or accumulation of floating vegetation mats, if diagnostic efforts determine that the current condition of vegetation mats in Orange Lake detrimental to lake and wetland ecosystem functions.

- The role of floating and emergent vegetation in the nutrient dynamics of Orange Lake

  Planned District contractual effort aimed at assessing the role floating and emergent vegetation plays in a number of processes such as uptake and sequestration of dissolved nutrients, production of detritus and contribution and organic matter sedimentation, retention of suspended particulate material, and interference with nutrient and organic matter export. Results of this assessment are critical to the evaluation of whether or not floating and emergent vegetation negatively impacts lake ecosystem processes.

Project OCB-108-D. *Fish and wetland wildlife assessments in the OCB*

- Fish and wetland wildlife population and habitat analyses in Orange, Lochloosa, and Newnans lakes

  Planned joint SJRWMD/FGFWFC effort to assess, based on field surveys, the current status of fish and wetland wildlife habitats and populations in Orange, Lochloosa, and Newnans lakes. The value of floating and emergent vegetation as habitat for fish and wetland wildlife populations will be evaluated.

- Inventory of T&E, SSC, and rare species in the OCB

  Planned joint SJRWMD/FGFWFC effort to complete a systematic inventory of threatened and endangered species, species of special concern, and rare species for special areas or waterbodies within the Orange Creek Basin. This inventory is needed for the Orange Lake area to determine the degree to which floating and emergent marsh habitat is used by special status species. The results of this effort will constitute an important component of feasibility assessments for floating and emergent marsh remediation in Orange Lake (see project OCB-201-F below).

Feasibility Program

Project OCB-201-F. *Feasibility of floating and emergent marsh remediation in OCB lakes*

- ◆ Feasibility of floating and emergent vegetation management in Orange and Lochloosa lakes

  Ongoing multi-agency (SJRWMD/FDEP/FGFWFC) effort to evaluate the feasibility for the large-scale removal of floating and emergent vegetation on Orange and Lochloosa lakes. Removal/management methods being tested include mechanical harvesting, burning, and herbiciding. Future continuation of this effort is contingent upon the completion of diagnostic efforts (projects OCB-106-D and OCB-108-D) which would determine if the current abundance and structure of floating and emergent vegetation in Orange and Lochloosa lakes is detrimental to the health and the function of the lake's aquatic and wetland ecosystems. The removal of nuisance native wetland species such as cattail (*Typha* sp.) is a component of this feasibility survey. The potential impacts of vegetation removal on the availability of fish and wetland wildlife habitats, on the health of fish and wetland wildlife populations, and on economic benefits from recreational and commercial harvesting of fish and wetland wildlife (including sport fisheries and commercial harvest of alligators) will be addressed in this feasibility assessment.

Project OCB-202-F. *Improvements to lake access in Orange and Lochloosa lakes*

- Lake access needs

Ongoing District in-house effort to assess lake access problems and needs in relation to water levels in Orange and Lochloosa lakes. Evaluation of lake access needs includes feasibility analyses for dredging access channels from the lake to public boat ramps and fish camps, to provide for navigation during low water periods. This may entail some removal of floating and/or emergent vegetation.

Project OCB-203-F. *Orange Lake weir modification*

- Orange Lake weir modification; evaluation of management alternatives

Planned effort to identify structural and operational modifications to the U.S. 301 weir, as well as to other downstream structures (e.g. U.S. 301 and railroad levees; Shands Canal) with the purpose of restoring, to the extent practicable and desirable, Orange Lake's natural outflow regime and providing minimum flows for Orange Creek. The feasibility of modifying water control structures, removing existing surface flow impediments, or restoring the upper Orange Creek channel to allow for enhanced export of aquatic plant material during storm events will be assessed.

Project OCB-206-F. *Feasibility assessment for the restoration of OCB lakes*

- Other feasibility assessments needed for identifying floating vegetation management strategies will be developed as diagnostic projects are completed.

Restoration/Management Program

Project OCB-301-RM. *Aquatic plant management in the OCB*

- Aquatic vegetation monitoring on Orange, Lochloosa, and Newnans lakes

Ongoing FDEP/SJRWMD effort to monitor aquatic plant populations in Orange, Lochloosa, and Newnans lakes as part of the state's aquatic plant management program. These surveys are needed to identify on an annual basis, aquatic weed management needs for the lakes, including the need for opening or maintaining airboat trails through Orange and Lochloosa lake's floating and emergent marsh areas.

- Vegetation management in OCB lakes

Ongoing joint FDEP/SJRWMD effort to implement aquatic weed control measures in OCB lakes. Chemical control operations are rendered by the District under contract with FDEP and in accordance with FDEP's aquatic plant management program goals and specifications. The District additionally responds to emergency requests by lake-shore residents for the removal of floating mats which interfere with access to public and private boat docks and ramps.

- Enhancement of aquatic weed control in OCB lakes

  Ongoing multiagency effort (FDEP, SJRWMD, IFAS) aimed at reassessing and enhancing, on a periodic basis, the performance of aquatic weed control measures currently employed in the basin. The final goal of this effort is to identify aquatic plant management practices (preferably ones that integrate chemical, biological, and physical techniques) which best provide for improved hydrilla control, for the continued maintenance control of traditional aquatic weeds, and for the future control of newly established exotic weeds. Effective management of nuisance floating and emergent vegetation is a component of this goal.

Project OCB-302-RM. *Lake littoral zone restoration in the OCB*

- Native aquatic plant revegetation in OCB lakes (revegetation efforts for lakes other than Newnans Lake have not yet been initiated)

  Ongoing FGFWFC effort to re-establish, through littoral revegetation techniques, native aquatic plant populations in Newnans Lake with the purpose of restoring lost or threatened fish and wetland wildlife habitats (emergent marshes and their associated floating vegetation) and improving water quality and shoreline erosion problems. Past efforts to plant Bulrush (*Scirpus californicus*) and maidencane (*Panicum hemitomon*) along Newnans Lake shoreline have been relatively successful.

Project OCB-304-RM. *Land management on public lands of the OCB*

- Land management on District properties

  Ongoing District effort to develop and implement, in cooperation with other agencies, sound, ecosystem-based management plans for District properties. The overriding management objective is for ecological resource protection and restoration. The management of floating and emergent marsh vegetation is a component of these land management efforts.

Project OCB-306-RM. *Restoration of waterbodies in the OCB*

- Efforts aimed at managing floating mats of vegetation in OCB lakes with the purpose of restoring lost ecosystem benefits and improving recreational uses (e.g. lake access) will be developed as diagnostic and feasibility projects are completed.

Interagency Coordination Program

Project OCB-503-I. *Fund procurement coordination*

- Fund procurement coordination for OCB-Plan implementation

  Ongoing multiagency effort to procure funding from federal, state, regional and local governmental sources for the implementation of various components of the OCB Surface Water Management Plan. Efforts to expand funding sources for aquatic plant management statewide are

currently underway. Increased funding would benefit efforts to develop and subsequently implement floating vegetation management initiatives in the basin.

Project OCB-504-I. *Intergovernmental basin coordination*

- Regional intergovernmental forum

Ongoing District initiative to periodically hold county-based intergovernmental forums (involving state, regional, and local government agencies) aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to facilitate coordination among cooperating agencies and to ensure the timely notification of government proposed actions which could potentially affect surface water management decisions in the Orange Creek Basin. Close coordination and effective communication is needed among FDEP, SJRWMD, FGFWFC, and county governments to facilitate implementation of cooperative measures for addressing floating vegetation management problems in waterbodies of the Orange Creek Basin. Intergovernmental forums for Alachua County (sponsored by SJRWMD and SRWMD) were initiated in November 1995.

Public Outreach Program

Project OCB-601-P. *Basin and subbasin task forces and advisory councils*

- Orange Creek Basin Advisory Council and Scientific Advisory Committee

Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. Floating vegetation management in Orange and Lochloosa lakes has been a major topic of discussion at past OCB Advisory Council meetings. Recommendations by the Council on management alternatives for floating mat remediation will be made after completion of a number of diagnostic efforts (projects OCB-102-D, OCB-104-D, OCB-106-D, and OCB-108-D).

- Subbasin task forces or working groups

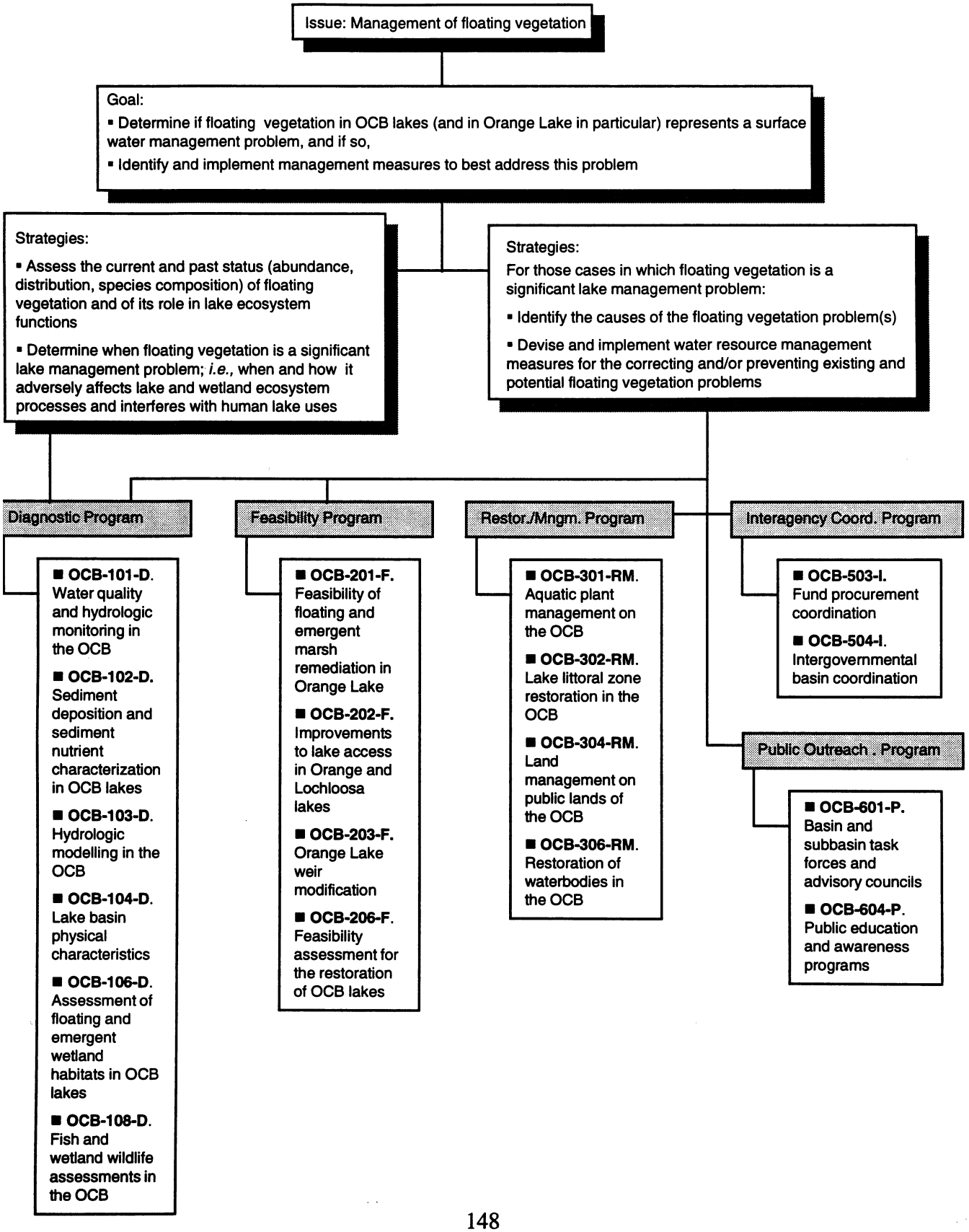
Task forces or working groups which specifically address the issue of floating vegetation management in Orange Creek Basin waterbodies will be created on an "as-needed" basis by request of the public or of the OCB Advisory Council.

Project OCB-604-P. *Public education and awareness programs*

- Adult awareness program

  Ongoing District effort aimed at identifying public (adult) education needs with the goal of enhancing awareness of basin issues and/or problems. Several efforts concerning the preparation of informational support material (e.g. fact sheets, portable displays) are currently underway. This outreach initiative will focus on disseminating information on the role of floating vegetation in lake and wetland ecosystems and on existing problems and solutions concerning floating vegetation in OCB lakes, once pertinent diagnostic and management and restoration efforts are completed.

Figure 29. Issue No. 5: Management of Floating Vegetation.



3.3 WATER QUALITY

ISSUE # 6. SOURCES OF POLLUTION IN THE ORANGE CREEK BASIN

Background

Nonpoint sources of pollution (e.g. urban stormwater runoff, leachate from failed septic systems, leachate from landfills and underground storage tanks, etc.) are generally a primary cause of water quality degradation in urban (non-industrial) lakes and streams. Water bodies in the Orange Creek Basin most likely to be affected by urban nonpoint source pollution include Hogtown Creek, Possum Creek, Lake Kanapaha, Sweetwater Branch, Little Hatchet Creek, Tumblin Creek, Bivens Arm, Newnans Lake and Lake Alice (Tables 7 & 8, Figure 17, FDEP 1994). Sweetwater Branch additionally receives effluent (a point source discharge) from the Gainesville Regional Utilities Main Street Waste Water Treatment Plant.

Water quality in urban or near-urban lakes and streams generally reflects high levels of nutrients and organic loading. This condition often leads to eutrophic or highly eutrophic conditions: e.g. algal blooms, high organic and/or inorganic turbidity, low dissolved oxygen, fish kills, etc. Toxic pollutants originating in urban stormwater runoff and/or industrial effluents are also a subject of concern in urban lakes and streams. Inadequate or non-existent stormwater treatment facilities and hazardous waste sites are recognized as potential sources of toxic pollutants to surface waters. Toxic pollutants represent a threat not only to the fish and wildlife communities of these water bodies but also to human populations which make use of them. Past and current land uses suggest the potential presence of toxic pollutants in Hogtown Creek (downstream of an old wood treatment plant, now a superfund cleanup site), Tumblin Creek and Bivens Arm (impacted by urban stormwater), Sweetwater Branch (impacted by urban stormwater and

sewage effluent), Little Hatchet Creek (downstream of the Gainesville Airport and industrial area), and Hatchet Creek (downstream of closed landfill sites). Future (planned) activities related to toxic/hazardous waste cleanup efforts could further exacerbate water quality problems in Little Hatchet, Hatchet, and Hogtown creeks.

The potential for a public health risk associated with the presence of toxic pollutants in surface waters is enhanced if the water bodies are directly connected to underground drinking water supplies. In the Orange Creek Basin, Sweetwater Branch, Hogtown Creek, and Orange Lake are all linked to the Floridan aquifer by sinkholes.

Water quality problems may also exist in areas not affected by urban development. Nonpoint source pollution associated with rural residential development (e.g. septic tank leakage) and with agricultural/silvicultural runoff can be a major cause of water quality degradation in non-urban lakes and streams. Results of the SJRWMD's recent Nonpoint Source Pollution Load model (Adamus and Bergman 1995) identify rural areas south and west of Orange Lake and around Cross Creek as potential pollutant loading areas (Figure 17).

A first step in addressing surface water pollution problems in the Orange Creek Basin involves the identification of existing and potential sources of pollution (both point and nonpoint sources). A useful tool for identifying existing nutrient inputs (sources) and outputs (sinks) is a basin-wide external nutrient budget. Availability of accurate and updated water quality data is a prerequisite for developing nutrient budgets. A basin-wide toxic pollutant screening survey is additionally necessary for identifying waterbodies with toxic contamination problems. Site-specific testing would then allow for further identification of these toxic pollutant sources.

A second step in addressing surface water pollution problems involves the implementation of necessary measures to correct existing problems and to prevent future problems from developing or escalating in magnitude. This entails a high degree of coordination among various local, regional, state, and federal agencies concerning issues related to (1) the enforcement and compliance of existing permits, (2) the possible development and implementation of new water quality related permits and pollutant load reduction programs, (3) the review and amendment of local government comprehensive plans to ensure their support of local, regional, and state water resource protection goals, and (4) the development and implementation of a "grass-roots" public education program aimed at preventing nonpoint source pollution into local waterbodies. Such a program would, for example, strive to promote public awareness on issues relating to environmental impacts and public health risks associated with pollutants in stormwater systems, and encourage the participation of local residents in pro-active community activities such as watershed cleanup operations and stormdrain stenciling programs.

Basin management goals for the identification and control of pollution sources in the Orange Creek Basin

The major goal associated with this priority issue is to provide the framework (technical, administrative, political, and social) needed to reduce or eliminate existing sources of pollution in water resources of the Orange Creek Basin and to protect these water resources from future degradation.

Basin management strategies for the identification and control of pollution sources in the Orange Creek Basin

Three strategies have been identified to achieve the goal specified above:

1. Determine the type and extent of water quality impairment in the Orange Creek Basin (identify those waterbodies with water quality problems). This can be achieved through the following activities:
   - basinwide water quality monitoring with storm-event sampling for major streams and tributaries,
   - toxic pollutant screening survey for waterbodies in the basin,
   - comparative analysis of current and historic water quality data for water-bodies suspected of being degraded.

2. Identify existing sources of pollution (point and nonpoint sources) to waterbodies in the Orange Creek Basin. This can be achieved by:
   - developing an external nutrient budget for the basin,
   - updating the compliance status of existing surface water related permits in the Orange Creek Basin (e.g. MSSW, stormwater, and NPDES permits),
   - identifying and evaluating nonpoint sources of nutrient loading to Orange, Lochloosa and Newnans lakes and connecting waterways.

3. Identify and implement measures to correct or improve existing water quality problems and to prevent future water quality degradation in the basin by:
   - optimizing permit enforcement,
   - developing and implementing new local and regional permits and ordinances for water quality protection, including pollutant load reduction goals for waterbodies in need of restoration,
   - assisting local governments in the upgrading or retrofitting of stormwater management systems,

- facilitating intergovernmental coordination to ensure that planning provisions contained in local and regional comprehensive plans are consistent with basinwide water resource protection goals,
- identifying potential land acquisition projects to support wetland/water resource protection needs in the basin, and
- developing a nonpoint source pollution prevention public education program to be implemented in Gainesville and other urban areas of the basin.

Projects to implement strategies for the control of pollution sources in the Orange Creek Basin

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 30, p. 159). Project elements are ranked according to status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority,

o planned-second priority, and ⊙ planned-third priority.

Diagnostic Program

Project OCB-101-D. *Water quality and hydrologic monitoring in the Orange Creek Basin.*

◆ District water quality monitoring in the Orange Creek Basin

Ongoing basinwide District water quality sampling effort aimed at providing the water quality data needed to characterize and quantify the current nature and extent of water quality degradation in major waterbodies of the Orange Creek Basin. In addition to assisting in the identification of those waterbodies with water quality problems, the District water quality monitoring effort will provide information needed to develop external nutrient budgets for the affected waterbodies and will help identify potential sources of pollution (primarily nonpoint sources).

- ◆ Review and analysis of historic and current water quality in the Orange Creek Basin.

  District project element (in progress) aimed at documenting long-term water quality changes in the Orange Creek Basin. This information may be used as an initial screening tool for identifying waterbodies in the basin affected by cultural eutrophication and for which pollution sources would need to be identified.

- ◆ Inflow, outflow, and lake level monitoring in the Orange Creek Basin

  Ongoing District contractual effort aimed at establishing and maintaining a streamflow gaging and lake level recording network for major waterbodies in the Orange Creek Basin. The hydrologic data generated by this monitoring effort are needed to determine nutrient and pollutant transport and loadings into basin waterbodies and to develop external nutrient budgets for these waterbodies.

- ● Volunteer stormwater monitoring of tributaries in the OCB

  Planned volunteer sampling initiative coordinated under the Public Outreach Program (project OCB-603-P) aimed at measuring concentrations of chemical and physical constituents in tributary streams under high-flow conditions. This information, together with data from the District's routine water quality monitoring program, will be used to assess pollutant loading into waterbodies of the basin and to develop external nutrient budgets for these waterbodies.

- ● Toxic pollutant screening survey

  Planned District contractual effort aimed at identifying those waterbodies in the Orange Creek Basin with high levels of toxic contaminants. Results from this diagnostic study will lead to the investigation of the sources of contamination and ultimately to the identification and subsequent implementation of management measures aimed at eliminating those sources and/or restoring water quality.

Project OCB-102-D. *Sediment deposition and sediment nutrient characterization in OCB lakes.*

- ● Historical sediment and nutrient accumulation rates and past water quality in Newnans Lake

  Planned District contractual effort aimed at using paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Newnans Lake, to determine the timing of these changes, and to investigate their possible causes. The information obtained from this diagnostic effort may be used to identify the extent and timing of cultural disturbance to the lake ecosystem and to set target limnological conditions for water quality restoration.

Project OCB-105-D. *External nutrient budgets for waterbodies in the OCB.*

◆ External nutrient budget for the Orange Creek Basin lakes

District in-house effort aimed at quantifying exchanges of water and nutrients between the watershed and water bodies in the Orange Creek Basin. Information derived from the external nutrient budget will help determine the relative contribution of anthropogenic sources of pollution (point and nonpoint sources) to nutrient loading in a given waterbody or subbasin within the Orange Creek Basin.

● Pollution sources in Orange, Lochloosa, and Newnans lakes

Planned effort to identify and quantify point and nonpoint sources of pollution into Orange, Lochloosa, and Newnans lakes. This information will be used for developing external nutrient budgets for these lakes and for identifying and subsequently implementing nonpoint source pollution reduction measures aimed at restoring water quality (Project OCB-402-RG). Efforts to assess pollution sources will initially be focused on Newnans Lake, given the severity of its water quality problems.

Feasibility Program

Project OCB-205-F. *Water management alternatives for Paynes Prairie.*

★ Preliminary assessment of options for management of Sweetwater Branch surface flow into Paynes Prairie

Completed report by Best, G.R., R.D.Peters, Jr., R.E. Borer, and F.F. Gaines III. 1995. Preliminary assessment of options for management of Sweetwater Branch surface flow into Paynes Prairie, Alachua County, Florida. Center for Wetlands and Water Resources, University of Florida, Gainesville, FL.

Project aimed at evaluating various options for the management of Sweetwater Branch inflow to Paynes Prairie State Preserve, with the purpose of restoring sheet flow to the northern portion of the Prairie and enhancing water quality of surface waters in the Prairie (including Alachua Lake/Sink and the Floridan aquifer). A multifunctional wetland treatment system based on a combined wet detention pond/free water surface wetland treatment system was found to be the recommended management option to reach these objectives.

◆ Paynes Prairie Vegetation Succession Model.

Ongoing contractual effort by the University of Florida for the FDEP entitled: GIS-based succession model for Prairie Creek Pourpoint Basin, Paynes Prairie State Preserve. Principal Investigator: Gregg White.

This investigation assesses water volume alternatives for distribution through the Camps Canal culvert system and develops vegetation succession models to show the effects that changing water regimes, water quality and sediment conditions have on wet prairie and wetland vegetation assemblages. The effects of hydrologic disturbance and external nutrient and sediment loading on native wetland plant communities will be determined with the model. The results of this study will contribute to the understanding of the impacts of nutrient-rich tributaries on prairie soils and vegetation.

- Surface water and vegetation management options for Paynes Prairie

  Planned multi-agency effort (Gainesville Regional Utilities, FDEP, SJRWMD, City of Gainesville Public Works) to identify surface water and vegetation management options leading to water quality and hydrologic improvements in Paynes Prairie and to the rehabilitation of terrestrial and wetland vegetative communities in the northern portion of the prairie. Options for reducing nutrient and other pollutant loadings into the prairie from northern tributaries (Sweetwater Branch and Bivens Arm) will be considered. Completion of the diagnostic effort "Vegetative communities in Paynes Prairie and relationships with environmental factors" (project OCB-110-D) is required for this effort.

Project OCB-206-F. *Feasibility assessment for the restoration of OCB lakes*

- Feasibility assessments needed for identifying basin management strategies aimed at reducing existing sources of pollution into waterbodies of the basin will be developed as diagnostic projects are completed.

Restoration/Management Program

Project OCB-303-RM. *Wetland/water resource protection through new land acquisition.*

- Assessment of potential land acquisition in the Orange Creek Basin

  Ongoing District initiative (part of the District's Basin Acquisition Studies Program) aimed at updating and evaluating the potential acquisition of environmentally sensitive lands in the Orange Creek Basin with the goal of restoring and/or preserving water resources in the basin. SJRMWD currently owns 11,230 acres of land in the OCB and has recently purchased development rights to an additional 17,000 acres (within the Lochloosa Wildlife CARL Project Area). An additional 30,000 or more acres of environmentally sensitive lands have been identified for potential acquisition. Future acquisitions focus on further expansion of the Lochloosa Wildlife Conservation Area and subsequently, on the Prairie Creek-Newnans Lake and the Orange Creek Run project areas. Acquisition and sound management of these lands offers an effective means of protecting on a long-term basis water quality in waterbodies of the basin (including Outstanding Florida Waters).

Project OCB-305-RM. *Outstanding Florida Waters (OFW) designation review.*

- Expansion of OFW designations in the Orange Creek Basin

  Planned intergovernmental effort aimed at (a) evaluating the need for augmenting OFW designations in the Orange Creek Basin and (b) preparing and submitting proposals for the designation of new waterbodies as OFWs. Expansion of the OFW designations in the Orange Creek Basin is a means of enhancing water quality protection of existing OFWs (when they are downstream of the proposed designations) and of augmenting the protection of water resources of exceptional ecological or recreational significance.

Project OCB-306-RM. *Restoration of waterbodies in the Orange Creek Basin.*

- Restoration efforts aimed at controlling or reducing pollution sources into waterbodies of the basin will be developed as diagnostic and feasibility projects are completed.

Project OCB-307-RM. *Urban stormwater assessment and remediation in the Orange Creek Basin.*

- Local government stormwater retrofitting assistance

  Ongoing District initiative aimed at co-sponsoring local government efforts to retrofit urban stormwater management systems. Plans to assist the City of Gainesville (Department of Public Works) with stormwater retrofitting in the Hogtown Creek watershed are currently underway. By helping to reduce sediment and nutrient loading into stormwater systems, the stormwater retrofitting effort will contribute to reduce pollution sources in urban waterbodies.

Regulatory Program

Project OCB-402-RM. *Local government environmental protection ordinance assistance.*

- Remediation of nonpoint source and unregulated point source pollutant loading into waterbodies of the Orange Creek Basin

  Planned District initiative to assist local governments in the development and implementation of stronger local ordinances and Local Development Regulations for environmental protection that are consistent with pollution prevention and remediation goals established in this plan. Targeted areas of assistance include stormwater management, land use development, and habitat protection.

Project OCB-403-RM. *Surface water permit review*

- Orange Creek Basin surface water permit review

  Ongoing multi-agency effort to assess the compliance status of surface water related permits in the Orange Creek Basin (e.g. ERP, MSSW, Stormwater, WRM, CUP, Agricultural Discharge permits, NPDES) and to evaluate the need for enhanced enforcement actions and new permit requirements. This effort is critical to the identification of permitted point source discharges into waterbodies of the basin and to the overall goal of basinwide pollution control/reduction.

Interagency Coordination Program

Project OCB-502-I.*Comprehensive Plan review.*

- Comprehensive Plan review

Ongoing intergovernmental coordination effort aimed at assisting local governments in the preparation and revision of comprehensive plans and at encouraging incorporation of OCB-Plan goals and objectives into these comprehensive plans. Pollution control and prevention and water quality protection are major goals of this effort.

Project OCB-503-I. *Fund procurement coordination.*

- Fund procurement coordination

Interagency effort toward procuring funds for the implementation of programs and projects within the OCB-Plan. For example, District funds recently allocated for District-wide stormwater retrofitting projects are being used for urban stormwater retrofitting assistance in the Orange Creek Basin.

Project OCB-504-I.*Intergovernmental basin coordination.*

- Regional intergovernmental forum

Ongoing District initiative to periodically hold county-based intergovernmental forums aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to ensure the timely notification of state and local government proposed actions which can potentially affect surface water management decisions (including control of pollution sources) in the Orange Creek Basin. Intergovernmental forums for Alachua County (sponsored by SJRWMD and SRWMD) were initiated in November 1995.

Public Outreach Program

Project OCB-601-P. *Basin and subbasin task forces and advisory councils*

- Orange Creek Basin Advisory Council and Scientific Advisory Committee

Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee (OCB SAC) provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. Pollutant loading and its control in waterbodies of the Orange Creek Basin are among the issue addressed by the Advisory Council.

Project OCB-602-P. *Citizen volunteer activities*

- Volunteer monitoring in the OCB

Ongoing multi-entity effort (governmental and nongovernmental) aimed at organizing and directing volunteer monitoring activities in the basin. The largest existing volunteer monitoring effort active in the Orange Creek Basin is the Lake Watch Program, a water quality monitoring network organized by the Department of Fisheries and Aquatic Sciences of the University of Florida.

Other volunteer efforts will soon be initiated, such as stormwater monitoring of tributaries in the basin. This effort is aimed at measuring concentrations of chemical and physical constituents in tributary streams under high-flow conditions. This information, together with data from the District's routine water quality monitoring program, will be used to assess pollutant loading into waterbodies of the basin and to develop external nutrient budgets for these waterbodies.

- Habitat cleanups

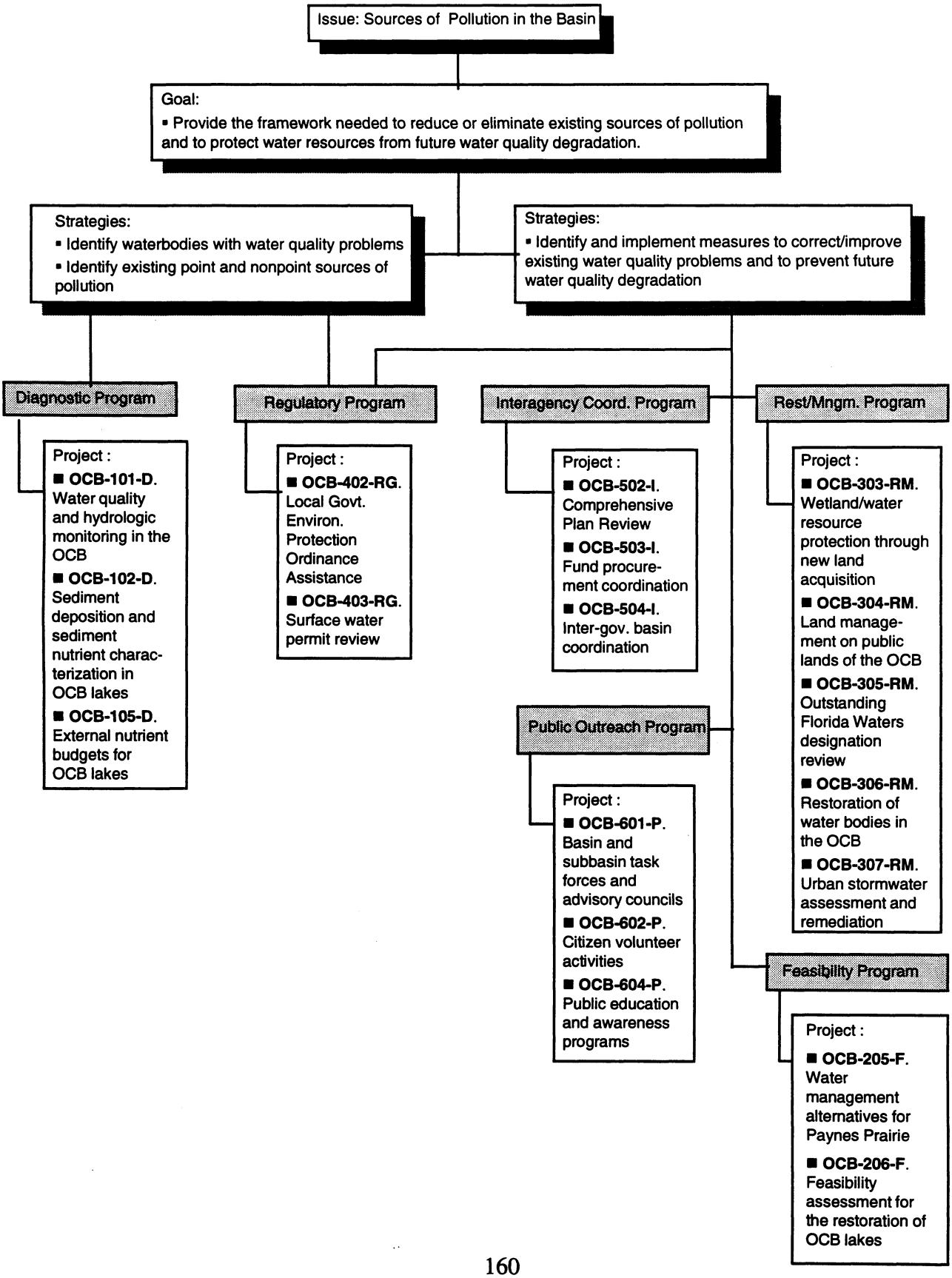
Ongoing series of cooperative (multi-agency) efforts aimed at sponsoring and organizing local citizen habitat cleanups in the Orange Creek Basin. Recently completed habitat cleanups include a Paynes Prairie cleanup (April 1995, University of Florida Wetlands Club), a Hogtown Creek cleanup (September 1995, multi-agency initiative), and a Newnans lake/Prairie Creek cleanup (Celebrate the St. Johns River Cleanup, Water Management District/County initiative). Habitat cleanups contribute to reduce nonpoint sources of pollution into waterbodies in the basin by removing solid waste materials in, or in the vicinity of, waterbodies.

Project OCB-604-P. *Public education and awareness programs*

- Adult awareness program
- School education and awareness program

District ongoing and planned efforts to enhance public (adult and school) education and awareness in the Orange Creek Basin. Issues addressed by the public education and awareness efforts include: (a) environmental impacts and public health risks associated with pollutants in stormwater systems and receiving waterbodies, (b) community actions that help reduce or prevent pollutant loading into surface waters.

Figure 30. Issue No. 6: Sources of Pollution in the Basin.



ISSUE # 7. LAKE TROPHIC CONDITIONS AND TRENDS

Background

An important step toward addressing water quality issues in the Orange Creek Basin involves understanding lake trophic conditions and trends. Lakes of elevated trophic state (eutrophic or hypereutrophic) or nutrient-enriched lakes, can develop undesirable characteristics such as dense algal blooms, excessive growth of macrophytic vegetation, decline in sportfish populations, and periodic fish kills. Such conditions can lead to impairment of natural ecosystem functions and of recreational, aesthetic, and economic values.

The extent to which nutrients in Orange Creek Basin water bodies originate from natural processes (e.g. weathering and transport of phosphate-rich soils, internal nutrient cycling) or from anthropogenic activities (point and nonpoint sources of pollution) is debatable and can vary from one lake to another. Lakes which lie in watersheds underlain by phosphate-rich soils are described by some authors as "naturally eutrophic". This may be the case for the Newnans Lake basin, which contains Pliocene phosphatic, clayey sands derived from the Hawthorn formation (Holly 1976, Brooks 1982a,b, Clark et al. 1964), and possibly for Orange and Lochloosa lakes as well, which also receive water from the Hawthorn formation (Putnam 1968, Brezonik and Shannon 1971, Canfield & Hoyer 1988).

However, long-term historical water quality data suggest that some Orange Creek Basin waterbodies (e.g., Newnans Lake, Bivens Arm, and Hatchet Creek) have also experienced cultural (or anthropogenic) eutrophication, as suggested by an apparent increase in nutrient concentrations, primary productivity (chlorophyll-a), and/or trophic condition over the last few decades (Tables 8 and 9). Preliminary results from the

District's routine (monthly) water quality monitoring program further support this observation. For example, average nutrient and chlorophyll-a concentrations in Bivens Arm and Newnans Lake are generally higher in 1994-95 (Table 10) than in previous sampling years (Table 8).

When long-term historic water quality records are unavailable or incomplete, water quality trends can be inferred from paleolimnological analyses. In addition to indicating cultural eutrophication, paleolimnological methods can offer a practical means of identifying baseline limnological conditions, which may then be used as target conditions for water quality restoration programs (Brenner et al. 1993).

Of the eight problem lakes in the Orange Creek Basin identified by FDEP (1994) as having elevated trophic state (TSI values > 60; Table 8), Newnans Lake is in greatest need of restoration, given the severity of its water quality problems and the importance of the lake as a regional recreational resource. Chlorophyll-a concentrations in the lake currently average around 210 ug/l (Table 10), with maximum values reported up to 370 ug/l (SJRWMD, unpublished data for 1994/95).

Restoration of water quality in a lake first requires an understanding of the trophic conditions and functions of the lake. This may entail a variety of diagnostic investigations, including the development of external and internal nutrient budgets, determination of which nutrient(s) limit primary production, and description and quantification of lake ecosystem components (e.g. phytoplankton species composition, fish community structure) and processes (primary productivity, secondary productivity, energy and nutrient fluxes, etc.). Diagnostic investigations should generate the information needed to identify the most appropriate management options for restoring water quality and trophic condition in the waterbody. Restoration actions may include measures which target a reduction in external nutrient loading (e.g., control of point and

non-point sources of pollution) or in internal nutrient loading (e.g., phosphorus inactivation, sediment oxidation, dredging, biomanipulation). Sources of external nutrient loading, when significant, need to be controlled before the control of internal nutrient loading is attempted.

Basin Management Goal for the identification of lake trophic conditions and trends

The major goal associated with the issue of lake trophic conditions and trends is to understand the underlying causes that determine current trophic conditions in Orange Creek Basin lakes so that appropriate lake restoration measures can be identified and implemented to help restore water quality in lakes influenced by cultural eutrophication.

Basin Management Strategies for addressing the issue of lake trophic conditions and trends

Three strategies have been identified to achieve the goal specified above:

- Evaluate current nutrient status, trophic condition, and historic water quality trends for waterbodies in the Orange Creek Basin,
- Identify lakes impacted by cultural eutrophication and in need of restoration,
- Identify and implement lake restoration alternatives designed to arrest or reverse cultural eutrophication in problem lakes.

Projects to implement strategies for addressing the issue of lake trophic conditions and trends

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 31, p. 172). Project elements are ranked according to status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority,

⊙ planned-second priority, and ⊙ planned-third priority.

Diagnostic Program

Project OCB-101-D. *Water quality and hydrologic monitoring in the Orange Creek Basin*

- ◆ District water quality monitoring in the Orange Creek Basin

  Ongoing District monitoring effort aimed at providing a continuous monthly record of water quality in major waterbodies of the Orange Creek Basin (26 sampling sites). The data generated by this monitoring effort are needed to assess the current trophic condition of lakes in the basin and to identify recent changes in trophic trends.

- ◆ Review and analysis of historical and current water quality conditions in the OCB

  Ongoing District project to be continued in FY 1995-96. Completion of this project is critical for the documentation of long-term water quality and trophic status changes in waterbodies of the Orange Creek Basin.

- ● Volunteer stormwater sampling of tributaries in the OCB

  Planned volunteer sampling initiative coordinated under the Public Outreach Program (project OCB-603-P) aimed at measuring concentrations of chemical and physical constituents in tributary streams under high-flow conditions. This information, in conjunction with data from the District's routine water quality monitoring program, will be used to develop external nutrient budgets for lakes in the basin and to assess the potential contribution of external nutrient loading to lake eutrophication.

Project OCB-102-D. *Sediment deposition and sediment nutrient characterization in OCB lakes*

- Sediment and water quality reconnaissance of Newnans Lake

Ongoing District effort aimed at monitoring changes in sediment stratigraphy and physical characteristics in Newnans Lake and changes in water quality both in Newnans Lake and in its inflow (Hatchet Creek) and outflow (Prairie Creek) during an 18-month period (1991-1993) immediately prior to and following the removal of the flashboards at Prairie Creek dam. Sampling has been completed under contract with King Engineering Associates, Inc. (Tampa) and analysis of data is currently underway by District scientists.

The information derived from these analyses will be used to assess the short-term effects of dam removal on lake water quality, sediment characteristics, and lake trophic condition. By comparing these results to more recent water quality and sediment characteristics data, more long-term effects of dam removal on lake trophic status may be inferred.

- Historical sediment and nutrient accumulation rates and past water quality in Orange Lake

District contractual effort currently underway (Phase I) aimed at utilizing paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Orange Lake, to determine the timing of these changes, and to investigate their possible causes. This project will generate information needed to assess the impact of past events (e.g., weir construction, highway and railroad levee construction, droughts, hydrilla, past sinkhole intervention) on lake sediment and nutrient stores and accumulation rates and on lake water quality. Historical changes in the lake trophic condition will be inferred from these analyses. Information obtained from this study will additionally be used to set target water quality and trophic state conditions for the restoration and management of the lake.

- Historical sediment and nutrient accumulation rates and past water quality in Newnans Lake

Planned District contractual effort aimed at using paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Newnans Lake, to determine the timing of these changes, and to investigate their possible causes. The information obtained from this diagnostic effort may be used to reconstruct the trophic history of Newnans Lake over the last 150 years, to identify possible causes (anthropogenic or natural) for trophic changes, and to identify target limnological conditions for water quality restoration (trophic rejuvenation) of the lake.

- Internal nutrient loading in Newnans Lake

Planned District contractual effort aimed at quantifying sediment nutrient stores in Newnans Lake and at measuring nutrient flux rates between the sediments and the water column. This information will help assess the role of sediments in internal nutrient loading processes. If internal nutrient loading is found to be significant (compared to external nutrient loading sources), then potential lake restoration alternatives intended to reduce internal nutrient loading and thereby halt or reverse the eutrophication process will be identified (OCB-206-F) and implemented (OCB-306-RM).

Project OCB-104-D. *Lake basin physical characteristics*

- Bathymetry and sediment thickness survey in Orange Lake

District contractual effort currently underway aimed at mapping the bathymetry of Orange Lake and the depth and thickness of its muck sediments. Information on muck depth and distribution in the lake is needed to identify lake sediment restoration needs and potential restoration alternatives which would help reduce internal organic matter and nutrient loading in the lake.

Project OCB-105-D. *External nutrient budgets for waterbodies in the OCB*

- External nutrient budget for Orange Creek Basin lakes

District in-house effort aimed at quantifying exchanges of water and nutrients between the watershed and water bodies in the Orange Creek Basin. Information derived from the external nutrient budget will help determine the relative contribution of anthropogenic sources of pollution (point and nonpoint sources) to nutrient loading in a given waterbody or subbasin within the Orange Creek Basin. These results are critical for identifying lake restoration and management alternatives which allow for the control of cultural eutrophication in waterbodies of the basin. Efforts to develop external nutrient budgets for OCB waterbodies will focus initially on Orange Lake.

- Pollution sources in Orange, Lochloosa, and Newnans lakes

Planned effort to identify and quantify point and nonpoint sources of pollution into Orange, Lochloosa, and Newnans lakes. This information will be used for developing external nutrient budgets for these lakes and for identifying and subsequently implementing nonpoint source pollution reduction measures aimed at reducing external nutrient loadings and restoring water quality and trophic status of lakes (Project OCB-402-RG). Efforts to assess pollution sources will initially be focused on hyper-eutrophic Newnans Lake, given the severity of its water quality problems.

Project OCB-106-D. *Assessment of floating and emergent wetland habitats in OCB lakes*

- Role of floating and emergent vegetation in the nutrient dynamics of Orange Lake

Planned District contractual effort aimed at assessing the role floating and emergent vegetation plays in a number of processes such as uptake and sequestration of dissolved nutrients, production of detritus and contribution and organic matter sedimentation, retention of suspended particulate material, and interference with nutrient and organic matter export. The potential effects of harvesting (and of in-lake or off-site disposal of harvested material) on the nutrient dynamics and trophic ecology of the lake will also be addressed. Initiation of this effort requires prior completion of other diagnostic efforts within this project (OCB-106-D).

Project OCB-107-D. *Phytoplankton assessments in OCB lakes*

- Phytoplankton surveys for Orange, Lochloosa, and Newnans lakes

Ongoing 2-year District contractual effort (initiated in July 1995) aimed at characterizing the phytoplankton assemblages of Orange, Lochloosa, and Newnans lakes. Phytoplankton samples are being collected by District personnel as part of the routine monthly water quality monitoring effort. Sample analysis is being performed under contract by Beaver Schaberg Associates. Information obtained from this effort, in conjunction with water quality data from the District's monthly water quality sampling program, will be used to evaluate the trophic condition of the lakes and their potential for trophic transformation (from a macrophyte dominated system to an algal dominated system or vice versa). Information on phytoplankton species composition and heterocyst abundance will additionally provide insight into nutrient availability/limitation in these lakes.

Project OCB-110-D. *Assessment of vegetative communities in Paynes Prairie*

- Vegetative communities in Paynes Prairie and relationships with environmental factors

Ongoing multi-agency effort (Gainesville Regional Utilities, FDEP, SJRWMD, City of Gainesville Public Works) currently underway aimed at establishing cause/effect relationships between altered surface hydrology and increased nutrient inflows in the northern portion of Paynes Prairie and changes in terrestrial and wetland vegetation assemblages. This study will contribute to the understanding of the role of external nutrient loading in the trophic function of wetland ecosystems. Information obtained from this diagnostic effort is needed to identify surface water and vegetation management options leading to the rehabilitation of terrestrial and wetland vegetative communities the prairie (Project OCB-205-F).

Feasibility Program

Project OCB-203-F. *Orange Lake weir modification*

- Orange Lake weir modification; evaluation of management alternatives

Planned effort to identify structural and operational modifications to the U.S. 301 weir, as well as to other downstream structures (e.g. U.S. 301 and railroad levees; Shands Canal) with the purpose of restoring, to the extent practicable and desirable, Orange Lake's outflow regime and providing minimum flows for Orange Creek. Among the ecosystem benefits considered in this analysis of management alternatives for improving lake outflow is the potential for trophic rejuvenation of the lake, resulting from enhanced sediment and nutrient export.

Project OCB-204-F. *Orange Lake sinkhole intervention analysis*

- Orange Lake sinkhole intervention; evaluation of management alternatives

Planned District in-house effort to evaluate management alternatives related to sinkhole discharge control at the Heagy-Burry Park area of Orange Lake and to assess the potential environmental impacts from these alternatives. The effects of sinkhole discharge control on

lake level fluctuations and sediment and nutrient retention and oxidation processes will be evaluated and the potential long-term implications to the lake's trophic condition will be predicted.

Project OCB-205-F. *Water management alternatives for Paynes Prairie*

★ Preliminary assessment of options for management of Sweetwater Branch surface flow into Paynes Prairie

Completed report by Best, G.R., R.D.Peters, Jr., R.E. Borer, and F.F. Gaines III. 1995. Preliminary Assessment of Options for Management of Sweetwater Branch Surface Flow into Paynes Prairie, Alachua County, Florida. Center for Wetlands and Water Resources, University of Florida, Gainesville, FL.

Project aimed at evaluating various options for the management of Sweetwater Branch inflow into Paynes Prairie State Preserve, with the purpose of restoring sheet flow to the northern portion of the Prairie and enhancing water quality of surface waters in the Prairie (including Alachua Lake/Sink and the Floridan aquifer). A multifunctional wetland treatment system constructed in the impacted area of the prairie along Sweetwater Branch was identified as the recommended option. By considering management options to reduce nutrient loading into the Prairie (Alachua Lake specifically), this feasibility assessment contributes to the overall goal of reducing cultural eutrophication in waterbodies of the basin.

◆ Paynes Prairie Vegetation Succession Model.

Ongoing contractual effort by the University of Florida for the FDEP entitled: GIS-based succession model for Prairie Creek Pourpoint Basin, Paynes Prairie State Preserve. Principal Investigator: Gregg White.

This investigation assesses water volume alternatives for distribution through the Camps Canal culvert system and develops vegetation succession models to show the effects that changing water regimes, water quality, and sediment conditions have on wet prairie and wetland vegetation assemblages. The effects of hydrologic disturbance and external nutrient and sediment loading on native wetland plant communities will be determined with the model. The results of this study will contribute to the understanding of the impacts of nutrient-rich tributaries on prairie soils and vegetation.

● Surface water and vegetation management options for Paynes Prairie

Planned multi-agency effort (Gainesville Regional Utilities, FDEP, SJRWMD, City of Gainesville Public Works) to identify surface water and vegetation management options leading to water quality and hydrologic improvements in Paynes Prairie and to the rehabilitation of terrestrial and wetland vegetative communities in the northern portion of the prairie. Options for reducing nutrient loadings into the prairie from northern tributaries (Sweetwater Branch and Bivens Arm) will be considered. Completion of the diagnostic effort "Vegetative communities in Paynes Prairie and relationships with environmental factors" (project OCB-110-D) is required for this effort.

Project OCB-206-F. *Feasibility assessment for the restoration of OCB lakes*

★ FGFWFC feasibility assessment of drawdown for restoring Newnans Lake (KBN Engineering)

Completed report: KBN Engineering and Applied Sciences, Inc. 1993. Assessing the Feasibility of Restoring Newnans Lake. Phase A: Conceptual Engineering Report. Prepared for the Florida Game and Fresh Water Fish Commission, Gainesville, FL.

Project aimed at evaluating various drawdown alternatives for Newnans Lake with the purpose of restoring lake sediments and fisheries habitat. A mechanical drawdown alternative involving a 9-month holddown duration was considered the preferred option, based on an evaluation of conceptual engineering plans, potential environmental impacts, and cost estimates. The cost of a 9-month mechanical drawdown alternative was estimated at $9-12 million. Water quality enhancement and trophic rejuvenation are among the benefits expected to result from lake sediment restoration techniques involving extreme drawdowns.

- Additional feasibility assessments needed for identifying lake management strategies aimed at restoring historic nutrient levels in culturally eutrophic lakes will be developed as diagnostic projects are completed.

Restoration/Management Program

Project OCB-301-RM. *Aquatic plant management in the OCB*

◆ Vegetation management in OCB lakes

Ongoing joint FDEP/SJRWMD effort to implement aquatic weed control measures in OCB lakes. Chemical control operations are rendered by the District under contract with FDEP and in accordance with FDEP's aquatic plant management program goals and specifications. Because management of aquatic plant growth in lakes contributes to reduce autochthonous primary production and internal nutrient and organic matter loading, it can be considered a potential alternative for lake trophic restoration/manipulation.

Project OCB-304-RM. *Land management in public lands of the OCB*

◆ Land management on District properties

Ongoing District effort to develop and implement, in cooperation with other agencies, sound, ecosystem-based management plans for District properties. The overriding management objective is for ecological resource protection and restoration. Identification and implementation of land management practices (including BMPs) which reduce external nutrient loading into waterbodies is an important objective in these land management plans. This is particularly critical in properties acquired as conservation easements (or less-than-fee acquisitions) where pre-existing land uses may be allowed to continue (e.g., the 10,333-acre property within the CARL Lochloosa Wildlife project recently acquired from Georgia Pacific).

Project OCB-305-RM. *Outstanding Florida Waters (OFW) designation review.*

- Expansion of OFW designations in the Orange Creek Basin

  Planned intergovernmental effort aimed at (a) evaluating the need for augmenting OFW designations in the Orange Creek Basin and (b) preparing and submitting proposals for the designation of new waterbodies as OFWs. Expansion of the OFW designations in the Orange Creek Basin offers a means of legally protecting water resources of exceptional ecological or recreational significance from water quality degradation and cultural eutrophication.

Project OCB-306-RM. *Restoration of waterbodies in the OCB*

- Restoration efforts aimed at restoring water quality in lakes subject to cultural eutrophication will be developed as diagnostic and feasibility projects are completed.

Project OCB-307-RM. *Urban stormwater assessment and remediation in the OCB*

- Local government stormwater retrofitting assistance

  Ongoing District initiative aimed at co-sponsoring local government efforts to retrofit urban stormwater management systems. Plans to assist the City of Gainesville (Department of Public Works) with stormwater retrofitting in the Hogtown Creek watershed are currently underway. The stormwater retrofitting effort will help reduce sediment and nutrient loading into stormwater systems and will contribute to ameliorate problems caused by cultural eutrophication in urban waterbodies.

Regulatory Program

Project OCB-402-RG. *Local government environmental protection ordinance assistance*

- Remediation of nonpoint source and unregulated point source pollutant loading into waterbodies of the OCB

  Planned District initiative to assist local governments in the development and implementation of stronger local ordinances and Local Development Regulations for environmental protection that are consistent with pollution prevention and remediation goals established in this plan. Targeted areas of assistance include stormwater management, land use development, and habitat protection. This regulatory effort will enhance the control of unregulated point and nonpoint sources of pollution, thereby contributing to the restoration of water quality in waterbodies impacted by anthropogenic activities (culturally eutrophic).

Project OCB-403-RG. *Surface water permit review*

- Orange Creek Basin surface water permit review

Ongoing multi-agency effort to assess the compliance status of surface water related permits in the Orange Creek Basin (e.g. ERP, MSSW, Stormwater, WRM, CUP, Agricultural Discharge permits, NPDES) and to evaluate the need for enhanced enforcement actions and new permit requirements. This effort is critical to the goal of restoring water quality in waterbodies influenced by cultural eutrophication.

Interagency Coordination Program

Project OCB-502-I. *Comprehensive plan review*

- Comprehensive Plan review

Ongoing intergovernmental coordination effort aimed at assisting local governments in the preparation and revision of comprehensive plans and at encouraging incorporation of OCB-Plan goals and objectives into these comprehensive plans. Pollution control and prevention and water quality protection are major goals of this effort. Attainment of these goals is necessary to prevent and control cultural eutrophication in waterbodies of the basin.

Project OCB-504-I. *Intergovernmental basin coordination*

- Regional intergovernmental forum

Ongoing District initiative to periodically hold county-based intergovernmental forums (involving state, regional, and local government agencies) aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to facilitate coordination among cooperating agencies and to ensure the timely notification of government proposed actions which could potentially affect surface water management decisions in the Orange Creek Basin. Close coordination and effective communication is needed among FDEP, SJRWMD, and local and county governments to facilitate implementation of cooperative measures for preventing and controlling cultural eutrophication in Orange Creek Basin lakes. Intergovernmental forums for Alachua County (sponsored by SJRWMD and SRWMD) were initiated in November 1995.

Public Outreach Program

Project OCB 601-P. *Basin and subbasin task forces and advisory councils*

- Orange Creek Basin Advisory Council and Scientific Advisory Committee

Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and

restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee (OCB SAC) provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. Among the issues addressed by the Advisory Council is the control and prevention of cultural eutrophication in basin waterbodies.

- Subbasin task forces or working groups

  Task forces or working groups which specifically address the issue of lake trophic conditions and trends in the Orange Creek Basin will be created on an "as-needed" basis by request of the public or of the OCB Advisory Council.

Project OCB 602-P. *Citizen volunteer activities*

- Volunteer monitoring in the OCB

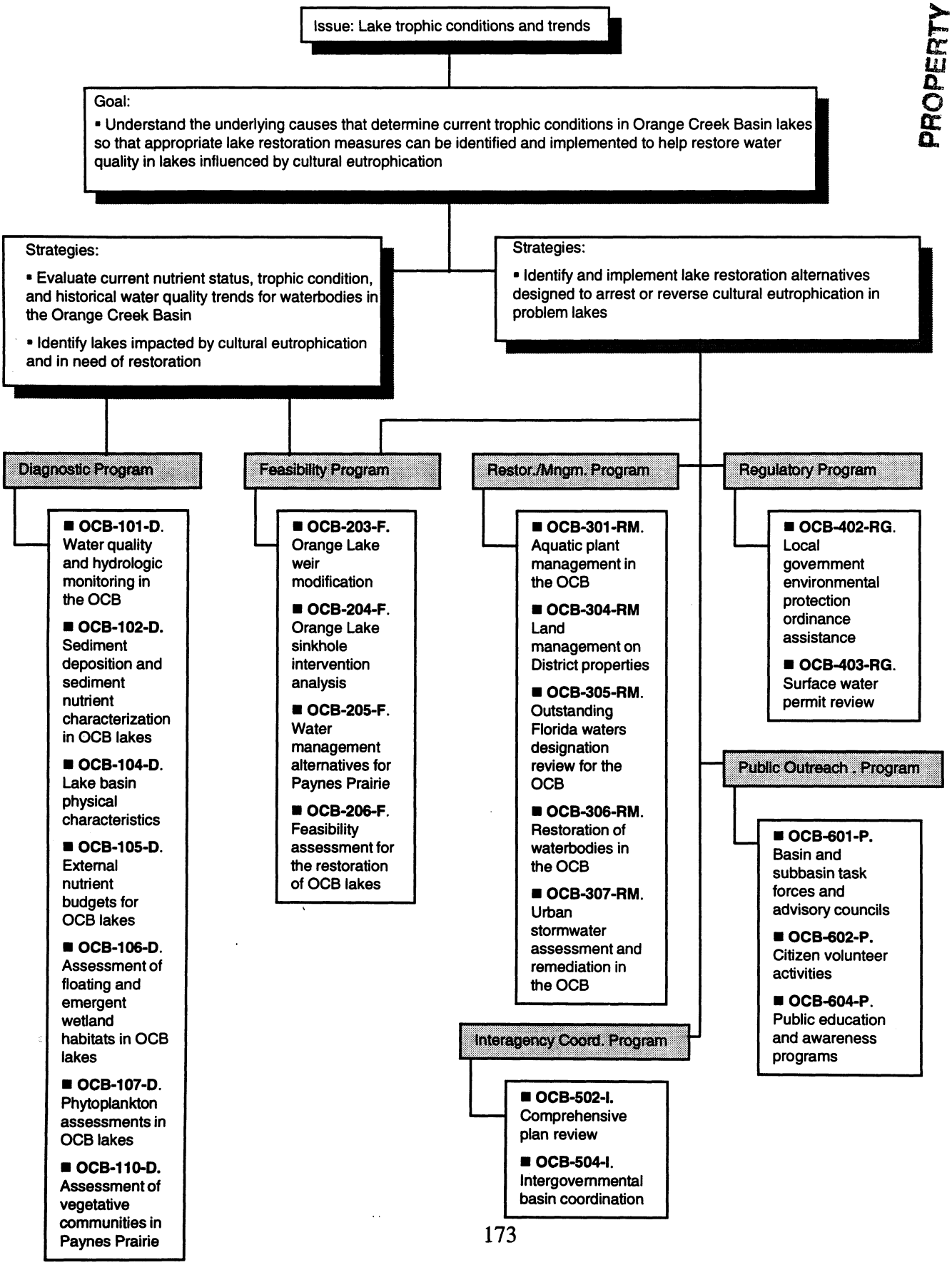
  Ongoing multi-entity (governmental and nongovernmental) effort aimed at organizing and directing volunteer monitoring activities in the basin. The largest existing volunteer monitoring effort active in the Orange Creek Basin is the Lake Watch Program, a water quality monitoring network organized by the Department of Fisheries and Aquatic Sciences of the University of Florida. Other volunteer efforts will soon be initiated, such as stormwater monitoring of tributaries in the basin. This effort is aimed at measuring concentrations of chemical and physical constituents in tributary streams under high-flow conditions. The stormwater tributary monitoring effort will quantify external nutrient loading into basin waterbodies during storm events. This information is needed to develop external nutrient budgets for the waterbodies and to assist in identifying areas of improvement under regulatory projects (OCB-402-RG and OCB-403-RG).

Project OCB-604-P. *Public education and awareness programs*

- District ongoing and planned efforts to enhance public (adult and school) education and awareness in the Orange Creek Basin. Elements of these efforts include: (a) educating the public on the subjects of lake nutrient status and trophic function and on the causes leading to lake eutrophication, and (b) directing and encouraging local communities/residents to participate in programs/activities aimed at reducing anthropogenic nutrient loading into surface waterbodies of the basin (e.g. lake/stream cleanup operations, stormdrain stenciling programs, correction of defective septic system operation, implementation of best management practices for the proper use and disposal fertilizers). Some of these public participation activities have already been initiated (see project OCB-602-P; Citizen volunteer activities). These education and awareness programs will be closely coordinated with the local government environmental protection ordinance assistance project (OCB-402-RG).

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Figure 31. Issue No. 7: Lake Trophic Conditions and Trends.



3.4 LAKE SEDIMENTS

ISSUE # 8. ORGANIC SEDIMENT ACCUMULATION IN LAKES

Background

Detrital organic matter is a major source of energy and nutrients driving the productivity of inland aquatic ecosystems (Wetzel 1975). In lakes, a large portion of this organic matter is stored or contained in the bottom sediments.

When present in excessive amounts, organic matter in sediments may have detrimental effects on the health of aquatic ecosystems. In shallow lakes of Florida, large amounts of unconsolidated organic sediments (muck) can result in: a) a reduction in the availability of preferred nesting habitat for centrarchid fish (Bruno 1984); b) elimination of suitable substrate for native rooted aquatic plants (Benton et al. 1988) and for benthic communities, c) increased chance of wind-induced bottom sediment resuspension (Carrick et al. 1993); and d) increased oxygen demand in the water column which can result in oxygen depletion near the bottom. Oxygen depletion can in turn cause physiological stress to heterotrophic communities, as well as promote internal nutrient loading from the sediments and trigger algal blooms.

Muck accumulation in lakes can be caused by an increase in the supply and/or retention of nutrients and particulate organic matter. Supplies can be either autochthonous (internally produced) or allochthonous (produced elsewhere in the watershed and imported via tributaries). Autochthonous organic matter (e.g. phytoplankton, aquatic plants and/or wetland vegetation) tends to be the main cause of muck accumulation in lakes. The production of autochthonous plant material is largely driven by internal and external nutrient loading processes. Higher external nutrient

loading associated with human development (urban, industrial, agricultural) is a common cause of eutrophication and muck accumulation in lakes today.

Sources of particulate organic matter

A major contributor of autochthonous organic matter in Orange and Lochloosa lakes is likely to be hydrilla, given its widespread distribution and high growth potential. Although it is commonly believed that herbicide control of hydrilla enhances organic sediment accumulation, experimental studies reveal that sedimentation by natural senescence of uncontrolled hydrilla (non-topped off) actually exceeds that resulting from herbicide management by as much as 2.1 times (Joyce et al. 1992). Maintenance control of hydrilla should therefore be considered a priority management goal in lakes with organic sediment problems caused by hydrilla growth.

The expansion of littoral wetland vegetation (composed mostly of floating and rooted vascular hydrophytes) and its effect on internal organic loading is also an issue of concern, particularly on Orange Lake. Like hydrilla, littoral vegetation senesces and becomes incorporated into the lake's organic sediment pool. Unlike hydrilla, however, littoral vegetation tends to decompose slowly (due to its greater content of structural tissue) and to contribute substantially more to the build-up of muck on the lake bottom.

Planktonic algae constitute a third important source of autochthonous detritus, particularly in highly eutrophic waterbodies with recurrent algal blooms (e.g. Newnans Lake). In macrophyte dominated lakes, however, phytoplankton production tends to be suppressed (Canfield & Hoyer 1992). In these systems, the organic sediment pool is probably dominated by macrophytic detrital material (e.g. Orange Lake).

Potential sources of allochthonous organic matter in lakes include terrestrial plant detritus, effluent (organic) discharges (point sources), urban, agricultural, or silvicultural runoff (non-point sources), and tributary streams. Identification and quantification of these external organic loadings is necessary before a plan to restore lake sediments can be developed. If external loadings are found to be significant, then the reduction of these loadings (via control of the sources) ought to be considered as a priority goal in any lake sediment restoration program.

Enhanced retention of particulate organic matter

In addition to being an important source of organic matter in lakes, macrophytes (submersed, emergent, or floating) also contribute to the retention and accumulation of particulate organic matter. Recent work by Sheng and Lee (1991) in Lake Okeechobee suggests that expanses of hydrilla in a lake reduce the degree of resuspension of soft sediments during wind events. Since wind and storm events are likely a major mechanism through which soft sediments are resuspended and flushed out of lakes, the presence of hydrilla would likely increase organic sediment detention in a lake. Although retention of suspended sediments by floating islands and tussocks is yet to be investigated in Florida lakes, investigations elsewhere reveal that floating mats of vegetation may function effectively as physical filters, capturing large amounts of sestonic and planktonic material (Hamilton et al. 1990, Engle & Melack 1990).

Water level stabilization associated with dam construction at lake outlets can also lead to increased retention of particulate organic matter in lakes. Dated sediment core analyses performed in Newnans Lake by Gottgens and Crisman (1992b) reveal an abrupt increase in organic matter content and a decrease in bulk density of the sediments immediately after 1967, when the lake's outflow was dammed. Because this pattern of change was found to be progressively less at stations farthest from the weir, dam

construction is thought to be its likely cause rather than other factors which would tend to have more lakewide effects (e.g. herbicide treatments of aquatic plants and increased external nutrient loading). However, the observed longitudinal gradient in sediment physical characteristics could also be caused by sediment focusing processes occuring naturally in the lake (J. Estes, FGFWFC, pers. com. 1996).

The stabilization of water levels due to dam construction accelerates organic sediment accumulation by reducing the frequency and duration of low water periods, which are critical for the oxidation and consolidation of littoral (exposed) sediments (KBN 1993). Dams at outlets of lakes also promote organic sediment retention by reducing lake outflow and increasing hydraulic residence time. Under impaired outflow conditions, light organic sediments resuspended in the water column are unlikely to be flushed out of the system.

A first step in evaluating organic sediment accumulation in Orange Creek Basin lakes involves a diagnostic assessment of the sediments in these lakes. Although the presence of thick, soft, organic sediments in several Orange Creek Basin lakes has been documented by occasional sediment sampling during the course of fisheries and water quality investigations, quantitative assessments of sediment thickness, distributions, and chemical and physical characteristics are generally lacking.

Once diagnostic sediment assessments are performed and those lakes with sediment quality problems are identified, then lake-specific sediment restoration plans can be developed. Development of these restoration plans requires that the factors responsible for excessive muck accumulation first be identified.

Basin management goals for the control of organic sediment accumulation in Orange Creek Basin lakes

The major goal associated with this issue is to develop and implement lake management strategies for restoring sediments in lakes with excessive organic sediment content and/or high organic sediment accumulation rates. Ecosystem benefits expected from successful sediment restoration/management initiatives in lakes include restoration of benthic habitats and communities, enhanced lake fisheries, re-establishment of rooted native aquatic plants, reduction in internal nutrient loading, and improvement in lake water quality.

Basin Management Strategies for addressing the issue of organic sediment accumulation in Orange Creek Basin lakes

Several strategies have been identified to achieve the goal specified above:

- Identify lakes in the OCB with organic sediment accumulation problems (muck problem lakes)
- In muck problem lakes, determine the causes of excessive organic sediment accumulation
- Identify potential controls for reducing muck production and accumulation (e.g., reduction in external nutrient loading, enhanced control of aquatic weed growth, improved lake outflow)
- Implement lake restoration measures aimed at preventing and correcting muck production and accumulation problems

Projects to address the control of organic sediment accumulation in Orange Creek Basin lakes.

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 32, p. 187). Project elements are ranked by status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority,

⊙ planned-second priority, and ⊙ planned-third priority.

Diagnostic Program

Project OCB-101-D. *Water quality and hydrologic monitoring in the Orange Creek Basin.*

- ◆ District water quality monitoring in the OCB

  Ongoing District monitoring effort aimed at providing a continuous monthly record of water quality in major waterbodies of the Orange Creek Basin (26 sampling sites). The data from this monitoring effort are needed to interpret and analyze results from other diagnostic efforts dealing with sediment deposition and sediment nutrient characterization in Orange Creek Basin Lakes (see project OCB-102-D below). Because of the dynamic nature of the exchange processes between sediments and the overlying water column, water quality monitoring is a major component of overall monitoring during lake sediment restoration actions.

- ◆ Review and analysis of historical and current water quality conditions in the OCB.

  Ongoing District project to be continued in FY 1995-96. Completion of this project is critical for the documentation of long-term water quality changes in Orange Creek Basin waterbodies. This information will be used to complement and help interpret the results of historical sediment characterizations (based on dated sediment core analyses) in OCB lakes (project OCB-102-D).

- ● Volunteer stormwater sampling of tributaries in the OCB

  Planned volunteer sampling initiative coordinated under the Public Outreach Program (project OCB-603-P) aimed at measuring concentrations of chemical and physical constituents in tributary streams under high-flow conditions. This information, in conjunction with data from the District's routine water quality monitoring program, will be used to develop external nutrient budgets for lakes in the basin and to quantify external nutrient and sediment loading into lakes. Measures can then be identified which will help reduce external sediment and

nutrient inputs via tributaries and help curtail organic sediment accumulation problems in OCB lakes.

Project OCB-102-D. *Sediment deposition and sediment nutrient characterization in OCB lakes*

★ Effects of short-term drawdown on sediments and nutrients of Newnans Lake (Phase I & II)

Completed contractual project by Gottgens & Crisman (1992a,b) for the SJRWMD designed to empirically evaluate the impact of a short-term drawdown on the retention, oxidation and compaction, and deposition and redistribution of organic sediments and particulate nutrients in Newnans Lake.

These studies determined that during the 1989 Newnans Lake drawdown, only a small amount of organic sediments and nutrients were flushed and little oxidation of exposed sediments occurred. The lack of flushing was attributed to the fact that the lake levels were unusually low prior to the initiation of the drawdown, so that only about 20% of the lake water was removed. Organic sediments were variably redistributed in the lake, however there was no consistent transfer of sediments from littoral to profundal zones. It was recommended that short-term drawdowns be initiated when lake levels are high and wind speeds are greater than normal.

◆ Sediment and water quality reconnaissance of Newnans Lake

Ongoing District effort aimed at monitoring changes in sediment stratigraphy and physical characteristics in Newnans Lake and changes in water quality both in Newnans Lake and in its inflow (Hatchet Creek) and outflow (Prairie Creek) during an 18-month period (1991-1993) immediately prior to and following the removal of the flashboards at Prairie Creek dam. Sampling has been completed under contract with King Engineering Associates, Inc. (Tampa) and analysis of data is currently underway by District scientists. The results of this assessment will contribute to the understanding of the effects of drawdowns on lake sediment characteristics and of the feasibility of utilizing drawdowns to restore sediments and water quality in Newnans Lake.

◆ Historical sediment and nutrient accumulation rates and past water quality in Orange Lake

District contractual effort currently underway aimed at utilizing paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Orange Lake, to determine the timing of these changes, and to investigate their possible causes. This project will generate information needed to assess the impact of past events (anthropogenic and natural) on lake sediment and nutrient stores and accumulation rates. By understanding these relationships, lake managers will be better able to identify lake management alternatives which contribute to prevent excessive accumulation of organic sediments and to reduce existing stores of organic matter in the lake's sediments. The paleolimnologic record can additionally provide the information needed to identify target conditions for lake sediment restoration.

- Internal nutrient loading in Newnans Lake

  Planned District contractual effort aimed at quantifying sediment nutrient stores in Newnans Lake and at measuring nutrient flux rates between the sediments and the water column. This information will help assess the role of sediments in internal nutrient loading processes. If internal nutrient loading from the sediments is found to be significant (compared to external nutrient loading sources), then lake sediment restoration measures aimed at reducing this internal nutrient loading be identified (OCB-206-F) and implemented (OCB-306-RM).

- Wind resuspension analysis in Newnans Lake

  Planned District contractual effort to assess the dynamics of wind-induced resuspension of bottom sediments in Newnans Lake and describe patterns of movement and focusing of sediments in the lake. This information will be utilized in the identification of effective strategies for sediment restoration in Newnans Lake.

- Historical sediment and nutrient accumulation rates and past water quality in Newnans Lake

  Planned District contractual effort aimed at using paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Newnans Lake, to determine the timing of these changes, and to investigate their possible causes. The information obtained from this diagnostic effort may be used to identify the extent and timing of cultural disturbance to the lake ecosystem and to set target limnological conditions for water quality and sediment restoration.

Project OCB-104-D. *Lake basin physical characteristics*

- Bathymetry and sediment thickness survey in Orange Lake

  District contractual effort currently underway aimed at mapping the bathymetry of Orange Lake and the depth and thickness of its muck sediments. This survey will: (a) provide missing bathymetric data for the lake, (b) generate a map of muck depth and thickness throughout the lake, and (c) relate muck depth and thickness information to plant cover. Information on muck depth and distribution in the lake is needed to identify lake sediment restoration needs and to assess the potential effects of aquatic plant management actions on lake sediment characteristics.

- Newnans Lake outlet stream profile

  District contractual work currently underway aimed at describing the profile of Prairie Creek from State Road 20 to Newnans Lake. The profile data obtained from this survey are needed to evaluate the current outflow potential of Newnans Lake at varying lake elevations and to identify outlet channel hydraulic impediments and restoration needs.

- ◆ Orange Lake outlet stream profile

  District contractual work currently underway aimed at describing the profile of Orange Creek/Shands Canal, downstream from Orange Lake weir at U.S. Highway 301. Information from this survey will be used to identify hydraulic impediments to Orange Lake outflow (downstream of the U.S. 301 weir) and channel restoration needs for eliminating these impediments.

Project OCB-105-D. *External nutrient budgets for waterbodies in the OCB*

- ◆ External nutrient budgets for Orange Creek Basin lakes

  District in-house effort aimed at quantifying exchanges of water and nutrients between the watershed and water bodies in the Orange Creek Basin. Information derived from external nutrient budgets will help determine, for a given waterbody, the relative contribution of anthropogenic sources of pollution (point and nonpoint sources) to nutrient and sediment loading. These results are needed to identify lake and watershed management alternatives for addressing problems concerning excessive organic sediment loadings in OCB lakes.

- ● Pollution sources in Orange, Lochloosa, and Newnans lakes

  Planned effort to identify and quantify point and nonpoint sources of pollution into Orange, Lochloosa, and Newnans lakes. This information will be used for developing external nutrient budgets for these lakes and for identifying and subsequently implementing pollution reduction measures aimed at curtailing external sediment and nutrient loading into basin waterbodies. Efforts to assess pollution sources will initially be focused on Newnans Lake, given the severity of its water quality problems.

Project OCB-106-D. *Assessment of floating and emergent wetland habitats in OCB lakes*

- ◘ The role of floating and emergent vegetation in the nutrient dynamics of Orange Lake

  Planned District contractual effort aimed at assessing the role floating and emergent vegetation plays in a number of processes such as uptake and sequestration of dissolved nutrients, production of detritus and contribution and organic matter sedimentation, retention of suspended particulate material, and interference with nutrient and organic matter export. The effects of floating and emergent vegetation on sediment resuspension/deposition processes in the lake will also be determined.

Project OCB-107-D. *Phytoplankton assessments in OCB lakes*

- ◆ Phytoplankton surveys for Orange, Lochloosa, and Newnans lakes

  Ongoing 2-year District contractual effort (initiated in July 1995) aimed at characterizing the phytoplankton assemblages (species composition, abundance, and biomass) of Orange, Lochloosa, and Newnans lakes. Phytoplankton samples are being collected by District personnel as part of the routine monthly water quality monitoring effort. Sample analysis is

being performed under contract by Beaver Schaberg Associates. Results of these analyses will be used to assess the importance of phytoplankton as a source of organic sediments in these lakes.

Feasibility Program

Project OCB-201-F. *Feasibility of floating and emergent marsh remediation in OCB lakes*

- ◆ Feasibility of floating and emergent vegetation management in Orange and Lochloosa lakes

  Ongoing multi-agency (SJRWMD/FDEP/FGFWFC) effort to evaluate the feasibility for the large-scale removal of floating and emergent vegetation on Orange and Lochloosa lakes. Removal/management methods being tested include mechanical harvesting, burning, and herbiciding. The potential application of these methods as sediment restoration tools will also be evaluated.

Project OCB-203-F. *Orange Lake weir modification*

- ● Orange Lake weir modification; evaluation of management alternatives

  Planned effort to identify structural and operational modifications to the U.S. 301 weir, as well as to other downstream structures (e.g. U.S. 301 and railroad levees; Shands Canal) with the purpose of restoring, to the extent practicable and desirable, Orange Lake's natural outflow regime and providing minimum flows for Orange Creek. The feasibility of modifying water control structures, removing existing surface flow impediments, or restoring the upper Orange Creek channel to allow for enhanced export of nutrients and sediments during storm events will be assessed.

Project OCB-204-F. *Orange Lake sinkhole intervention analysis*

- ● Orange Lake sinkhole intervention; evaluation of management alternatives

  Planned District in-house effort to evaluate management alternatives related to sinkhole discharge control at the Heagy-Burry Park area of Orange Lake and to assess the potential environmental impacts from these alternatives. The effects of sinkhole discharge control on lake level fluctuations and sediment and nutrient retention and oxidation processes will be evaluated.

Project OCB-206-F. *Feasibility assessment for the restoration of OCB lakes*

★ FGFWFC feasibility assessment of drawdown for restoring Newnans Lake (KBN Engineering)

Completed report: KBN Engineering and Applied Sciences, Inc. 1993. Assessing the feasibility of restoring Newnans Lake. Phase A: Conceptual engineering report. Prepared for the Florida Game and Fresh Water Fish Commission, Gainesville, FL.

Project aimed at evaluating various drawdown alternatives for Newnans Lake with the purpose of restoring lake sediments and fisheries habitat. A mechanical drawdown alternative involving a 9-month holddown duration was considered the preferred option, based on an evaluation of conceptual engineering plans, potential environmental impacts, and cost estimates. The cost of a 9-month mechanical drawdown alternative was estimated at $9-12 million. Reduced internal nutrient loading, water quality enhancement, and fish and wetland wildlife habitat improvement are among the benefits expected to result from lake sediment restoration techniques involving extreme drawdowns.

- Additional feasibility assessments needed for identifying management strategies aimed at restoring sediments in lakes with organic sediment accumulation problems will be developed as diagnostic projects are completed.

Restoration/Management Program

Project OCB-301-RM. *Aquatic plant management in the OCB*

◆ Vegetation management in OCB lakes

Ongoing joint FDEP/SJRWMD effort to implement aquatic weed control measures in OCB lakes. Chemical control operations are rendered by the District under contract with FDEP and in accordance with FDEP's aquatic plant management program goals and specifications. Because management of aquatic plant growth in lakes contributes to reduce autochthonous primary production and internal nutrient and organic matter loading, it may additionally serve as a sediment restoration tool in lakes with organic sedimentation problems.

◆ Enhancement of aquatic weed control in OCB lakes

Ongoing multiagency effort (FDEP, SJRWMD, IFAS) aimed at reassessing and enhancing, on a periodic basis, the performance of aquatic weed control measures currently employed in the basin. The final goal of this effort is to identify aquatic plant management practices (preferably ones that integrate chemical, biological, and physical techniques) which best provide for improved hydrilla control, for the continued maintenance control of traditional aquatic weeds, and for the future control of newly established exotic weeds. Enhanced control of aquatic weed growth contributes to the improvement of sediment conditions in lakes with excessive organic sedimentation problems.

Project OCB-306-RM. *Restoration of waterbodies in the OCB*

- Project elements addressing sediment restoration efforts in OCB lakes will be developed as diagnostic and feasibility projects are completed

Project OCB-307-RM. *Urban stormwater assessment and remediation in the OCB*

- Local government stormwater retrofitting assistance

  Ongoing District initiative aimed at co-sponsoring local government efforts to retrofit urban stormwater management systems. Plans to assist the City of Gainesville (Department of Public Works) with stormwater retrofitting in the Hogtown Creek watershed are currently underway. The stormwater retrofitting effort will help reduce sediment and nutrient loading into stormwater systems and downstream receiving waterbodies.

Regulatory Program

Project OCB-402-RG. *Local government environmental protection ordinance assistance*

- Remediation of nonpoint source and unregulated point source pollutant loading into waterbodies of the OCB

  Planned District initiative to assist local governments in the development and implementation of stronger local ordinances and Local Development Regulations for environmental protection that are consistent with pollution prevention and remediation goals established in this plan. Targeted areas of assistance include stormwater management, land use development, and habitat protection. This regulatory effort will enhance the control of unregulated point and nonpoint sources of pollution, thereby contributing to the restoration of water quality and sediments in waterbodies impacted by anthropogenic activities.

Project OCB-403-RG. *Surface water permit review*

- OCB surface water permit review

  Ongoing multi-agency effort to assess the compliance status of surface water related permits in the Orange Creek Basin (e.g. ERP, MSSW, Stormwater, WRM, CUP, Agricultural Discharge permits, NPDES) and to evaluate the need for enhanced enforcement actions and new permit requirements. This effort is critical to the goal of improving water quality and sediment quality in culturally impacted waterbodies.

Interagency Coordination Program

Project OCB-502-I. *Fund procurement coordination*

- Fund procurement coordination for OCB-Plan implementation

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Interagency effort toward procuring funds for the implementation of programs and projects within the OCB-Plan. Funding for implementing projects and project elements needed to address the issue of organic sediment accumulation in OCB lakes is needed.

Project OCB-504-I. *Intergovernmental basin coordination*

- Regional intergovernmental forum

Ongoing District initiative to periodically hold county-based intergovernmental forums aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to ensure the timely notification of state and local government proposed actions which can potentially affect surface water management decisions in the Orange Creek Basin. Close coordination and effective communication is needed among various governmental agencies to facilitate implementation of cooperative measures which prevent and control nutrient enrichment and organic sediment accumulation in Orange Creek Basin lakes. Intergovernmental forums for Alachua County (sponsored by SJRWMD and SRWMD) were initiated in November 1995.

Public Outreach Program

Project OCB 601-P. *Basin and subbasin task forces and advisory councils*

- Orange Creek Basin Advisory Council and Scientific Advisory Committee

Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee (OCB SAC) provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. Among the issues addressed by the Advisory Council is the problem of excessive organic sediments (muck) in lakes (and its environmental consequences) and the possible solutions to this problem.

- Subbasin task forces or working groups

Task forces or working groups which specifically address the issue of organic sediment accumulation in Orange Creek Basin lakes will be created on an "as-needed" basis by request of the public or of the OCB Advisory Council.

Project OCB 602-P. *Citizen volunteer activities*

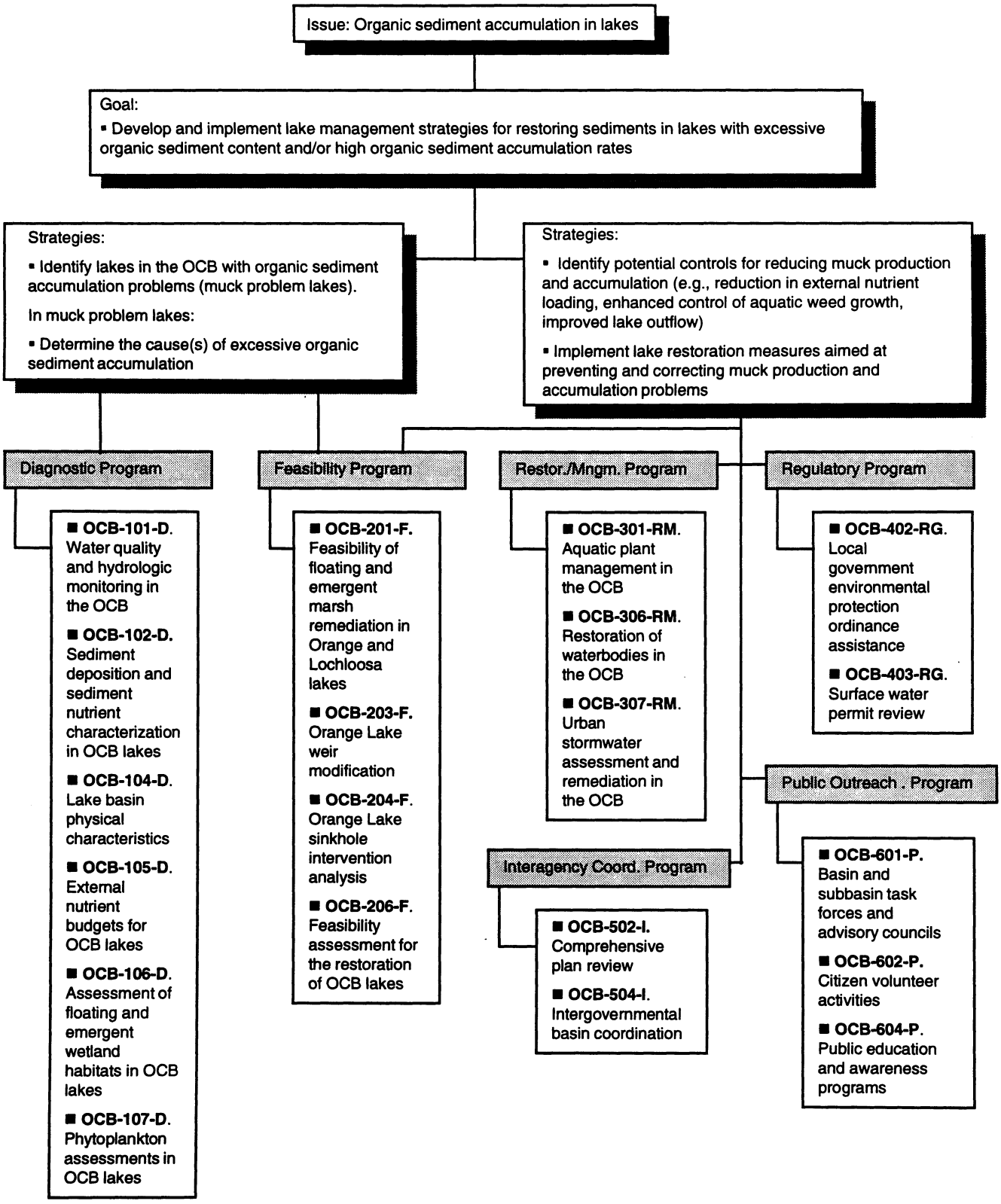
- Volunteer monitoring in the OCB

  Ongoing multi-entity (governmental and nongovernmental) effort aimed at organizing and directing volunteer monitoring activities in the basin. The volunteer stormwater sampling of tributaries in the OCB will provide information needed to effectively address the problem of organic sediment accumulation in OCB lakes (see project OCB-101-D).

Project OCB 604-P. *Public education and awareness programs*

- District ongoing and planned efforts to enhance public (adult and school) education and awareness in the Orange Creek Basin. Elements of these efforts include: (a) educating the public on the subjects of lake eutrophication and muck accumulation, and (b) directing and encouraging local communities/residents to participate in programs/activities aimed at reducing anthropogenic nutrient and sediment loading into surface waterbodies of the basin (e.g. lake/stream cleanup operations, stormdrain stenciling programs, correction of defective septic system operation, implementation of best management practices for the proper use and disposal fertilizers). Some of these public participation activities have already been initiated (see project OCB-602-P; Citizen volunteer activities). These education and awareness programs will be closely coordinated with the local government environmental protection ordinance assistance project (OCB-402-RG).

Figure 32. Issue No. 8: Organic sediment accumulation in lakes.



3.5 FISH AND WETLAND WILDLIFE HABITATS

ISSUE # 9. MANAGEMENT AND ENHANCEMENT OF FISH AND WETLAND WILDLIFE HABITATS

Background

The exceptional ecological significance of the Orange Creek Basin's lakes and wetlands has prompted the designation of several of its major waterbodies as Outstanding Florida Waters (Orange and Lochloosa lakes, Lochloosa Creek, River Styx, and Cross Creek). Additionally, three Orange Creek subbasin regions are ranked as CARL Priority List Project areas (Paynes Prairie, Lochloosa Wildlife, and Newnans Lake Project Areas). Lake and wetland habitats of the Orange Creek Basin provide important nesting, feeding, and refuge areas for numerous species of fish, invertebrates, reptiles, amphibians, and birds, a number of which are listed as rare, threatened, or endangered species (Allen 1986, FDNR 1986). Orange and Lochloosa lakes have long been recognized as providing excellent year-round recreational fisheries, ranking among the State's 24 top freshwater fishing sites (Fernald & Purdum 1992). The presence of high quality nesting and feeding habitats has been a major contributing factor for the productive fishery of these lakes (Allen 1986). Orange and Lochloosa lakes, together with Newnans Lake are designated fish management areas by the FGFWFC.

Factors which are known to impact the availability and quality of lake and wetland habitats and to affect fish and wetland wildlife population dynamics include: altered fire regimes, man-made alterations to natural hydrologic regimes, increased organic sedimentation in lakes, loss of native aquatic plant populations, invasion of hydrilla, and water quality impairment and eutrophication.

Most lake and wetland systems in the Orange Creek Basin today are already afflicted by one or more of the above environmental impacts and have experienced, to a greater or lesser degree, loss of fish and wetland wildlife habitats. Newnans Lake, for example, experienced fish kills in 1989-1991 which involved primarily largemouth bass and black crappie populations (Estes 1993).

The long-term success of any surface water management effort intended to protect and restore lake and wetland habitats and communities relies on the effective prevention, reduction, or elimination, of the underlying causes of environmental damage which lead to a deterioration of these habitats. Consequently, the issue of management and enhancement of fish and wetland wildlife populations and their habitats is intimately connected with other issues addressed in this plan, e.g., altered hydrologic regimes, control of hydrilla, protection and restoration of native aquatic plant communities, lake trophic conditions and trends, sources of pollution, organic sediment accumulation, and future protection of the basin.

Understanding the effects of fire, hydrology, water quality, aquatic vegetation, and lake sediment quality on lake and wetland habitat structure and dynamics is the key to developing sound lake and wetland habitat management strategies aimed at protecting and enhancing native fish and wetland wildlife populations. The management of biological communities in lake and wetland systems needs to be ecosystem based rather than resource based, and should include the following elements:

- Protection/restoration of natural hydrologic regimes (natural water level fluctuations) which enhance spatial and temporal habitat heterogeneity, thus allowing for healthy, dynamic, and diverse lake and wetland communities.
- Protection of natural fire regimes.

- Protection of lake and wetland habitats from human-induced physical destruction/disruption and fragmentation.
- Protection of water quality from cultural influences.
- Enhancement of lake sediment quality.
- Maintenance of nuisance aquatic plants (e.g. hydrilla) at levels considered non-harmful to native fish and wetland wildlife populations.
- Enhancement of native aquatic plant populations of high habitat value for fish and wetland wildlife species.

Basin management goal for the management and enhancement of fish and wetland wildlife habitats

The major goal associated with this issue is to develop and implement water resource management strategies which provide for the protection, restoration, and/or rehabilitation of high-quality lake and wetland habitats in the Orange Creek Basin and for the maintenance and enhancement of native fish and wetland wildlife populations.

Basin management strategies for the management and enhancement of fish and wetland wildlife habitats

The following strategies will be employed to attain the above goal:

- Carry out a basin-wide aquatic and wetland habitat inventory/analysis and identify specific areas within the basin in need of habitat restoration.
- Carry out surveys for threatened and endangered species, species of special concern, and other species of regional significance in lake and wetland habitats of the basin.

- Develop management strategies for specific areas in need of habitat restoration.
- Implement programs and projects designed to restore or rehabilitate native fish and wetland wildlife habitats.
- Identify land protection measures, such as proposed new land acquisitions and improved management of public and privately owned lands (implementation of BMPs) needed to secure the future ecological integrity of native fish and wetland wildlife habitats and communities.

Projects to address the management and enhancement of fish and wetland wildlife habitats

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 34, p. 191). Project elements are ranked by status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority,

⊙ planned-second priority, and ⊙ planned-third priority.

Diagnostic Program

Project OCB-101-D. *Water quality and hydrologic monitoring in the Orange Creek Basin*

◆ District water quality monitoring in the OCB

Ongoing District water quality sampling effort aimed at monitoring surface water quality on a monthly basis at 26 sites in the Orange Creek Basin. Water quality is a major component of habitat quality for aquatic organisms. Characterization of water quality is therefore of fundamental importance in the analyses of fish and aquatic wildlife habitats and communities.

Project OCB-102-D. *Sediment deposition and sediment nutrient characterization in OCB lakes*

★ Effects of short-term drawdown on sediments and nutrients of Newnans Lake (Phase I & II)

Completed contractual project by Gottgens & Crisman (1992a,b) for the SJRWMD designed to empirically evaluate the impact of a short-term drawdown on the retention, oxidation and compaction, and deposition and redistribution of organic sediments and particulate nutrients in Newnans Lake.

These studies determined that during the 1989 Newnans Lake drawdown, only a small amount of organic sediments and nutrients were flushed and little oxidation of exposed sediments occurred. The lack of flushing was attributed to the fact that the lake levels were unusually low prior to the initiation of the drawdown, so that only about 20% of the lake water was removed. Organic sediments were variably redistributed in the lake, however there was no consistent transfer of sediments from littoral to profundal zones. It was recommended that short-term drawdowns be initiated when lake levels are high and wind speeds are greater than normal. The results and recommendations of this study have important potential application to the identification and development of plans for the restoration of fish and wetland wildlife habitats in Newnans Lake.

◆ Sediment and water quality reconnaissance of Newnans Lake

Ongoing District effort aimed at monitoring changes in sediment stratigraphy and physical characteristics in Newnans Lake and changes in water quality both in Newnans Lake and in its inflow (Hatchet Creek) and outflow (Prairie Creek) during an 18-month period (1991-1993) immediately prior to and following the removal of the flashboards at Prairie Creek dam. Sampling has been completed under contract with King Engineering Associates, Inc. (Tampa) and analysis of data is currently underway by District scientists. This reconnaissance will assess if the changes observed in sediment stratigraphy and water quality in Newnans Lake following the removal of the dam signify improvements in fish and wetland wildlife habitat quality.

◆ Historical sediment and nutrient accumulation rates and past water quality in Orange Lake

District contractual effort currently underway aimed at utilizing paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Orange Lake, to determine the timing of these changes, and to investigate their possible causes. Phase II of this study (planned) will investigate historical sediment and nutrient accumulation and water quality in vegetated areas of the lake (floating marsh and hydrilla). Results from phase II and from other diagnostic efforts (OCB-106-D; Assessment of floating and emergent wetland habitats in OCB lakes) will be used to reconstruct the history of wetland vegetation in Orange Lake and to understand possible causes for historical changes in vegetation assemblages. This information will provide an important basis for identifying target goals for the restoration and maintenance of fish and wetland wildlife habitats in Orange Lake and for evaluating lake management alternatives which could potentially affect the quality and quantity of these habitats.

Project OCB-104-D. *Lake basin physical characteristics*

- Bathymetry and sediment thickness survey in Orange Lake

District contractual effort currently underway aimed at mapping the bathymetry of Orange Lake and the depth and thickness of its muck sediments. This survey will: (a) provide missing bathymetric data for the lake, (b) generate a map of muck depth and thickness throughout the lake, and (c) relate muck depth and thickness information to plant cover. Information from this survey is needed to complete the diagnostic project: Fish and wetland wildlife assessments in the basin (OCB-108-D; Analyses of fish and wetland wildlife habitats and populations in Orange, Lochloosa, and Newnans lakes).

Project OCB-106-D. *Assessment of floating and emergent wetland habitats in OCB lakes*

- Historical analysis of wetland vegetation in Orange, Lochloosa, and Newnans lakes

District in-house effort currently underway aimed at evaluating historical changes in the abundance, composition, and distribution of floating and emergent vegetation in Orange, Lochloosa, and Newnans lakes and at relating these changes with past human intervention in the basin. The analyses are based on historic and current photographic and cartographic records and on interviews with local residents.

Past changes in wetland vegetation habitat can be analyzed in conjunction with results from other diagnostic efforts within this project and with results from the historical analysis of lake sediment characteristics and organic matter content (project OCB-102-D), in the attempt to explain the current and past status of fish and wetland wildlife habitats in Orange Lake and the possible causes for historical changes in these habitats.

- Characterization of floating and emergent vegetation in Orange Lake

District in-house effort currently underway aimed at describing in detail (based on field on field surveys) the current species composition and the ecological characteristics of floating and emergent marsh vegetation in Orange Lake. Results of this study include a preliminary typological classification of floating and emergent vegetation assemblages and cursory observations on the value of these plant assemblages as habitat for wildlife. This project will generate important baseline information on Orange Lake needed to complete other wetland vegetation studies under this project and the fish and wetland wildlife assessments under project OCB-108-D.

- Formation of floating mats in Orange Lake and causes for historic changes

Planned District contractual effort aimed at identifying the probable mechanisms of formation of floating vegetation mats in Orange Lake. If changes in the abundance and structure of floating mats are documented in the historical analyses of wetland vegetation, then the probable causes for these changes will also be addressed. The information gained from this effort will contribute significantly to understanding the effects changes in floating vegetation may have on the availability and quality of fish and wetland wildlife habitats in Orange Lake.

Project OCB-108-D. *Fish and wetland wildlife assessments in the OCB*

- Fish and wetland wildlife population and habitat analyses in Orange, Lochloosa, and Newnans lakes

  Planned joint SJRWMD/FGFWFC effort to assess, based on field surveys, the current status of fish and wetland wildlife habitats and populations in Orange, Lochloosa, and Newnans lakes. FGFWFC will conduct the diagnostic fisheries surveys for these lakes, as a continuation of their ongoing fisheries assessments. The analyses of fish and wetland wildlife habitats will rely extensively on the results from diagnostic efforts under projects OCB-102-D (Sediment deposition and sediment nutrient characterization in OCB lakes) and OCB-106-D (Assessment of floating and emergent wetland habitats in OCB lakes). The value of floating and emergent vegetation as habitat for fish and wetland wildlife populations will be assessed. The results of these analyses will be used to identify habitat restoration needs for the three lakes and their associated wetlands and to assess the potential impacts of proposed lake management alternatives (e.g. sinkhole intervention in Orange Lake) on fish and wetland wildlife habitats and populations.

- Inventory of T&E, SSC, and rare species in the OCB

  Planned joint SJRWMD/FGFWFC effort to complete a systematic inventory of threatened and endangered species, species of special concern, and rare species for special areas or waterbodies within the Orange Creek Basin. This inventory is needed to determine the degree to which lake and wetland habitats are used by special status species. The results of this effort will constitute an important component of a number of feasibility assessments concerning the restoration and management of floating and emergent vegetation, lake access, and hydrologic modifications (projects OCB-201-F, OCB-202-F, OCB-203-F, OCB-204-F, OCB-205-F, and OCB-206-F).

Project OCB-109-D. *ECONOMIC ASSESSMENT IN THE OCB*

- Analyses of economic benefits from recreational and commercial uses in the OCB

  Planned District contractual effort to assess economic benefits from recreational and commercial uses in the Orange Creek Basin. Such economic analyses will include a current assessment of economic benefits from sport fishing and wildlife-based recreational activities in the Orange Lake/Lochloosa lake area and will determine how economic benefits from these activities have changed over time (since the 1980's). This information, in conjunction with results from other diagnostic efforts for Orange and Lochloosa lakes will provide baseline data by which to measure restoration and management progress toward the goal of enhancing fish and wetland wildlife-based recreational opportunities and their economic benefits.

Feasibility Program

Project OCB-201-F. *Feasibility of floating and emergent marsh remediation in OCB lakes*

- Feasibility of floating and emergent vegetation management in Orange and Lochloosa lakes

Ongoing multi-agency (SJRWMD/FDEP/FGFWFC) effort to evaluate the feasibility for the large-scale removal of floating and emergent vegetation on Orange and Lochloosa lakes. Removal/management methods being tested include mechanical harvesting, burning, and herbiciding. Future continuation of this effort is contingent upon the completion of diagnostic efforts (projects OCB-106-D and OCB-108-D) which would determine if the current abundance and structure of floating and emergent vegetation in Orange and Lochloosa lakes is detrimental to the health and the function of the lake's aquatic and wetland ecosystems. The potential impacts of vegetation removal on the availability of fish and wetland wildlife habitats, on the health of fish and wetland wildlife populations, and on economic benefits from recreational and commercial harvesting of fish and wetland wildlife (including sport fisheries and commercial harvest of alligators) will be addressed in this feasibility assessment.

Project OCB-203-F. *Orange Lake weir modification*

- Orange Lake weir modification; evaluation of management alternatives

Planned effort to identify structural and operational modifications to the U.S. 301 weir, as well as to other downstream structures (e.g. U.S. 301 and railroad levees; Shands Canal) with the purpose of restoring, to the extent practicable and desirable, Orange Lake's natural outflow regime and providing minimum flows for Orange Creek. Analyses of the options will consider potential effects of proposed hydrologic changes to Orange Lake and Orange Creek on fish and wetland wildlife habitat availability.

Project OCB-204-F. *Orange Lake sinkhole intervention analysis*

- Orange Lake sinkhole intervention; evaluation of management alternatives

Planned District in-house effort to evaluate management alternatives related to sinkhole discharge control at the Heagy-Burry Park area of Orange Lake and to assess the potential environmental impacts from these alternatives. The effects of sinkhole discharge control on lake and wetland habitats and fish and wetland wildlife populations will be evaluated, based on the results of various diagnostic efforts (under projects OCB-102-D, OCB-106-D, and OCB-108-D)..

Project OCB-205-F. *Water management alternatives for Paynes Prairie*

- ◆ Paynes Prairie vegetation succession model

  Ongoing contractual effort by the University of Florida for the FDEP entitled: GIS-based Succession Model for Prairie Creek Pourpoint Basin, Paynes Prairie State Preserve. Principal Investigator: Gregg White.

  This investigation assesses water volume alternatives for distribution through the Camps Canal culvert system and develops vegetation succession models to show the effects that changing water regimes, water quality, and sediment conditions have on wet prairie and wetland vegetation assemblages. The effects of hydrologic disturbance and external nutrient and sediment loading on native wetland plant communities will be determined and implications to fish and wildlife populations associated with these habitats will be assessed.

Project OCB-206-F. *Feasibility assessment for the restoration of OCB lakes*

- ★ FGFWFC feasibility assessment of drawdown for restoring Newnans Lake (KBN Engineering)

  Completed report: KBN Engineering and Applied Sciences, Inc. 1993. Assessing the Feasibility of Restoring Newnans Lake. Phase A: Conceptual Engineering Report. Prepared for the Florida Game and Fresh Water Fish Commission, Gainesville, FL.

  Project aimed at evaluating various drawdown alternatives for Newnans Lake with the purpose of restoring lake sediments and fisheries habitat. A mechanical drawdown alternative involving a 9-month holddown duration was considered the preferred option, based on an evaluation of conceptual engineering plans, potential environmental impacts, and cost estimates. The cost of a 9-month mechanical drawdown alternative was estimated at $9-12 million. Reduced internal nutrient loading, water quality enhancement, and fish and wetland wildlife habitat improvement are among the benefits expected to result from lake sediment restoration techniques involving extreme drawdowns.

- ○ Additional feasibility assessments needed for identifying management strategies aimed at protecting and restoring fish and wetland wildlife habitats in the OCB will be developed as diagnostic projects are completed.

Restoration/Management Program

Project OCB-301-RM. *Aquatic plant management in the OCB*

- ◆ Aquatic vegetation monitoring on Orange, Lochloosa, and Newnans lakes

  Ongoing FDEP/SJRWMD effort to monitor aquatic plant populations in Orange, Lochloosa, and Newnans lakes as part of the state's aquatic plant management program. Results of these surveys may be used to monitor changes in fish and wetland wildlife habitats following the implementation of aquatic weed control measures.

- Vegetation management in OCB lakes

  Ongoing joint FDEP/SJRWMD effort to implement aquatic weed control measures in OCB lakes. Chemical control operations are rendered by the District under contract with FDEP and in accordance with FDEP's aquatic plant management program goals and specifications. These include fluridone and contact herbicide applications for hydrilla control (whole lake treatments and boat trails) as well as herbicide applications for other exotic weeds. Emergency short-term actions intended to deal with the removal of nuisance vegetation (e.g. dislodged floating islands that cause access problems) are currently being undertaken by the District. Evaluation of the risks that different control measures may pose to fish and wetland wildlife populations is an important aspect in the selection and subsequent implementation of aquatic plant management alternatives.

- Enhancement of aquatic weed control in OCB lakes

  Ongoing multiagency effort (FDEP, SJRWMD, IFAS) aimed at reassessing and enhancing, on a periodic basis, the performance of aquatic weed control measures currently employed in the basin. An important goal of this effort is to identify aquatic plant management practices (preferably ones that integrate chemical, biological, and physical techniques) which provide for effective control of nuisance aquatic vegetation in lakes, while causing little or no impacts to existing fish and wetland wildlife populations.

Project OCB-302-RM. *Lake littoral zone restoration in the OCB*

- Native aquatic plant revegetation in OCB lakes (littoral planting effort by the FGFWFC currently underway at Newnans Lake)

  Ongoing FGFWFC effort to re-establish, through littoral revegetation techniques, native aquatic plant populations in Newnans Lake with the purpose of restoring lost or threatened fish and wetland wildlife habitats and improving water quality and shoreline erosion problems. Past efforts to plant bulrush (*Scirpus californicus*) and maidencane (*Panicum hemitomon*) along Newnans Lake shoreline have been relatively successful.

Project OCB-303-RM. *Wetland/water resource protection through new land acquisition in the OCB*

- Assessment of potential land acquisition in the OCB

  Ongoing District initiative (part of the District's Basin Acquisition Studies Program) aimed at updating and evaluating the potential acquisition of environmentally sensitive lands in the Orange Creek Basin with the goal of restoring and/or preserving water resources in the basin. Acquisition and sound management of these lands offers an effective means of protecting on a long-term basis, fish and wetland wildlife habitats and populations in the basin.

Project OCB-304-RM. *Land management in public lands of the OCB*

- ◆ Land management on District properties

  Ongoing District effort to develop and implement, in cooperation with other agencies, sound, ecosystem-based management plans for District properties. The overriding management objective is for ecological resource protection and restoration. The Protection and enhancement of high-quality lake and wetland habitats and their associated fish and wildlife populations are important goals of these land management efforts.

Project OCB-305-RM. *Outstanding Florida waters designation review for the OCB*

- ○ Expansion of OFW designations in the Orange Creek Basin

  Planned intergovernmental effort aimed at (a) evaluating the need for augmenting OFW designations in the Orange Creek Basin and (b) preparing and submitting proposals for the designation of new waterbodies as OFWs. Expansion of the OFW designations in the Orange Creek Basin offers a means of legally protecting water resources of exceptional ecological or recreational significance from water quality degradation and cultural eutrophication. Benefits to fish and wetland wildlife habitats and populations from expanded OFW designations in the Orange Creek Basin ensue.

Project OCB-306-RM. *Restoration of waterbodies in the OCB*

- ○ Project elements addressing the management and enhancement of fish and wetland wildlife habitats in the Orange Creek Basin will be developed as diagnostic and feasibility projects are completed

Regulatory Program

Project OCB-401-RG. *Minimum flows and levels*

- ◆ Minimum flows and levels in the OCB

  Ongoing effort to set environmentally based minimum flows and levels for Paynes Prairie, Orange Creek, and Orange, Lochloosa, and Newnans lakes (by FY 1995/1996). The minimum flows and levels determinations will assess the hydrologic requirements of functional lake and wetland ecosystems and will help identify hydrologic goals for these water bodies and their associated wetlands. Adoption of the minimum flows and levels rule for the OCB waterbodies will ensure that consumptive uses of these surface waters do not cause significant harm to water resources and associated natural systems. A major environmental criterion used to determine minimum flows and levels in natural waterbodies is the protection and maintenance of functional fish and wetland wildlife habitats.

Project OCB-403-RG. *Surface water permit review*

- OCB surface water permit review

Ongoing multi-agency effort to assess the compliance status of surface water related permits in the Orange Creek Basin (e.g. ERP, MSSW, Stormwater, WRM, CUP, Agricultural Discharge permits, NPDES) and to evaluate the need for enhanced enforcement actions and new permit requirements. This effort is critical to the goal of protecting and restoring the ecological integrity of waterbodies (including the maintenance of functional fish and wetland wildlife habitats) affected by permitted activities.

Interagency Coordination Program

Project OCB-503-I. *Fund procurement coordination*

- Fund procurement coordination for OCB-Plan implementation

Interagency effort toward procuring funds for the implementation of programs and projects within the OCB-Plan.

Project OCB-504-I. *Intergovernmental basin coordination*

- Regional intergovernmental forum

Ongoing District initiative to periodically hold county-based intergovernmental forums aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to ensure the timely notification of state and local government proposed actions which can potentially affect surface water management decisions in the Orange Creek Basin. The maintenance of fish and wetland wildlife habitats through the protection of water quality, wetland vegetation, and lake sediments needs to be a common goal for all governmental agencies.

Public Outreach Program

Project OCB 601-P. *Basin and subbasin task forces and advisory councils*

- Orange Creek Basin Advisory Council and Scientific Advisory Committee

Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee (OCB SAC) provides the technical and scientific expertise needed to evaluate specific issues being addressed by the

OCB Advisory Council. Among the issues addressed by the Advisory Council is the management and enhancement of fish and wetland wildlife habitats.

- Subbasin task forces or working groups

Task forces or working groups which specifically address the issue of management and enhancement of fish and wetland wildlife habitats in the Orange Creek Basin will be created on an "as-needed" basis by request of the public or of the OCB Advisory Council.

Project OCB 602-P. *Citizen volunteer activities*

- Habitat cleanups

Ongoing series of cooperative (multi-agency) efforts aimed at sponsoring and organizing local citizen habitat cleanups in the Orange Creek Basin. Recently completed habitat cleanups include a Paynes Prairie cleanup (April 1995, University of Florida Wetlands Club), a Hogtown Creek cleanup (September 1995, multi-agency initiative), and a Newnans lake/Prairie Creek cleanup (Celebrate the St. Johns River Cleanup, Water Management District/County initiative). Habitat cleanups contribute to improve the quality, and hence, the functionality of aquatic and wetland environments for use by fish and wetland wildlife.

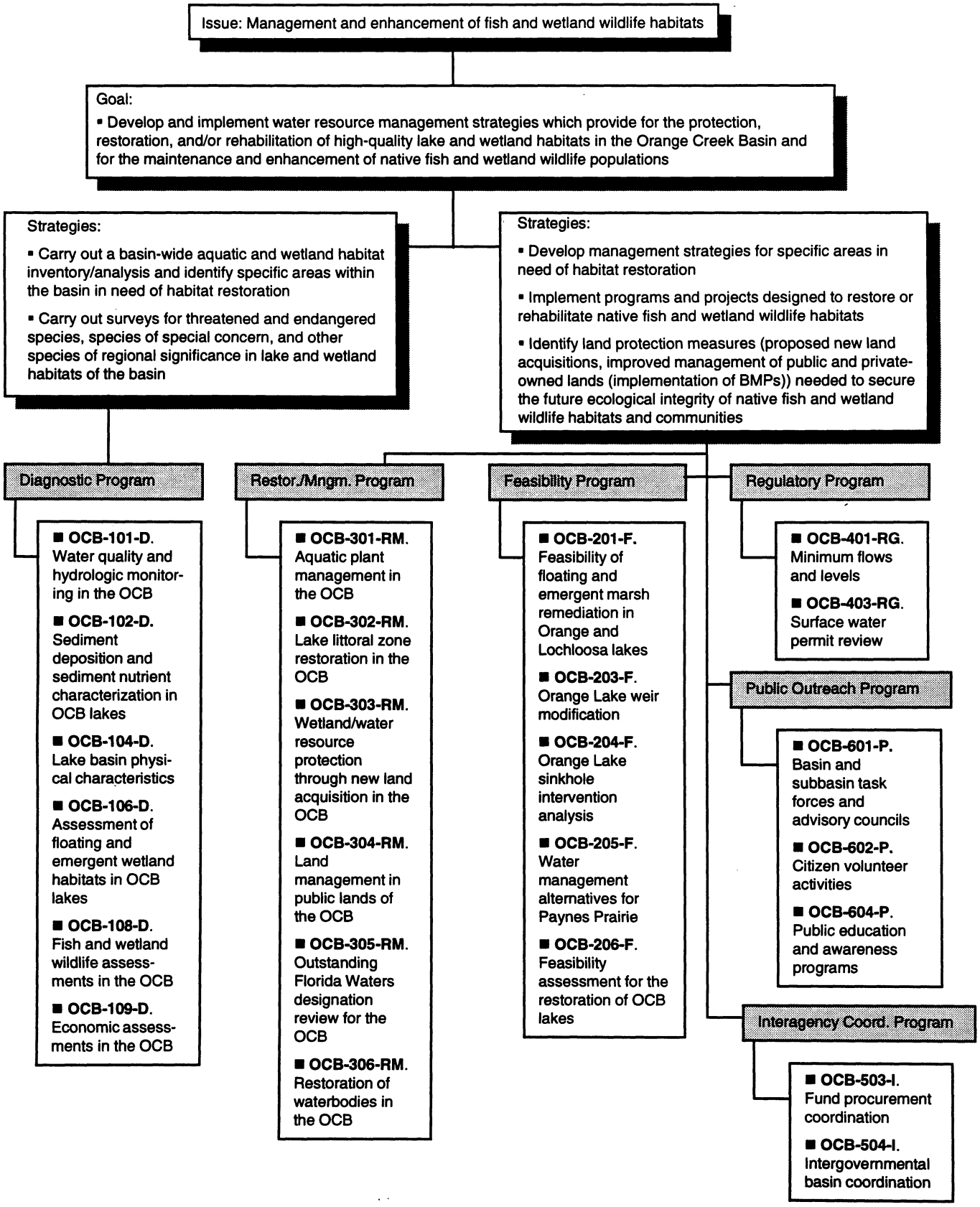
- Volunteer monitoring in the OCB

Ongoing Multi-entity (governmental and nongovernmental) effort aimed at organizing and directing volunteer monitoring activities in the basin. Volunteer bird counts organized by nongovernmental organizations such as the Audubon Society are an example of highly effective volunteer monitoring activities which contribute significantly to the overall goal of maintaining and enhancing fish and wetland wildlife populations in the Orange Creek Basin.

Project OCB 604-P. *Public education and awareness programs*

- District ongoing and planned efforts to enhance public (adult and school) education and awareness in the Orange Creek Basin concerning the issue of fish and wetland wildlife management and protection through the preservation and enhancement of lake and wetland habitats.

Figure 33. Issue No. 9: Management and enhancement of fish and wetland wildlife habitats.



3.6 FUTURE PROTECTION OF THE BASIN

ISSUE # 10. LAND CONSERVATION AND RESTORATION

Background

The principal objective of land conservation and restoration, as it pertains to the Orange Creek Basin's surface water management plan is summarized in the SJRWMD's definition of their general land acquisition goal: "to preserve lands that produce high water resource and related environmental benefits, and to facilitate the restoration of altered systems from which such benefits have been lost" (SJRWMD 1995b). Hence conservation and restoration are two main components of the larger issue, protection of water resources in the basin.

Public land acquisition (federal, state, regional, or local) has proven to be one of the most effective means for protecting environmentally sensitive areas from future degradation caused by human use and development. Although often criticized for lowering the local tax base through withdrawal of taxable lands, public land acquisitions in District lands usually have an insignificant negative impact on local economy (SJRWMD 1989). This is largely because the acquired lands, which are often agricultural or silvicultural lands or undeveloped wetlands, have a low taxable value to begin with (SJRWMD 1989). In fact, public lands can in some cases augment economic benefits to local governments given their relatively low demands for service costs and their potential for generating sales tax revenue from recreation or tourism activities.

An innovative form of land acquisition for rural areas consists of the purchase of development rights, at a fraction of the full market value of the property. This is also referred to as less-than-fee-acquisition or conservation easement. Although under this type

of purchase agreement the seller is allowed to continue its land use activities, it does so under restricted conditions dictated by the buyer. The land is additionally protected from future residential or commercial development in perpetuity and can be conditioned and opened for public recreational use. Less-than-fee acquisition in the Orange Creek Basin is exemplified with the recent purchase of 16,994 acres of silvicultural lands (from Georgia Pacific) within the CARL Lochloosa Wildlife Project Area.

In addition to protecting environmentally sensitive lands from future degradation, public land acquisition also offers an effective means of restoring damaged ecosystems of high ecological/hydrological value. Acquisitions for restoration commonly involve agricultural lands such as muck farms adjacent to lakes and rivers. The SJRWMD has been actively involved in the acquisition and restoration of various muck farm areas in the upper Ocklawaha River Basin. In the Orange Creek Basin, the District is contemplating future acquisition of agricultural land along the upper Orange Creek (Orange Creek Run Project area; Figure 18). Restoration of Orange Creek, the main outflow for the Newnans/ Orange/Lochloosa hydrologic system, would significantly enhance water management capabilities for the basin.

The exceptional biological qualities of Orange Creek also make this sand-bottomed stream an ideal candidate for protection and restoration. Cursory biological surveys of Orange Creek, downstream of Shands Muck Farms, reveal the existence of an extremely rich and diverse aquatic macroinvertebrate biota, indicative of a well-balanced community and stable water quality (FDER 1992b). For this reason, the FDEP, in their Statewide Surface Water Ambient Monitoring Program, has selected Orange Creek as a candidate reference (benchmark) stream for the Florida Flatwoods Subregion (Southern Coastal Plains Ecoregion) of the State.

Future District land acquisitions in the Orange Creek Basin are currently focused on further expanding protection in the CARL Lochloosa Wildlife Project Area by either purchasing land or buying development rights for several smaller parcels in the area (SJRWMD 1995b). The District will then target lands within the Prairie Creek-Newnans Lake Project Area and, eventually, within the Orange Creek Run Project Area.

Basin management goals for land conservation/restoration in the Orange Creek Basin

The major goals associated with this issue are:

- Promote the preservation of lands in the Orange Creek Basin that produce high water resource and related environmental benefits
- Facilitate the restoration of altered systems from which such benefits have been lost
- Develop and implement sound management and restoration plans for acquired properties that support water resource preservation and protection, while providing for compatible recreational use

Basin Management Strategies for land conservation/restoration in the Orange Creek Basin

Several strategies have been identified to achieve the goals specified above:

- Identify and prioritize needs for land acquisition in the OCB, based on close coordination with state, regional, and local governments and public input.
- Consider land acquisition alternatives which best provide for effective water resource protection/restoration while minimizing impacts to local economies

- Enhance public awareness of the benefits and values of public land acquisition in the OCB as a means of achieving the long-term preservation of aquatic and wetland ecosystems and their associated natural and recreational resources.
- Implement land acquisition in the basin in accordance to the District's 5-year plan for land acquisition and management

Projects to implement strategies for land conservation/restoration in the Orange Creek Basin

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 34, p 210). Project elements are ranked according to status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority,

⊙ planned-second priority, and ⊙ planned-third priority.

Diagnostic Program

Project OCB-101-D. *Water quality and hydrologic monitoring in the Orange Creek Basin.*

◆ District water quality monitoring in the OCB

Ongoing District water quality sampling effort aimed at monitoring surface water quality on a monthly basis at 26 sites in the Orange Creek Basin. Water quality monitoring in receiving waterbodies may be used as a screening tool to measure the progress of restoration/ management measures implemented on conservation lands.

◆ Review and analysis of historical and current water quality conditions in the OCB

Ongoing District project to be continued in FY 1995-96. Completion of this project is critical for the documentation of long-term water quality changes in Orange Creek Basin waterbodies. This information will be used to set target water quality management and restoration goals for acquired properties.

Project OCB-106-D. *Assessment of floating and emergent wetland habitats in OCB lakes*

★ Wetlands mapping/inventory in the OCB

Completed District in-house effort to generate a wetlands database on GIS for the Orange Creek Basin based on aerial 1:24,000 color infrared photography from 1990-1991. This database provides recent quantitative information on composition, aerial coverage, and distribution of wetland vegetation types in the basin. The wetlands GIS database may be used to identify environmentally sensitive lands suitable for potential acquisition and to describe, map, and catalog wetland vegetation assemblages in newly acquired lands. This information may be used to develop appropriate vegetation management plans to meet the maintenance or restoration needs of the property.

◆ Historical analysis of wetland vegetation in Orange, Lochloosa, and Newnans lakes

District in-house effort currently underway aimed at evaluating historical changes in the abundance, composition, and distribution of floating and emergent vegetation in Orange, Lochloosa, and Newnans lakes and at relating these changes with past human intervention in the basin. The analyses are based on historic and current photographic and cartographic records and on interviews with local residents. Results of this effort may be used to identify target (pre-impact) goals for wetland vegetation restoration on conservation lands adjoining these lakes.

Project OCB-108-D. *Fish and wetland wildlife assessments in the OCB*

● Fish and wetland wildlife population and habitat analyses in Orange, Lochloosa, and Newnans lakes

Planned joint SJRWMD/FGFWFC effort to assess, based on field surveys, the current status of fish and wetland wildlife habitats and populations in Orange, Lochloosa, and Newnans lakes. The results of these analyses will be used to identify habitat maintenance or restoration needs for the three lakes and their associated wetlands and to assist in identifying sound, ecosystem-based management plans for adjoining uplands and wetlands (in the Lochloosa Wildlife Management and the Newnans Lake-Prairie Creek Conservation areas).

● Inventory of T&E, SSC, and rare species in the OCB

Planned joint SJRWMD/FGFWFC effort to complete a systematic inventory of threatened and endangered species, species of special concern, and rare species for special areas or waterbodies within the Orange Creek Basin. Special status species inventories will also be completed for conservation lands in the Basin. Results of these inventories will in large part dictate the degree of protection these lands and their adjoining waterbodies will receive to provide for the long-term survival and well-being of these species.

Project OCB-109-D. *Economic assessments in the OCB*

- Analyses of economic benefits from recreational and commercial uses in the OCB

  Planned District contractual effort to assess economic benefits from recreational and commercial uses in the Orange Creek Basin. Such economic analyses include assessments of economic consequences (impacts and/or benefits) of proposed land acquisition initiatives in the Orange Creek Basin, as they relate to existing or potential commercial (agricultural, silvilcultural) and recreational (game-hunting, sport-fishing) uses.

Feasibility Program

Project OCB-206-F. *Feasibility assessment for the restoration of OCB lakes*

- Feasibility assessments needed for identifying land acquisition needs and associated land management/restoration needs to provide for the restoration of lakes in the Orange Creek Basin will be developed as diagnostic projects and other feasibility projects are completed.

Restoration/Management Program

Project OCB-303-RM. *Wetland/water resource protection through new land acquisition in the OCB*

- Assessment of potential land acquisition in the OCB

  Ongoing District initiative (part of the District's Basin Acquisition Studies Program) aimed at updating and evaluating the potential acquisition of environmentally sensitive lands in the Orange Creek Basin with the goal of restoring and/or preserving water resources in the basin. Future District land acquisitions in the Orange Creek Basin are currently focused on further expanding protection in the CARL Lochloosa Wildlife Project Area. Other potential land acquisitions include portions of the Prairie Creek-Newnans Lake Project Area and the Orange Creek Run Project Area.

Project OCB-304-RM. *Land management on public lands of the OCB*

- Land management on District properties

  Ongoing District effort to develop and implement, in cooperation with other agencies, sound, ecosystem-based management plans for District properties. The overriding management objective is for ecological resource protection and restoration and compatible recreational use. Development of the management plans relies heavily on results from diagnostic and feasibility projects listed above.

Project OCB-305-RM. *Outstanding Florida Waters designation review for the OCB*

- Expansion of OFW designations in the Orange Creek Basin

  Planned intergovernmental effort aimed at (a) evaluating the need for augmenting OFW designations in the Orange Creek Basin and (b) preparing and submitting proposals for the designation of new waterbodies as OFWs. Expansion of the OFW designations in the Orange Creek Basin offers a means of legally protecting water resources of exceptional ecological or recreational significance from water quality degradation. Expansion of OFW designations to include waterbodies or sections of waterbodies within newly acquired conservation lands (e.g., portions of Lochloosa Creek south of State Road 20) needs to be addressed with priority.

Project OCB-306-RM. *Restoration of waterbodies in the OCB*

- Waterbody restoration plans in public conservation lands will be developed in tandem with land management plans as diagnostic and feasibility projects are completed.

Regulatory Program

(no projects are pertinent to this issue)

Interagency Coordination Program

Project OCB-503-I. *Fund procurement coordination*

- Fund procurement coordination for OCB-Plan implementation

  Interagency effort toward procuring funds for the implementation of programs and projects within the OCB-Plan. Funding for District land acquisition and management in the basin is obtained primarily from state sources (P-2000 and Save Our Rivers Programs) and from District levied ad valorem taxes (see SJRWMD's 1995 Five-Year Plan for Land Acquisition and Management).

Project OCB-504-I. *Intergovernmental basin coordination*

- Regional intergovernmental forum

  Ongoing District initiative to periodically hold county-based intergovernmental forums aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to ensure the timely notification of state and local government proposed actions which can potentially affect surface water management decisions in the Orange Creek Basin. Coordinated planning for the future acquisition of potential conservation lands and notification of proposed land management changes in existing public lands are two examples of land acquisition and management needs expected to benefit from the intergovernmental forum initiative.

Public Outreach Program

Project OCB-601-P. *Basin and subbasin task forces and advisory councils*

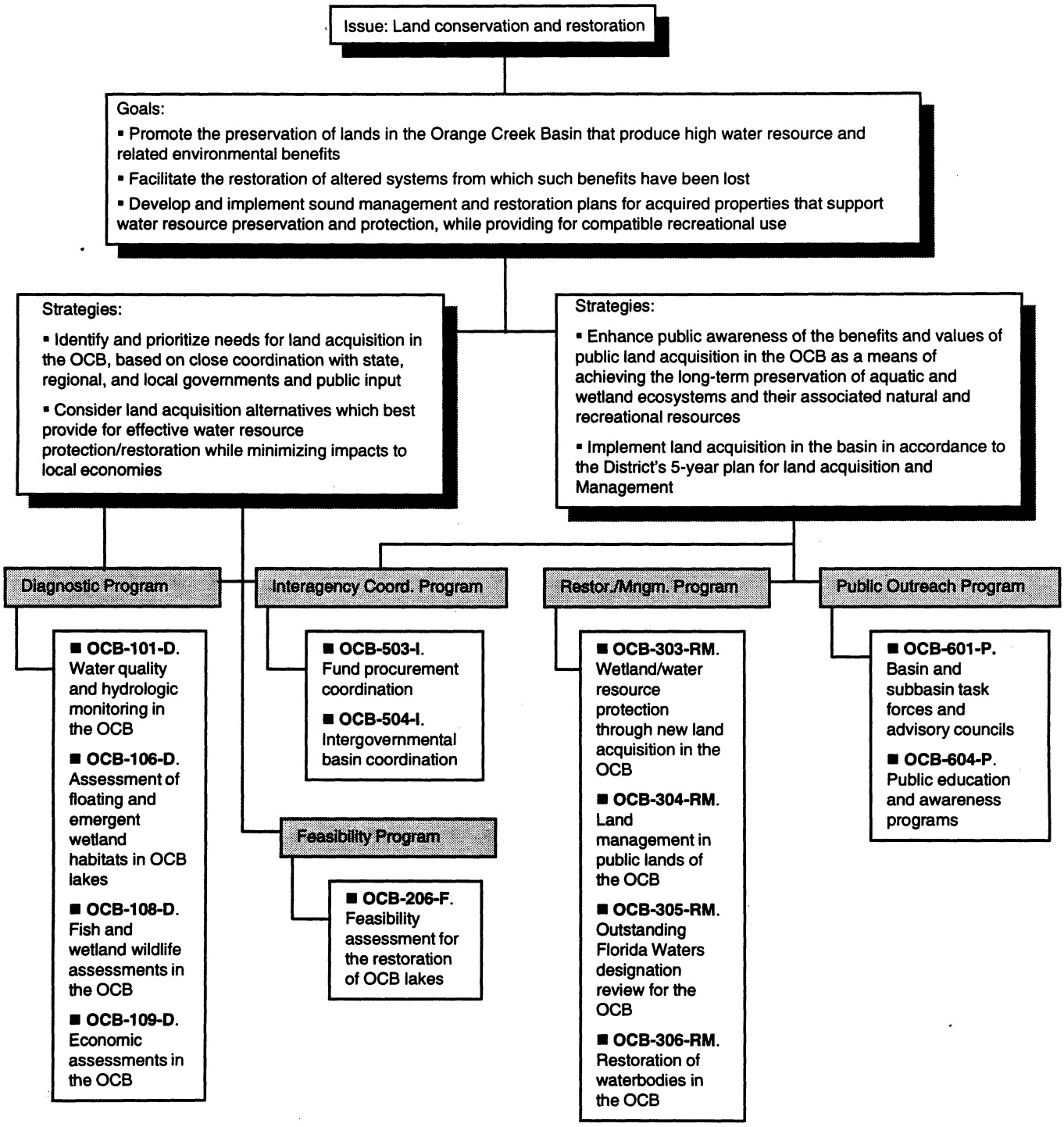
- Orange Creek Basin Advisory Council and Scientific Advisory Committee

  Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee (OCB SAC) provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. Land acquisition and management needs related to the goal of preserving and restoring water resources and related environmental benefits is an important issue addressed by the Orange Creek Basin Advisory Council.

Project OCB-604-P. *Public education and awareness programs*

- District ongoing and planned efforts to enhance public (adult and school) education and awareness in the Orange Creek Basin. An important area of focus of this effort deals with enhancing awareness of the values and benefits of public land acquisition as a means of achieving the goals of (a) conserving and restoring water resources and their associated ecosystem benefits and (b) providing compatible recreational opportunities to the public.

Figure 34. Issue No. 10: Land Conservation and Restoration.



3.7 PUBLIC OUTREACH

ISSUE # 12. PUBLIC AWARENESS AND PARTICIPATION

Background

Success in implementing the Orange Creek Basin surface water management plan depends to a large extent on public support, and public support is in turn gained through the implementation of an integrated and effective outreach program. Ultimately, outreach promotes environmental education and stewardship in all public sectors and informs community groups and individuals about actions needed to manage and protect natural resources.

As a human resource tool, outreach provides the District with ways to effectively communicate with a broad cross section of target groups (ranging from elected government officials to local homeowners) on a wide range of issues, thereby addressing existing needs which may interfere with sound management and protection of water resources in a basin. Some outreach needs which have been identified for the Orange Creek Basin are: (1) increased public awareness and education, (2) increased public involvement (stewardship) in basin initiatives, and (3) improved inter-agency and inter-governmental coordination.

Increased public awareness and education enables local residents and lake users to support actions which are beneficial to the well-being of the basin's aquatic ecosystems. A public which demonstrates heightened awareness and knowledge on how local aquatic ecosystems function, on the problems that afflict them, and on the possible causes of these problems will undoubtedly be better prepared to become involved in local water resource issues and to assume the role of stewards of their environment.

Public involvement in basin issues and management decisions may be encouraged through participation in grass roots activities such as habitat cleanups and voluntary citizen monitoring programs, and in local nongovernmental organizations. Special interest group meetings such as task forces, advisory councils, and local or regional workshops also provide opportunities for public participation and involvement. The current Orange Creek Basin Advisory Council exemplifies a public outreach initiative which has effectively enhanced public involvement and contributed toward increasing public awareness and education concerning basin issues and problems.

Given the number of different government agencies involved in natural resource protection and management issues in the Orange Creek Basin, optimal inter-agency cooperation and consensus is necessary if the basin's comprehensive surface water management plan is to be implemented effectively, and if it is to have full public support. As a public outreach initiative, the Orange Creek Basin Advisory Council contributes importantly to the improvement of inter-governmental and government/public communication and functions as a forum for consensus reaching among citizens and government agencies regarding basin management issues.

Basin management goals for public awareness and participation in the Orange Creek Basin

The main public outreach goals for the Orange Creek Basin are to:

- enhance public awareness and education
- increase public involvement in basin initiatives
- improve inter-governmental coordination

Public Outreach strategies for addressing the issue of public awareness and participation in the Orange Creek Basin

The following strategies have been identified to achieve the goals specified above:

- Disseminate information to the public through:

  Publications

  - brochures (e.g. for local fishermen at public boat ramps)
  - general fact sheets on the OCB
  - topic-specific fact sheets (white sheets) for homeowners or lake resident groups, nonresident anglers/lake users, and public meeting attendees
  - feature stories in local newspapers, regional sports (angler) magazines, District publications (Streamlines)

  Broadcasts

  - radio spots (e.g. "Streamlines on the Air")
  - T.V. broadcasts

- Sponsor local and regional community events:
  - technical/public workshops with media coverage
  - displays or information booths at regional conferences or workshops
  - community volunteer activities (e.g. habitat cleanups)

- Develop training programs and coordinate citizen volunteer efforts involving restoration projects, water quality monitoring, etc.

- Provide technical support and other assistance to advisory councils (e.g. OCB Advisory Council and the OCB Scientific Advisory Committee), task forces, civic organizations, and homeowners groups

- Sponsor and coordinate intergovernmental activities and meetings

- Develop and implement adult and school education programs

Projects to implement strategies for enhancing public awareness and participation in the Orange Creek Basin.

The following programs, projects, and project elements are considered necessary to implement the above strategies (summarized in Figure 35, p. 218). Project elements are ranked according to status, as indicated by the following bullet symbols:

★ completed, ◆ in progress, ● planned-first priority,

⊙ planned-second priority, and ⊙ planned-third priority.

Interagency Coordination Program

Project OCB-504-I. *Intergovernmental basin coordination.*

- ◆ Regional intergovernmental forum

  Ongoing District initiative to periodically hold county-based intergovernmental forums aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to ensure the timely notification of state and local government proposed actions which can potentially affect surface water management decisions in the Orange Creek Basin.

Public Outreach Program

Project OCB-601-P. *Basin and subbasin task forces and advisory councils*

- ◆ Orange Creek Basin Advisory Council and Scientific Advisory Committee

  Currently active multi-member groups appointed by the SJRWMD Governing Board to address Orange Creek Basin issues. The primary function of the OCB Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee (OCB SAC) provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. In accordance to the Florida Sunshine Law, all meetings held by either the Advisory Council or the Scientific Advisory Committee are open to the public. Public comment and participation is strongly encouraged at these meetings.

- Subbasin task forces or working groups

  Planned District outreach initiative to organize task forces or working groups aimed at addressing in greater detail specific basin issues identified by the OCB Advisory Council or the OCB Scientific Advisory Committee. These task forces will be created on an "as-needed" basis by request of the OCB Advisory Council, the OCB SAC, or the public.

Project OCB-602-P. *Citizen volunteer activities*

- Habitat cleanups

  Ongoing series of cooperative (multi-agency) efforts aimed at sponsoring and organizing local citizen habitat cleanups in the Orange Creek Basin. Recently completed habitat cleanups include a Paynes Prairie cleanup (April 1995, University of Florida Wetlands Club), a Hogtown Creek cleanup (September 1995, multi-agency initiative), and a Newnans lake/Prairie Creek cleanup (Celebrate the St. Johns River Cleanup, Water Management District/County initiative). Habitat cleanups are an effective way of enhancing public awareness on the importance of pollution prevention and ecosystem protection. By directly involving citizens in local community restoration actions, habitat cleanups additionally contribute to increase feelings of accomplishment and motivation at a grass roots level.

- Volunteer monitoring in the OCB

  Ongoing multi-entity (governmental and nongovernmental) effort aimed at organizing and directing volunteer monitoring activities in the basin. The largest existing volunteer monitoring effort active in the Orange Creek Basin is the Lake Watch Program, a water quality monitoring network organized by the Department of Fisheries and Aquatic Sciences of the University of Florida. Other volunteer efforts will soon be initiated, such as stormwater monitoring of tributaries in the basin. By allowing active participation of citizens in the data collection process, volunteer monitoring activities effectively enhance the public's sense of involvement and accomplishment in the basin.

Project OCB-603-P. *Local government commission updates*

- City and county commissions meeting updates

  Planned District outreach effort to stay informed regarding items discussed at city and county commission meetings which pertain to basin surface water management and protection issues such as stormwater management needs, flood control needs, and aquatic resources protection. The city and county commission meeting updates contribute to the public outreach goal of enhancing intergovernmental coordination in the basin.

Project OCB-604-P. *Public education and awareness programs*

- Adult awareness program

  Ongoing District effort aimed at identifying public (adult) education needs with the goal of enhancing awareness of basin issues and/or problems. Several efforts concerning the preparation of informational support material (e.g. fact sheets, portable displays; Project OCB-

606-P) and presentations at basin and subbasin workshops (OCB-605-P) are have been completed or are currently underway.

- School education and awareness program

  Planned District effort aimed at evaluating informational needs for local school programs (elementary through highschool) with the goal of increasing the awareness among the resident school population of the need and the means to manage and protect water resources in the Orange Creek Basin.

Projects OCB-605-P and OCB-606-P below directly support the public education and awareness project described above.

Project OCB-605-P. *Basin and subbasin workshops*

- ◆ Presentations at scientific meetings

  Ongoing District effort to inform the scientific and technical community of the results and progress of completed and ongoing projects and project elements identified in the OCB Plan. These presentations serve the purpose of (1) enhancing awareness among members of scientific community of basin issues and actions being taken to address these issues, and (2) providing input to basin project managers from scientific peer review.

- ◆ Presentations to local citizen groups

  Ongoing District effort to deliver technical or non-technical presentations to local citizen groups on request. This effort contributes in an important way to the enhancement of public education and awareness on basin issues.

Project OCB-606-P. *Educational and informational support material*

- ◆ Fact sheet for the OCB

  Ongoing District effort to develop informative, multi-purpose fact sheets for general distribution at advisory council, scientific, and local citizen group meetings, or at regional or local community events (e.g. habitat cleanups). A fact sheet containing an overview of the basin and a general description of the main issues currently being addressed in the basin has been completed.

- ◆ Portable display for the OCB

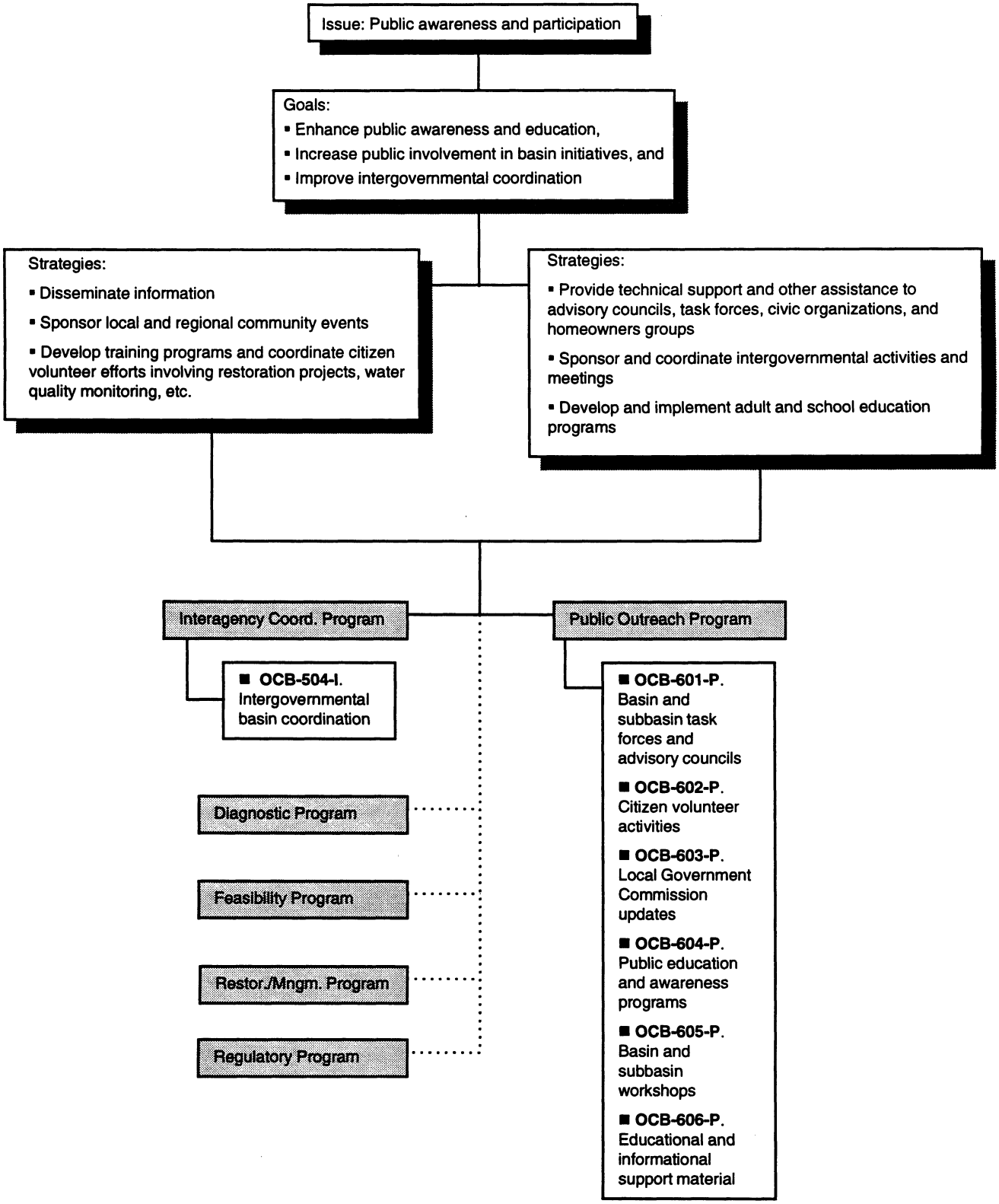
  District initiative to construct a multi-purpose portable display for the Orange Creek Basin to set up at meetings and events. Currently, the portable display contains graphic and textual information complementary to the fact sheet on the basin. The portable display will be updated in the future on an as-needed basis.

- White (fact) sheets

  Planned District effort to produce fact sheets for addressing specific issues or topics concerning the Orange Creek Basin.

Other programs (Diagnostic, Feasibility, Restoration/Management, and Regulatory programs) which support the public outreach efforts for the basin in indirect ways are shown in Figure 35 with dotted connecting lines.

Figure 35. Issue No. 11: Public awareness and participation.



NOTE: Dotted lines indicate related, yet indirect support of programs to public outreach efforts in the Orange Creek Basin.

4

4. PROJECT DESCRIPTIONS

Individual projects and project elements listed in Chapter 3 are described here in greater detail. Projects and their elements are organized by programs and are listed in the order in which they appear in Chapter 3.

Future revisions of this plan will include expanded and updated descriptions of projects and project elements as they are further developed. Additional current and future projects by other agencies will be included in future revisions of the plan.

4.1 DIAGNOSTIC PROGRAM

PROJECT (OCB-101-D): ***WATER QUALITY AND HYDROLOGIC MONITORING IN THE ORANGE CREEK BASIN***

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities, Future Protection of the Basin

◆ District water quality monitoring in the OCB

Goals/Rationale: District effort aimed at monitoring on a monthly basis, water quality in major waterbodies of the Orange Creek Basin (26 stations; see Appendix E). The goal of this monitoring effort is to provide an updated, long-term, and continuous record of surface water quality for the basin needed to (1) assess current water quality and trophic status of waterbodies in the basin, (2) perform updated water quality trend analyses, (3) develop an external nutrient budget for the basin, (4) assist in locating potential point and nonpoint sources of pollution in the basin (toxic pollutants excluded), and (5) support other projects with water quality data requirements (diagnostic, feasibility, and restoration/management projects addressing issues related with lake sediments, wetland vegetation, fish and wetland wildlife habitats, and conservation lands).

Participants: SJRWMD; in-house effort.

Status: In progress; initiated January 1994.

◆ Review and analysis of historic and current water quality conditions in the OCB

Goals/rationale: District effort to describe short- and long-term water quality and trophic status trends in waterbodies of the Orange Creek Basin. This analysis may be used as a screening tool to identify waterbodies which have experienced recent cultural eutrophication and to help explain historical changes in wetland vegetation assemblages, organic sediment accumulation, and sediment nutrient content, as a function of hydrologic changes.

Participants: SJRWMD; in-house effort.

Status: In progress.

◆ Inflow, outflow, and lake level monitoring in the OCB

Goals/rationale: District contractual effort aimed at establishing and maintaining a streamflow gauging and lake level recording network for major waterbodies in the Orange Creek Basin. The hydrologic data generated by this monitoring effort are needed to update the data base for the District's hydrologic model (Robison *et al.* 1996), to quantify nutrient and pollutant loadings into lakes and other waterbodies as well as exports to downstream areas, to develop external nutrient budgets for these waterbodies, and to identify lake level or stream flow management and restoration needs for the basin.

Participants: SJRWMD; contractual effort with USGS.

Status: In progress.

● Sinkhole discharge monitoring in Orange Lake

Goals/rationale: District contractual effort aimed at quantifying (through field determinations) the seepage loss from the Orange Lake Heagy Burry Park sinkhole complex at varying lake elevations. This information will be utilized to verify modeled seepage loss and to evaluate the potential impacts of sinkhole discharge control on groundwater recharge and lake levels

.

Participants: SJRWMD; contractual effort.

Status: Planned; first priority.

● Volunteer stormwater sampling of tributaries in the OCB

Goals/rationale: Volunteer sampling initiative coordinated under the Public Outreach Program (project OCB-603-P) aimed at measuring concentrations of chemical and physical constituents in tributary streams under high-flow conditions. This information, together with data from the District's routine water quality monitoring program, will be used to develop external nutrient budgets for basin waterbodies, to assess sediment and nutrient loading into these waterbodies, and to identify nutrient and sediment load reduction needs for these waterbodies. Candidate streams for including in the stormwater monitoring effort include the major urban streams (Hatchet Creek, Little Hatchet Creek, Hogtown Creek, Sweetwater Branch) and Lochloosa and Little Orange creeks.

Participants: Joint multi-agency effort lead by SJRWMD. Partnership involvement

Status: Planned; first priority.

● Toxic pollutant screening survey in the OCB

Goals/rationale: District contractual effort aimed at identifying those waterbodies in the Orange Creek Basin with high levels of toxic contaminants. Results from this diagnostic study will lead to the investigation of the sources of contamination and ultimately to the identification and subsequent implementation of management measures aimed at eliminating those sources and/or at restoring water quality. The risk of groundwater contamination will be investigated for those waterbodies with a direct connection to the Floridan aquifer.

Participants: SJRWMD; in-house effort.

Status: Planned; second priority.

DIAGNOSTIC PROGRAM

PROJECT (OCB-102-D)*: *SEDIMENT DEPOSITION AND SEDIMENT NUTRIENT CHARACTERIZATION IN OCB LAKES

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities

★ Effects of short-term drawdown on sediments and nutrients of Newnans Lake (Phase I & II)

Goals/Rationale: Completed contractual efforts by Gottgens & Crisman (1992a,b) for the SJRWMD designed to empirically evaluate the impact of a short-term drawdown on the retention, oxidation and compaction, and deposition and redistribution of organic sediments and particulate nutrients in Newnans Lake. These studies determined that during the 1989 Newnans Lake drawdown, only a small amount of organic sediments and nutrients were flushed and little oxidation of exposed sediments occurred. The lack of flushing was attributed to the fact that the lake levels were unusually low prior to the initiation of the drawdown, so that only about 20% of the lake water was removed. Organic sediments were variably redistributed in the lake, however there was no consistent transfer of sediments from littoral to profundal zones. It was recommended that short-term drawdowns be initiated when lake levels are high and wind speeds are greater than normal.

Understanding these sediment processes and how they are affected by different water level management alternatives in Newnans Lake is important in the design of plans for sediment and water quality restoration, for littoral revegetation, and for fish and wetland wildlife habitat restoration.

Participants: SJRWMD; contractual effort with the University of Florida.

Status: Completed.

Gottgens, J.F. and T.L. Crisman 1992a. *Newnans Lake, Florida: Removal of particulate organic matter and nutrients using a short-term drawdown (Phase I)*. Special Publication SJ 92-SP23. Palatka, Fla.: St Johns River Water Management District.

Gottgens, J.F. and T.L. Crisman 1992b. *Sediments of Newnans Lake: Characteristics and patterns of redistribution following a short-term drawdown (Phase II)*. Special Publication SJ 92-SP24. Palatka, Fla.: St Johns River Water Management District.

◆ Sediment and water quality reconnaissance of Newnans Lake

Goals/rationale: District effort aimed at monitoring changes in sediment stratigraphy and physical characteristics in Newnans Lake and changes in water quality both in Newnans Lake and in its inflow (Hatchet Creek) and outflow (Prairie Creek) during an 18-month period (1991-1993) immediately prior to and following the removal of the flashboards at Prairie Creek dam. Sampling has been completed under contract with King Engineering Associates, Inc. (Tampa) and analysis of data is currently underway by District scientists.

The information derived from these analyses will be used to assess the short-term effects of dam removal on Newnans Lake water quality and sediment characteristics. This assessment will also contribute to the understanding of the effects of natural drawdowns (drought conditions) on lake sediment and water quality characteristics. The significance of the observed changes in sediment stratigraphy and water quality to the trophic condition of the lake and to the quality of its fish and wetland wildlife habitats will be assessed.

Participants: SJRWMD; in-house/contractual effort.

Status: In progress.

◆ Historical sediment and nutrient accumulation rates and past water quality in Orange Lake (Phase I & II)

Goals/rationale: District contractual effort aimed at utilizing paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Orange Lake, to determine the timing of these changes, and to investigate their possible causes.

Phase I of this study (currently underway) addresses the limnological history for the open water (limnetic) region of the lake. Historical sediment and nutrient accumulation rates and past water quality will be related to historic lake events (e.g., weir construction, highway and railroad levee construction, droughts, hydrilla, past sinkhole intervention). Results from these analyses will be used to (a) assess impacts of possible management strategies such as sinkhole intervention in the lake, and weir modifications at the lake's outlet, (b) develop a nutrient budget for the lake, and (c) establish target water quality conditions for restoration and management of the lake.

Phase II of the study (planned) will address sediment and nutrient accumulation in vegetated areas of the lake, using specific information obtained from Phase I. The goal of Phase II is to assess the possible impacts of hydrilla and floating vegetation and their management on historical patterns of sediment and nutrient accumulation and water quality in the lake. This information will be important for predicting the environmental effects of lake management actions such as hydrilla eradication and floating and emergent vegetation management or removal.

Phase I and Phase II of this study, combined, will provide a better understanding of present and past sediment and water quality conditions in the various types of aquatic habitats in Orange Lake and will assist lake managers in identifying target limnological conditions for the restoration and management of the lake.

Participants:

Phase I: District; contractual effort with the University of Florida (IFAS, Dept. of Fisheries and Aquatic Sciences).
Phase II: District; contractual effort (contractor to be determined)

Status:

Phase I: In progress (estimated completion date: December, 1996).
Phase II: Planned, first priority.

◆ Internal nutrient loading in Newnans Lake

Goals/rationale: District contractual effort aimed at quantifying sediment nutrient stores in Newnans Lake and at measuring nutrient flux rates between the sediments and the water column. This

information will help assess the role of sediments in internal nutrient loading processes. If internal nutrient loading is found to be significant (compared to external nutrient loading sources), then potential lake restoration alternatives intended to reduce internal nutrient loading and thereby halt or reverse the eutrophication process will be identified and implemented.

Participants: District; contractual effort.

Status: Planned; second priority.

○ Wind resuspension analysis in Newnans Lake

Goals/rationale: District contractual effort to assess the dynamics of wind-induced resuspension of bottom sediments in Newnans Lake and describe patterns of movement and focusing of sediments in the lake. This information will be utilized in the identification of effective strategies for sediment restoration in Newnans Lake.

Participants: District; contractual effort.

Status: Planned; second priority.

● Historical sediment and nutrient accumulation rates and past water quality in Newnans Lake

Goals/rationale: Planned District contractual effort aimed at using paleolimnological techniques (radionuclide sediment core dating and buried diatom analyses) to infer past sediment and nutrient accumulation rates and water quality changes in Newnans Lake, to determine the timing of these changes, and to investigate their possible causes. The information obtained from this diagnostic effort will be used to identify the extent and timing of cultural disturbance to the lake ecosystem, to reconstruct the trophic history of the lake (phytoplankton vs. macrophyte based), and to set target limnological conditions for water quality and sediment restoration.

Participants: SJRWMD; contractual effort.

Status: Planned; first priority.

DIAGNOSTIC PROGRAM

PROJECT (OCB-103-D): *HYDROLOGIC MODELLING IN THE OCB*

ISSUE TOPICS: Hydrology. Aquatic Plant Management, Lake Sediments, Fish and Wildlife Habitats and Communities

- **Effects of surface water management alternatives on wetlands and lake levels in the OCB**

  Goals/rationale: District study that addresses, through the use of a predictive hydrologic model, the effects of various water management alternatives on lake levels, flood regimes, and wetland vegetation composition and coverage. The objectives of the study are to: (a) comprehensively evaluate the surface water hydrology of the watershed based on a predictive hydrologic model for each lake and Paynes Prairie, (b) develop biohydrological criteria for water levels so that the restoration and conservation potential of alternative surface water management plans can be evaluated, (c) develop alternative surface water management plans and evaluate each with respect to the biohydrological criteria, and (d) identify those water management alternatives that require more specialized study, as well as those that can be eliminated from consideration because they cause adverse environmental impacts. The hydrologic model is a valuable diagnostic and planning tool for determining the feasibility (from an ecosystem perspective) of proposed water management alternatives in the basin. It will be used to evaluate the biohydrological consequences of the various lake level management alternatives associated with the Orange Lake sinkhole discharge control and the Orange Lake weir modification projects. Additionally, water budget information derived from the hydrologic model will be used to develop the external nutrient budgets for basin waterbodies.

  Participants: SJRWMD; in-house effort.

  Status: In progress. Completed draft report by Robison, C.P., C. Ware, G.B. Hall, & R. Hupalo. 1996. Water management alternatives: effects on lake levels and wetlands in the Orange Creek Basin. SJRWMD.

DIAGNOSTIC PROGRAM

PROJECT (OCB-104-D): *LAKE BASIN PHYSICAL CHARACTERISTICS*

ISSUE TOPICS: Hydrology, Lake Sediments, Fish and Wildlife Habitats and Communities

◆ Bathymetry and sediment thickness survey of Orange Lake

Goals/rationale: District contractual effort currently underway aimed at mapping the bathymetry of Orange Lake and the depth and thickness of its muck sediments. This survey will: (a) provide missing bathymetric data for the lake (between 55 ft and 60 ft elevations), (b) generate a map of muck depth and thickness throughout the lake, and (c) relate muck depth and thickness information to wetland vegetation cover. Results of the bathymetric and sediment thickness surveys are needed to complete other diagnostic efforts under this project (characterization of floating and emergent vegetation in Orange Lake, formation of floating mats in Orange Lake and causes for historical changes) and under the fish and wetland wildlife assessments project (OCB-108-D). The information derived from these surveys will contribute significantly toward identifying sediment, wetland vegetation, and fish and wetland wildlife habitat restoration and management needs in Orange Lake and toward evaluating the feasibility of proposed lake management alternatives to address these needs.

Participants: SJRWMD; contractual effort with Environmental Consulting and Technology, Inc.

Status: In progress (estimated completion date: December, 1996).

◆ Newnans Lake outlet stream profile survey

Goals/rationale: District contractual work currently underway aimed at describing the profile of Prairie Creek from State Road 20 to Newnans Lake. The profile data obtained from this survey are needed to evaluate the current outflow potential of Newnans Lake at varying lake elevations and to identify outlet channel hydraulic impediments. This information is needed for completing new lake sediment restoration feasibility analyses involving artificial drawdowns.

Participants: SJRWMD; contractual effort with George F. Young, Inc.

Status: In progress.

◆ Orange Lake outlet stream profile survey

Goals/rationale: District contractual work currently underway aimed at describing the profile of Orange Creek/Shands Canal, downstream from Orange Lake weir at U.S. Highway 301. Information derived from this survey will be used to identify hydraulic impediments to Orange Lake outflow (downstream of the U.S. 301 weir) and channel restoration needs for eliminating these impediments. Channel restoration would allow for enhanced passage and export of sediments and floating vegetation from Orange Lake during storm events. The profile data from this survey are needed for the minimum flows and levels analyses of Orange Lake and Orange Creek (Project OCB-401-RG), and the Orange Lake weir modification feasibility analyses (Project OCB-203-F).

Participants: SJRWMD; contractual effort with George F. Young, Inc.

Status: In progress.

DIAGNOSTIC PROGRAM

PROJECT (OCB-105-D): EXTERNAL NUTRIENT BUDGETS FOR WATERBODIES IN THE OCB

ISSUE TOPICS: Hydrology, Water Quality, Lake Sediments

- **External nutrient budget for Orange Creek Basin lakes**

  Goals/rationale: District in-house effort aimed at describing the movement of water and nutrients between a waterbody and its watershed in the Orange Creek Basin. Information derived from the external nutrient budget will help determine the relative contribution of anthropogenic sources of pollution (point and nonpoint sources) to nutrient and sediment loading into waterbodies. These results are critical for identifying basin management strategies (including implementation of regulatory measures) to reduce nutrient loading into the waterbody and restore water quality and bottom sediments. Efforts to develop external nutrient budgets for OCB waterbodies will initially focus on Orange Lake.

  Participants: SJRWMD; in-house effort.

  Status: In progress.

- **Pollution sources in Orange, Lochloosa, and Newnans lakes**

  Goals/rationale: District in-house/contractual effort to identify and quantify point and nonpoint sources of pollution into Orange, Lochloosa, and Newnans lakes. Point sources of pollution are identifiable as discrete sources such as outfalls from waste water treatment facilities, industrial discharges, and some stormwater discharges. Nonpoint pollution sources include leaking near-lake septic systems, agricultural runoff, and most stormwater runoff. This information will be used to develop external nutrient budgets for these lakes and to identify and subsequently implement nonpoint source pollution reduction measures aimed at curtailing sediment and nutrient loading and restoring water quality. Efforts to assess point nonpoint pollution sources will initially be focused on Newnans Lake, given the severity of its water quality problems.

  Participants: SJRWMD; in-house/contractual effort.

  Status: Planned; first priority.

DIAGNOSTIC PROGRAM

PROJECT (OCB-106-D): *ASSESSMENT OF FLOATING AND EMERGENT WETLAND HABITATS IN OCB LAKES*

ISSUE TOPICS: Aquatic Plant Management, Lake Sediments, Fish and Wildlife Habitats

★ Wetlands mapping/inventory in the OCB

Goals/rationale: Completed District in-house effort aimed at creating a GIS wetlands database for the Orange Creek Basin, based on aerial 1:24,000 color infrared photography from 1990-1991. This data base provides relatively recent quantitative information on composition, aerial coverage, and distribution of wetland vegetation types in the basin. The District wetlands data base supports other diagnostic efforts within project OCB-106-D: historical analysis of wetland vegetation in Orange, Lochloosa, and Newnans lakes and characterization of floating and emergent vegetation in Orange Lake (see below).

It is also valuable mapping tool for assessing the status of wetland habitats in given area and for identifying environmentally sensitive lands (and associated wetlands) in need of protection (potential conservation lands).

Participants: SJRWMD; in-house effort.

Status: Completed.

◆ Historical analysis of wetland vegetation in Orange, Lochloosa and Newnans lakes

Goals/rationale: District effort aimed at evaluating historical abundance, composition, and distribution of wetland vegetation (floating and emergent) in Orange, Lochloosa, and Newnans lakes and at relating these changes with past human intervention in the basin. The analyses are based on historical and current photographic and cartographic records and on interviews with local residents. The causes for changes in the distribution, aerial coverage, and floristic composition of floating and emergent vegetation of Orange Lake will be addressed in conjunction with other diagnostic efforts within this project (formation of floating mats in Orange Lake and causes for historical changes) and other projects (OCB-102-D; historical analysis of lake sediment characteristics and organic matter content). By correlating vegetational changes with historical lake level fluctuations, insight will be provided into the effects of extended lows (frequent and infrequent droughts) on lake and wetland plant communities. This assessment will also contribute to documenting historical changes in native aquatic plant populations and to identifying fish and wetland wildlife habitat restoration goals for the lakes.

Participants: District- in house effort.

Status: In progress.

◆ Characterization of floating and emergent vegetation in Orange Lake

Goals/rationale: District in-house effort aimed at describing in detail (based on field surveys) the current species composition and the ecological characteristics of floating and emergent marsh vegetation in Orange Lake. Results of this study include a preliminary typological classification of floating and emergent vegetation assemblages and cursory observations on the value of these plant assemblages as habitat for wildlife. This project will generate important baseline information needed to complete other diagnostic floating vegetation studies under this project as well elements under other projects (OCB-108-D, OCB-201-F, OCB-301-RM, and OCB-302-RM). Nuisance aquatic vegetation and native aquatic plant populations will be characterized. This information will enable lake managers to determine exotic weed control and native aquatic plant restoration needs for the lake.

Participants: SJRWMD; in-house effort.

Status: In progress.

◆ Formation of floating mats in Orange Lake and causes for historical changes

Goals/rationale: Planned District contractual effort aimed at identifying the mechanisms of formation of floating vegetation mats in Orange Lake. If changes in the abundance and structure of floating mats are documented in the historical analyses of wetland vegetation (see above), then the probable causes for these changes will also be addressed. The information gained from this effort will help determine the role of lake level fluctuations in floating mat formation/breakup and will help assess the potential effects of proposed hydrologic modifications in Orange Lake (sinkhole discharge control and weir modification) on floating vegetation dynamics. This effort will also contribute toward the understanding of the possible causes for the observed declines in the abundance of native aquatic plant populations. If diagnostic studies determine that existing floating vegetation mats are detrimental to lake and wetland ecosystem functions of Orange Lake, then understanding the origin of formation of floating mats will help lake managers identify effective measures to prevent further formation of undesirable floating vegetation mats.

Participants: SJRWMD; contractual effort with the University of Florida (IFAS, Department of Soil and Water Science).

Status: In progress (estimated completion date: December, 1996).

○ Role of floating and emergent vegetation in the nutrient dynamics of Orange Lake

Goals/rationale: Planned District contractual effort aimed at assessing the role floating and emergent vegetation plays in a number of processes such as uptake and sequestration of dissolved nutrients, production of detritus and contribution and organic matter sedimentation, retention of suspended particulate material, and interference with nutrient and organic matter export. Results of this assessment are critical to the evaluation of whether or not floating and emergent vegetation negatively impacts lake ecosystem functions. The potential effects of harvesting (and of in-lake or off-site disposal of harvested material) on the nutrient dynamics and trophic ecology of the lake will be addressed.

Participants: SJRWMD; contractual effort.

Status: Planned; second priority.

DIAGNOSTIC PROGRAM

PROJECT (OCB-107-D): *PHYTOPLANKTON ASSESSMENTS IN OCB LAKES*

ISSUE TOPICS: Water Quality, Lake Sediments

- **Phytoplankton survey for Orange, Lochloosa, and Newnans lakes**

  Goals/rationale: District contractual effort aimed at characterizing the phytoplankton assemblages of Orange, Lochloosa, and Newnans lakes, based on monthly samples collected during a two-year time period. The phytoplankton samples are collected by the District during its routine monthly water quality sampling. Sample analyses are performed under contract with the District by Beaver Schaberg Associates. Information obtained from this project, in conjunction with Chlorophyll-*a* data from the District's monthly water quality sampling program will be used to evaluate the trophic condition of the lakes and their potential for trophic transformation (from a macrophyte dominated system to an algal dominated system, or vice versa). Assessment of the potential for trophic transformation has important implications concerning aquatic plant management in these lakes. Information on phytoplankton species composition and heterocyst abundance will additionally provide insight into nutrient availability/limitation in these lakes. Results from these analyses may also be used to assess the role of phytoplankton as a source of organic matter in lake sediments.

  Participants: Contract by Beaver Schaberg Associates for SJRWMD.

  Status: In progress (sampling initiated in July 1995).

DIAGNOSTIC PROGRAM

PROJECT (OCB-108-D): *FISH AND WETLAND WILDLIFE ASSESSMENTS IN THE OCB*

ISSUE TOPICS: Fish and Wildlife Habitats, Future Protection of the Basin

- **Fish and wetland wildlife population and habitat analyses in Orange, Lochloosa, and Newnans lakes**

  Goals/rationale: Joint SJRWMD/FGFWFC effort to assess, based on field surveys, the current status of fish and wetland wildlife habitats and populations in Orange, Lochloosa, and Newnans lakes. FGFWFC will conduct the diagnostic fisheries surveys for these lakes, as a continuation of their ongoing fisheries assessments. The analyses of fish and wetland wildlife habitats will rely extensively on the results from diagnostic efforts under projects OCB-102-D (Sediment deposition and sediment nutrient characterization in OCB lakes) and OCB-106-D (Assessment of floating and emergent wetland habitats in OCB lakes). The value of floating and emergent vegetation (including native aquatic plants) as habitats for fish and wetland wildlife will be assessed. The results of these analyses will be used to identify habitat restoration needs for the three lakes and their associated wetlands, and to assess the potential impacts of proposed lake management alternatives (e.g. Orange Lake sinkhole intervention and weir modification) on fish and wetland wildlife populations.

  These results will also contribute to the identification of resource management needs in contiguous wetlands and uplands (Lochloosa Wildlife Management Area and Newnans Lake-Prairie Creek Conservation Area).

  Participants: Joint FGFWFC/SJRWMD effort.

  Status: Planned; first priority.

- **Inventory of T&E, SSC, and rare species in the OCB**

  Goals/rationale: Joint SJRWMD/FGFWFC/FDEP effort to complete a systematic inventory of threatened and endangered species, species of special concern, and rare species for special areas or waterbodies within the Orange Creek Basin. This inventory is needed for the Orange Lake area to determine the degree to which floating and emergent marsh habitat is used by special status species. The results of this effort will constitute an important component of feasibility assessments related to floating and emergent marsh remediation in Orange Lake (project OCB-201-F) and Orange Lake weir modification and sinkhole intervention (projects OCB-203-F and OCB-204-F). This effort will additionally provide input to feasibility projects OCB-205-F (Water management alternatives for Paynes Prairie) and OCB-206-F (Feasibility assessment for the restoration of OCB lakes). Results of the special status species inventories will determine to a large degree land management decisions in the basin.

  Participants: Joint effort by the FGFWFC, FDEP, and SJRWMD.

  Status: Planned, first priority.

DIAGNOSTIC PROGRAM

PROJECT (OCB-109-D): *ECONOMIC ASSESSMENTS IN THE OCB*

ISSUE TOPICS: Hydrology, Fish and Wildlife Habitats, Future Protection of the Basin

- **Analyses of economic benefits from recreational and commercial uses in the OCB**

  Goals/rationale: Planned District contractual effort to assess economic benefits from recreational and commercial uses in the Orange Creek Basin. Such economic analyses will first be done for the Orange Lake-Lochloosa Lake area, to assess the economic impacts on lake recreational fisheries during and following the 1990-91 drought. This information, in conjunction with results from other diagnostic efforts for Orange and Lochloosa lakes will provide baseline data by which to measure restoration and management progress toward the goal of enhancing recreational opportunities and economic benefits from recreation. These analyses also include assessments of economic impacts and/or benefits of proposed land acquisition initiatives in the Orange Creek Basin, as they relate to existing or potential commercial (agricultural, silvilcultural) and recreational (game-hunting, sport-fishing) uses.

  Participants: SJRWMD; in-house/contractual effort.

  Status: Planned, first priority.

DIAGNOSTIC PROGRAM

PROJECT (OCB-110-D): *ASSESSMENT OF VEGETATIVE COMMUNITIES IN PAYNES PRAIRIE*

ISSUE TOPICS: Hydrology, Water Quality

- **Vegetative communities in Paynes Prairie and relationships with environmental factors**

  Goals/rationale: Ongoing multi-agency effort (Gainesville Regional Utilities, FDEP, SJRWMD, City of Gainesville Public Works) currently underway aimed at establishing cause/effect relationships between altered surface hydrology and increased nutrient inflows in the northern portion of Paynes Prairie and changes in terrestrial and wetland vegetation assemblages. Information obtained from this diagnostic effort is needed to identify surface water and vegetation management options leading to the rehabilitation of terrestrial and wetland vegetative communities the prairie (Project OCB-205-F)..

  Participants: Multi-agency effort involving Gainesville Regional Utilities, FDEP, SJRWMD, and City of Gainesville Public Works.

  Status: In progress.

4.2 FEASIBILITY PROGRAM

PROJECT (OCB-201-F)*: *FEASIBILITY OF FLOATING AND EMERGENT MARSH REMEDIATION IN OCB LAKES

ISSUE TOPICS: Aquatic Plant Management, Lake Sediments, Fish and Wildlife Habitats and Communities

- **Feasibility of floating and emergent vegetation management in Orange and Lochloosa lakes**

  Goals/rationale: Multi-agency (SJRWMD/FDEP/FGFWFC) effort to evaluate the feasibility for the large-scale removal of floating and emergent vegetation on Orange and Lochloosa lakes. Removal/management methods being tested include mechanical harvesting, burning, and herbiciding. Future continuation of this effort is contingent upon the completion of diagnostic efforts (projects OCB-106-D and OCB-108-D) which would determine if the current abundance and structure of floating and emergent vegetation in Orange and Lochloosa lakes is detrimental to the health and the function of the lake's aquatic and wetland ecosystems. The potential impacts of vegetation removal on the availability of fish and wetland wildlife habitats, on the health of fish and wetland wildlife populations, and on economic benefits from recreational and commercial harvesting of fish and wetland wildlife (including sport fisheries and commercial harvest of alligators) will be addressed in this feasibility assessment.

  Participants: Multi-agency effort, involving SJRWMD, FDEP and FGFWFC.

  Status: In progress.

FEASIBILITY PROGRAM

PROJECT (OCB-202-F): *IMPROVEMENTS TO LAKE ACCESS IN ORANGE AND LOCHLOOSA LAKES*

ISSUE TOPICS: Hydrology, Aquatic Plant Management

★ Feasibility study of Cross Creek Dredging

Goals/rationale: Completed District in-house effort performed at the request of the Alachua County Public Works Department, to assess the feasibility of dredging Cross Creek to allow for navigation during drought conditions. The purpose of the study was to evaluate dredging alternatives and the costs associated with them. The study investigated the effects of dredging Cross Creek to provide minimum depths of 1, 2, or 3 feet, based on the lowest elevations reached in the 1990-91 drought. It concluded that there would be no effects on either Lochloosa or Orange Lakes during normal years but that during drought years, low lake levels on Lochloosa Lake would be even lower. This effect would be slightly augmented if the Orange Lake weir were removed. The 2-foot minimum dredging option would lower the amount of time Cross Creek is unusable from 13% to 4% of the time. Dredging costs were estimated between $110,000 (for the 1-foot minimum) and $390,000 (for the 3-foot minimum).

Participants: SJRWMD; in-house effort.

Status: Completed in 1992.

◆ Lake access needs

Goals/rationale: District in-house effort to assess lake access problems and needs in relation to water levels in Orange and Lochloosa lakes. Evaluation of lake access needs includes feasibility analyses for dredging access channels from the lake to public boat ramps and fish camps, and to provide for navigation during low water periods. This may entail some removal of floating and/or emergent vegetation.

Participants: SJRWMD; in-house effort.

Status: In progress.

FEASIBILITY PROGRAM

PROJECT (OCB-203-F): *ORANGE LAKE WEIR MODIFICATION*

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Future Protection of the Basin

- **Orange Lake weir modification; evaluation of management alternatives**

  Goals/rationale: District effort to identify structural and operational modifications to the U.S. 301 weir, as well as to other downstream structures (e.g. U.S. 301 and railroad levees; Shands Canal) with the purpose of restoring, to the extent practicable and desirable, Orange Lake's natural outflow regime and providing minimum flows for Orange Creek. Potential benefits to Orange Lake from weir modifications include enhanced export of nutrients, sediments, and floating vegetation during storm events. Analysis of the hydrologic improvements to the Orange Lake outlet will be done in conjunction with the Orange Lake sinkhole intervention analysis (see project OCB-204-F) and will address the issue of extended infrequent low lake levels.

  Participants: SJRWMD, in-house effort.

  Status: Planned, first priority (to be completed in FY 1996-1997).

FEASIBILITY PROGRAM

PROJECT (OCB-204-F): *ORANGE LAKE SINKHOLE INTERVENTION ANALYSIS*

ISSUE TOPICS: Hydrology, Water Quality, Lake Sediments

★ High resolution seismic reflection surveys in Orange Lake

Goals/rationale: Completed joint SJRWMD/USGS effort to map subsidence features on the bottom of Orange Lake using high resolution seismic reflection. The results of these surveys confirm the existence of two major collapsed sinkholes along the southwestern shore of the lake which provide a conduit for exchange between the lake and subsurface aquifer. These results are an important first step in the task of addressing other sinkhole issues on Orange Lake.

Participants: SJRWMD and U.S. Geological Survey.

Status: Completed report by Kindinger, J.L., J.B. Davis, and J.G. Flocks. 1994. High-Resolution Single-Channel Seismic Reflection Surveys of Orange Lake and Other Selected Sites, North Central Florida. Draft report submitted to St. Johns River Water Management District as part of a U.S. Geological Survey/St. Johns River Water Management District joint funding agreement.

★ Engineering feasibility study, Orange Lake sinkhole intervention

Goals/rationale: Completed District contractual effort that evaluated the feasibility of various engineering alternatives for reducing or controlling water losses through the Heagy Burry sinkhole(s) at Orange Lake. A coffer dam built east of the sinkhole was identified as the isolation method most likely to succeed. If filling were selected, compaction grouting was recommended. It was also recommended that detailed studies be done to evaluate the impacts of flow reduction to the Floridan aquifer system (including geophysical, geotechnical, environmental, geohydrological, and bathymetric surveys along with hydrological modeling) prior to the selection of the remediation method and to its final design.

Participants: Contract by Bromwell & Carrier, Inc. for SJRWMD.

Status: Completed report by Bromwell & Carrier, Inc. 1994. Feasibility Study, Orange Lake Sinkhole Remediation, Orange Lake, Florida. Draft Report prepared for the St. Johns River Water Management District, Palatka, Florida.

◆ Karst geology and groundwater analyses in Orange Lake

Goals/rationale: District contractual effort aimed at assessing the possible groundwater and geologic effects of sinkhole discharge control in the Heagy-Burry Park area of Orange Lake. This feasibility assessment is part of a larger effort to determine the potential environmental impacts of sinkhole intervention at Orange Lake.

Participants: SJRWMD; contractual effort with University of Florida (Departments of Geology and Civil Engineering).

Status: In progress (estimated completion date: June, 1996).

● Orange Lake sinkhole intervention; evaluation of management alternatives

Goals/rationale: District in-house effort to evaluate management alternatives related to sinkhole discharge control at the Heagy-Burry Park area of Orange Lake and to assess the potential environmental impacts from these alternatives. The assessment includes predicted impacts of sinkhole discharge control on lake level fluctuations, sediment and nutrient retention and oxidation processes, karst geologic stability and ground water recharge, lake and wetland habitats and fish and wetland wildlife populations, and long-term implications to lake trophic status. This assessment relies on the results of other feasibility efforts under this project (OCB-204-F) as well as on information from a number of diagnostic efforts addressing water quality, hydrology, sediment characteristics, and wetland habitats in Orange Lake (projects OCB-101-D, OCB-102-D, OCB-103-D, OCB-106D, and OCB-108-D).

Participants: SJRWMD; in-house effort.

Status: Planned; first priority. Project element to be completed in FY 1996-1997.

FEASIBILITY PROGRAM

PROJECT (OCB-205-F): ***WATER MANAGEMENT ALTERNATIVES FOR PAYNES PRAIRIE***

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Fish and Wildlife Habitats and Communities

★ Preliminary assessment of options for management of Sweetwater Branch surface flow into Paynes Prairie

Goals/rationale: Project aimed at evaluating various options for the management of Sweetwater Branch inflow into Paynes Prairie State Preserve, with the purpose of restoring sheet flow to the northern portion of the Prairie and enhancing water quality of surface waters in the Prairie (including Alachua Lake/Sink and the Floridan aquifer). A multifunctional wetland treatment system constructed in the impacted area of the prairie along Sweetwater Branch was identified as the recommended option.

Participants: Contractual effort by the Center for Wetlands and Water Resources, University of Florida.

Status: Completed report by Best, G.R., R.D.Peters, Jr., R.E. Borer, and F.F. Gaines III. 1995. *Preliminary Assessment of Options for Management of Sweetwater Branch Surface Flow into Paynes Prairie, Alachua County, Florida.* Center for Wetlands and Water Resources, University of Florida, Gainesville, FL.

◆ Paynes Prairie vegetation succession model

Goals/rationale: Contractual effort by the University of Florida (for FDEP) aimed at assessing water volume alternatives for distribution through the Camps Canal culvert system and developing vegetation succession models to show the effects that changing water regimes, water quality and sediment conditions have on wet prairie and wetland vegetation assemblages. The effects of hydrologic disturbance and external nutrient and sediment loading on native wetland plant communities will be determined with the model. The results of this study will contribute to the understanding of the impacts of nutrient-rich tributaries (e.g. Sweetwater Branch and Bivens Arm) on prairie soils and vegetation, and to the fish and wildlife populations associated with these habitats. This modeling effort provides FDEP with a valuable tool for identifying and implementing sound, ecosystem-based restoration and management actions in the Paynes Prairie State Preserve.

Participants: Contractual effort by the University of Florida for the FDEP.

Status: In progress. Contractual effort entitled: *GIS-based Succession Model for Prairie Creek Pourpoint Basin, Paynes Prairie State Preserve.* Principal Investigator: Greg White.

● Surface water and vegetation management options for Paynes Prairie

Goals/rationale: Planned multi-agency effort aimed at identifying surface water and vegetation management options leading to water quality and hydrologic improvements in Paynes Prairie and to the rehabilitation of terrestrial and wetland vegetative communities in the northern portion of the prairie. Options for reducing nutrient and other pollutant loadings into the prairie from Sweetwater Branch and Bivens Arm will be considered. This feasibility study depends on completion of the diagnostic effort

"Vegetative communities in Paynes Prairie and relationships with environmental factors" (project OCB-110-D).

Participants: Gainesville Regional Utilities, SJRWMD, FDEP, and City of Gainesville Department of Public Works.

Status: Planned; first priority.

FEASIBILITY PROGRAM

PROJECT (OCB-206-F): *FEASIBILITY ASSESSMENT FOR THE RESTORATION OF OCB LAKES*

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities, Future Protection of the Basin

★ **FGFWFC feasibility assessment of drawdown for restoring Newnans Lake (KBN Engineering)**

Goals/rationale: Contractual effort by KBN Engineering for FGFWFC aimed at evaluating various drawdown alternatives for Newnans Lake with the purpose of restoring lake sediments and fisheries habitat. A mechanical drawdown alternative involving a 9-month holddown duration was considered the preferred option, based on an evaluation of conceptual engineering plans, potential environmental impacts, and cost estimates. The cost of a 9-month mechanical drawdown alternative was estimated at $9-12 million. Expected short-term benefits from extreme drawdowns include sediment oxidation and consolidation, reduced sediment resuspension and internal nutrient loading, enhanced native aquatic plant populations, and improved fish and wetland wildlife habitats.

Participants: Contractual effort by KBN Engineering and Applied Sciences, Inc. for the FGFWFC.

Status: Completed report by KBN Engineering and Applied Sciences, Inc. 1993. *Assessing the Feasibility of Restoring Newnans Lake. Phase A: Conceptual Engineering Report.* Prepared for the Florida Game and Fresh Water Fish Commission, Gainesville, FL.

● Feasibility project elements for identifying strategies to protect and restore OCB lakes will be developed as diagnostic projects are completed.

4.3 RESTORATION and MANAGEMENT PROGRAM

PROJECT (OCB-301-RM): AQUATIC PLANT MANAGEMENT IN THE OCB

ISSUE TOPICS: Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities

◆ Aquatic vegetation monitoring in Orange, Lochloosa, and Newnans lakes

Goals/rationale: FDEP/SJRWMD effort to monitor aquatic plant populations in Orange, Lochloosa, and Newnans lakes as part of the state's ongoing aquatic plant management program. Results of these surveys are needed to identify annual aquatic weed treatment needs, particularly with regard to exotics such as hydrilla, water-hyacinth, water-lettuce, torpedo grass, and alligator-weed. These surveys are needed to develop strategies for herbicide applications. The aquatic vegetation surveys regularly provide updated information on the status of native aquatic plant populations and allow for follow-up evaluations to assess non-target native plant mortality resulting from herbicide applications. They also are important for identifying the need for opening or maintaining airboat trails through Orange and Lochloosa lake's floating and emergent marsh areas, and for monitoring changes in fish and wetland wildlife habitats following the implementation of aquatic weed control measures.

Participants: FDEP and SJRWMD.

Status: In progress.

◆ Vegetation management in OCB lakes

Goals/rationale: Joint FDEP/SJRWMD effort to implement aquatic weed control measures in OCB lakes. Chemical control operations are rendered by the District under contract with FDEP and in accordance with FDEP's aquatic plant management program goals and specifications. These include fluridone and contact herbicide applications for hydrilla control (whole lake treatments and boat trails) and herbicide applications for other exotic weeds. Other ongoing vegetation management activities include emergency harvesting of nuisance floating vegetation, maintenance of boat trails through floating and emergent vegetation, and prescribed burning of floating marshes. Aquatic weed management in OCB lakes is implemented in tandem with the aquatic vegetation monitoring. Protection and enhancement of non-nuisance native aquatic plant populations is an important goal for vegetation management in OCB lakes. Evaluation of the risks that different control measures may pose to fish and wetland wildlife populations is an important aspect in the selection and subsequent implementation of aquatic plant management strategies.

Participants: FDEP and SJRWMD.

Status: In progress.

◆ Enhancement of aquatic weed control in OCB lakes

Goals/rationale: Multiagency effort (FDEP, SJRWMD, IFAS) aimed at reassessing and enhancing the performance of aquatic weed control measures employed in the basin. The goal of this effort is to identify aquatic plant management practices (preferably ones that integrate chemical, biological, and physical techniques) which best provide for improved hydrilla control, for the continued maintenance control of aquatic weeds, and for the future control of newly established exotic weeds. Important

objectives within this effort are to minimize the impact of herbicide applications on non-target aquatic plants (particularly native species) and to manage nuisance floating and emergent vegetation in an effective way. Successful maintenance control of aquatic weeds (particularly hydrilla) may contribute to reduce muck accumulation rates in lakes.

Participants: FDEP, SJRWMD and IFAS.

Status: In progress.

RESTORATION and MANAGEMENT PROGRAM

PROJECT (OCB-302-RM): LAKE LITTORAL ZONE RESTORATION IN THE OCB

ISSUE TOPICS: Aquatic Plant Management, Fish and Wildlife Habitats and Communities

- **Native aquatic plant revegetation in OCB lakes (littoral planting effort by the FGFWFC currently underway in Newnans Lake)**

  Goals/rationale: FGFWFC effort to re-establish, through littoral revegetation techniques, native aquatic plant populations in Newnans Lake with the purpose of restoring lost or threatened fish and wetland wildlife habitats and improving water quality and shoreline erosion problems. Past efforts to plant bulrush (*Scirpus californicus*) and maidencane (*Panicum hemitomon*) along Newnans Lake shoreline have been relatively successful.

  Participants: FGFWFC in-house effort; possible cost-share with SJRWMD.

  Status: In progress.

RESTORATION and MANAGEMENT PROGRAM

PROJECT (OCB-303-RM): WETLAND/WATER RESOURCE PROTECTION THROUGH NEW LAND ACQUISITION IN THE OCB

ISSUE TOPICS: Hydrology, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities, Future Protection of the Basin

- **Assessment of potential land acquisition in the OCB**

  Goals/rationale: District initiative aimed at updating and evaluating the potential acquisition of environmentally sensitive lands in the Orange Creek Basin with the goal of restoring and/or preserving water and wetland resources in the basin. SJRMWD currently owns 11,230 acres of land in the OCB and has recently purchased development rights to an additional 17,000 acres (within the Lochloosa Wildlife CARL Project Area). An additional 30,000 or more acres of environmentally sensitive lands have been identified for potential acquisition. Possible future acquisitions may focus on expansion of the Lochloosa Wildlife Conservation Area and the Prairie Creek-Newnans Lake and the Orange Creek Run project areas. Acquisition and sound management of these lands offers an effective means of protecting on a long-term basis, fish and wildlife habitats and populations in the basin. It can also provide the means for restoring natural surface drainage patterns in lands affected by agricultural or silvicultural development and for restoring natural hydrologic regimes of receiving waterbodies.

  Participants: SJRWMD in-house effort, coordinated with other state agencies, local governments, and property owners.

  Status: In progress.

RESTORATION and MANAGEMENT PROGRAM

PROJECT (OCB-304-RM): *LAND MANAGEMENT ON PUBLIC LANDS OF THE OCB*

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Fish and Wildlife Habitats and Communities, Future Protection of the Basin

- **Land management on public lands of the OCB**

  Goals/rationale: District effort to develop and implement management plans for District properties, in cooperation with other agencies such as FDEP, FGFWFC, the Division of Forestry, and local governments. Through the implementation of land management plans, the District seeks to fulfill its overriding management objective of ecological resource protection and restoration and compatible recreational use. In particular, objectives of land management plans include the maintenance (through preservation or restoration) of natural land drainage patterns on District lands, the protection and enhancement of native aquatic and terrestrial plant populations, protection and enhancement of high quality lake and wetland habitats and their associated fish and wildlife populations, the control of exotic terrestrial and aquatic vegetation, and the management of floating and emergent marsh vegetation. Identification and implementation of land management practices (including BMPs) which reduce external nutrient loading into waterbodies is an important objective in these land management plans. This is particularly critical in properties acquired as conservation easements (or less-than-fee acquisitions) where pre-existing land uses may be allowed to continue.

  Participants: SJRWMD in cooperation with other agencies such as FDEP, FGFWFC, the Division of Forestry, and local governments.

  Status: In progress.

RESTORATION and MANAGEMENT PROGRAM

PROJECT (OCB-305-RM): *OUTSTANDING FLORIDA WATERS DESIGNATION REVIEW FOR THE OCB*

ISSUE TOPICS: Water Quality, Fish and Wildlife Habitats and Communities, Future Protection of the Basin

- **Expansion of OFW designations in the OCB**

  Goals/rationale: Intergovernmental effort aimed at (a) evaluating the need for augmenting OFW designations in the Orange Creek Basin and (b) preparing and submitting proposals for the designation of new waterbodies as OFWs. Expansion of the OFW designations in the Orange Creek Basin is a means of enhancing water quality protection of existing OFWs (when they are downstream of the proposed designations) and of augmenting the protection of water resources of exceptional ecological or recreational significance from water quality degradation and cultural eutrophication.
  Expansion of OFW designations may include waterbodies or sections of waterbodies within newly acquired conservation lands (e.g. portions of Lochloosa Creek south of State Road 20).

  Participants: SJRWMD, FDEP and interested parties.

  Status: Planned; second priority.

RESTORATION and MANAGEMENT PROGRAM

PROJECT (OCB-306-RM): RESTORATION OF WATERBODIES IN THE OCB

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities, Future Protection of the Basin

- Project elements addressing restoration efforts in waterbodies of the Orange Creek Basin will be developed as diagnostic and feasibility projects are completed.

RESTORATION and MANAGEMENT PROGRAM

PROJECT (OCB-307-RM): *URBAN STORMWATER ASSESSMENT AND REMEDIATION IN THE OCB*

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities, Future Protection of the Basin

- **Local government stormwater retrofitting assistance**

  Goals/rationale: District initiative aimed at co-sponsoring local government efforts to retrofit urban stormwater management systems. Plans to assist the City of Gainesville (Department of Public Works) with stormwater retrofitting in the Hogtown Creek watershed are currently underway. The stormwater retrofitting effort will help reduce sediment and nutrient loading into stormwater systems and downstream receiving waterbodies.

  Participants: City of Gainesville Department of Public Works, Alachua County Office of Environmental Protection, SJRWMD.

  Status: In progress.

4.4 REGULATORY PROGRAM

PROJECT (OCB-401-RG): MINIMUM FLOWS AND LEVELS

ISSUE TOPICS: Hydrology, Fish and Wildlife Habitat

- **Minimum flows and levels in the OCB**

  Goals/rationale: Effort to set environmentally based minimum flows and levels for Paynes Prairie, Orange Creek, and Orange, Lochloosa, and Newnans lakes (by FY 1995/1996). The minimum flows and levels determinations will assess the hydrologic requirements of functional lake and wetland ecosystems and will help identify hydrologic goals for these water bodies and their associated wetlands. Adoption of the minimum flows and levels rule for the OCB waterbodies will ensure that consumptive uses of these surface waters do not cause significant harm to water resources and associated natural systems (including fish and wildlife).

  Participants: SJRWMD, in-house effort.

  Status: In progress. Minimum flows and levels for the Orange Creek Basin will be set by the end of Fiscal Year 1995/96.

REGULATORY PROGRAM

PROJECT (OCB-402-RG): LOCAL GOVERNMENT ENVIRONMENTAL PROTECTION ORDINANCE ASSISTANCE

ISSUE TOPICS: Water Quality, Lake Sediments

- **Remediation of nonpoint source and unregulated point source pollutant loading into waterbodies of the OCB**

  Goals/rationale: Planned District initiative to assist local governments in the development and implementation of stronger local ordinances and Local Development Regulations for environmental protection that are consistent with pollution prevention and remediation goals established in this plan. Targeted areas of assistance include stormwater management, land use development, and habitat protection. This project is aimed at evaluating the feasibility of alternatives leading to the correction of the causes of unregulated external nutrient loading into waterbodies of the Orange Creek Basin. Alternatives include: (a) local citizen voluntary controls (e.g. correction of malfunctioning residential septic systems); (b) local government environmental protection ordinance; and (c) development of lake specific pollutant load reduction goals. This regulatory effort will enhance the control of unregulated point and nonpoint sources of pollution, thereby contributing to the restoration of water quality and sediments in waterbodies impacted by anthropogenic activities.

  Participants: SJRWMD and local governments.

  Status: Planned, third priority.

REGULATORY PROGRAM

PROJECT (OCB-403-RG): SURFACE WATER PERMIT REVIEW

ISSUE TOPICS: Hydrology, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities

- **OCB surface water permit review**

  Goals/rationale: Multi-agency effort to assess the compliance status of surface water related permits (MSSW, Stormwater, WRM, CUP, Agricultural Discharge permits, ERPs, NPDES) and to evaluate the need for enhanced enforcement actions and/or new permit requirements which will improve water quality and hydrologic conditions in surface waterbodies of the basin. The surface water permit review allows for the identification of existing (permitted) point source discharges into waterbodies of the basin. Implementation of this effort is critical for attaining the overall goals of basinwide pollution control and reduction, water quality and sediment quality enhancement in anthropogenically impacted waterbodies, and protection and restoration of aquatic ecosystem integrity (including the maintenance of functional fish and wildlife habitats).

  Participants: Governmental agencies with regulatory authority (SJRWMD, FDEP, regional and local governments).

  Status: In progress.

4.5 INTERAGENCY COORDINATION PROGRAM

PROJECT (OCB-501-I)*:** ***OCB PLAN REVIEW

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitat, Future Protection of the Basin, Public Outreach

◆ Revision of the Orange Creek Basin Surface Water Management Plan

Goals/rationale: District-led effort to revise and update, on a periodic and as-needed basis, the Orange Creek Basin Surface Water Management Plan. Revisions of the Plan rely on continuous input from District staff, from the Orange Creek Basin Advisory Council, from the Orange Creek Basin Scientific Advisory Committee, from state and local government agencies involved in basin management issues, and from the public. Results obtained from individual project efforts now in progress will be used to re-evaluate and re-prioritize strategies and planned projects. In this manner, the surface water management plan will incorporate new knowledge toward optimal restoration and management of surface water resources in the basin. Because of the overall inclusive nature of this review process, the OCB plan review effort relates equally to each and all of the priority issues addressed in the plan.

Participants: This is an interactive multiagency effort that involves the District as well as other governmental entities (e.g. FDEP, FGFWFC, FDOT, regional and local governments), and the public sector.

Status: In progress.

INTERAGENCY COORDINATION PROGRAM

PROJECT (OCB-502-I): *COMPREHENSIVE PLAN REVIEW*

ISSUE TOPICS: Hydrology, Water Quality, Lake Sediments

- **Local government comprehensive plan review**

  Goals/rationale: Ongoing intergovernmental coordination effort aimed at assisting local governments in the preparation and revision of comprehensive plans and at encouraging incorporation of OCB-Plan objectives into these comprehensive plans. Pollution control and prevention and the protection of water resources, natural hydrologic regimes, and water quality, are major goals of the comprehensive plan review effort. Attainment of these goals is necessary to prevent and control cultural eutrophication in waterbodies of the basin.

  Participants: SJRWMD, Alachua, Marion, and Putnam counties, City of Gainesville, and other municipalities; coordinated through the District's Division of Policy and Planning.

  Status: In progress

INTERAGENCY COORDINATION PROGRAM

PROJECT (OCB-503-I): *FUND PROCUREMENT COORDINATION*

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitat, Future Protection of the Basin, Public Outreach

- **Fund procurement coordination for OCB plan implementation**

  Goals/rationale: Ongoing multiagency effort to procure funding from federal, state, regional and local governmental sources (as well as from private contributors) for the implementation of various components of the OCB Surface Water Management Plan. Efforts to expand funding sources for aquatic plant management statewide (in particular for hydrilla management in the Orange Creek Basin and elsewhere) are currently underway. Additional funding is particularly needed to implement projects and project elements in this plan concerned with water quality and hydrologic monitoring in the basin, floating and emergent marsh remediation, Orange Lake sinkhole intervention, and organic sediment accumulation in lakes.

  Recently, the District has allocated funds to assist local governments in the basin with stormwater retrofitting efforts. Funding sources for District land acquisition and management in the basin generally proceed from state sources (P-2000 and Save Our Rivers Programs) and/or District levied ad valorem taxes (SJRWMD 1995; District Five-Year Plan for Land Acquisition and Management).

  Participants: SJRWMD, other governmental agencies (Federal, State, regional, and local), and private contributors.

  Status: In progress.

INTERAGENCY COORDINATION PROGRAM

PROJECT (OCB-504-I): *INTERGOVERNMENTAL BASIN COORDINATION*

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitat, Future Protection of the Basin, Public Outreach

- **Regional intergovernmental forums**

  Goals/rationale: Ongoing District initiative to periodically hold county-based intergovernmental forums (involving state, regional, and local government agencies) aimed at addressing multiple issues dealing with sound growth management in the region. The regional intergovernmental forum provides a practical means of opening interagency communication channels to facilitate coordination among cooperating agencies and to ensure the timely notification of government proposed actions which could potentially affect surface water management decisions in the Orange Creek Basin.

  Close coordination is needed between FDEP, SJRWMD, and county and city governments to facilitate implementation of cooperative measures for exotic weed control, protection and restoration of native aquatic plant populations, floating vegetation management, and for preventing and controlling nutrient enrichment and organic sediment accumulation resulting from cultural eutrophication. The maintenance of fish and wetland wildlife habitats through the protection of water quality, wetland vegetation, and lake sediments needs to be a common goal for all governmental agencies. Coordinated planning for the future acquisition of potential conservation lands and for the notification of proposed land management changes in existing public lands are two examples of land acquisition and management needs expected to benefit from the intergovernmental forum initiative.

  Participants: Coordinated multiagency effort (federal, state, regional, and local governmental agencies);

  Status: In progress. Intergovernmental forums for Alachua County (organized and sponsored by SJRWMD and SRWMD) were initiated in November 1995.

4.6 PUBLIC OUTREACH PROGRAM

PROJECT (OCB-601-P): ***BASIN AND SUBBASIN TASK FORCES AND ADVISORY COUNCILS***

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities, Future Protection of the Basin, Public Outreach

◆ Orange Creek Basin Advisory Council and Scientific Advisory Committee

Goals/rationale: Currently active multi-member groups coordinated by the SJRWMD to address Orange Creek Basin issues. The OCB Advisory Council is represented by local residential and business communities and local, regional, and state governments. The primary function of the Advisory Council is to provide guidance in formulating and evaluating strategies for waterbody management, protection, and restoration activities and to promote public awareness and intergovernmental cooperation regarding basin issues. The OCB Scientific Advisory Committee (OCB SAC) provides the technical and scientific expertise needed to evaluate specific issues being addressed by the OCB Advisory Council. Issues that have been considered by the Council and more recently by the OCB SAC include management and enhancement of fish and wetland wildlife habitats, management of fisheries, lake management alternatives aimed at preventing negative impacts of extreme low lake levels in Orange Lake, restoration of altered hydrology in OCB lakes and other waterbodies, and improvement needs for aquatic weed management in the basin. Other issues include protection and restoration of native aquatic plant populations, management of floating islands, pollutant loading into basin waterbodies, lake eutrophication, muck accumulation in lakes, and land conservation through public land acquisition. Recommendations by the OCB Advisory Council and the OCB SAC to the SJRWMD on management decisions regarding basin water resource issues will be based on the results and findings of the diagnostic and feasibility projects presented in this plan.

In accordance with the Florida Sunshine Law, all meetings held by the Advisory Council or the Scientific Advisory Committee are open to public attendance. Public comment and participation is strongly encouraged at these meetings.

Participants:

OCB Advisory Council
- Alachua County Commission (Leveda Brown)
- Business community, Alachua County (Thomas Coward)
- Environmental Organization (Gary Appleson)
- FDEP (Pam McVety/David Trimble)
- FGFWFC (Jim Estes)
- GRU (David Richardson)
- Landowner, Lochloosa Lake (Ed Tanner)
- Landowner, Newnans Lake (Robert Hutchinson)
- Landowner, Orange Lake (Crawford Solomon)
- Recreational fishing industry (Jerry Harris)
- SJRWMD (Richard Hamann)

OCB SAC members

Alachua County Public Works (Ed Culpepper)
FDEP, Bureau of Aquatic Plants (Joe Hinkle)
FDEP, Bureau of National and Cultural Resources (Dana Bryan)
FGFWFC, Fisheries Division (Jim Estes)
FGFWFC, Division of Wildlife (Steve Nesbitt)
Marion County (Stuart McElhaney, Fire Chief)
SJRWMD (Lawrence Battoe, Chairman of the Committee)
UF, Dept. of Zoology (Frank Nordlie)
UF, Department of Fisheries and Aquatic Sciences (Claire Schelske)

Status: In progress. The OCB Advisory Council has been meeting regularly since January 1994. The OCB SAC began monthly meetings in July 1995.

◆ Subbasin task forces or working groups

Goals/rationale: Planned District outreach initiative to organize task forces or working groups which will be created on an "as-needed" basis by request of the public or of the OCB Advisory Council. These task forces or working groups will be aimed at addressing in greater detail, specific basin issues identified by the OCB Advisory Council or the OCB Scientific Advisory Committee..

Participants: Mixed effort, determined by the purpose of the task force.

Status: in progress. Past task forces that have addressed specific lake management issues in the Orange Creek Basin include a task force by the FGFWFC (to address fisheries management issues on Orange and Lochloosa lakes). More recently, the OCB Advisory Council created a task force to address recreational access issues on Prairie Creek.

PUBLIC OUTREACH PROGRAM

PROJECT (OCB-602-P): *CITIZEN VOLUNTEER ACTIVITIES*

ISSUE TOPICS: Aquatic Plant Management, Water Quality, Fish and Wildlife Habitats and Communities, Public Outreach

◆ Habitat cleanups

Goals/rationale: Ongoing series of cooperative (multi-agency) efforts aimed at sponsoring and organizing habitat cleanups in the Orange Creek Basin. Recently completed habitat cleanups include a Paynes Prairie cleanup (April 1995, University of Florida wetlands Club) and a Hogtown Creek cleanup (September 1995, multi-agency initiative). Recently completed habitat cleanups include a Paynes Prairie cleanup (April 1995, University of Florida Wetlands Club), a Hogtown Creek cleanup (September 1995, multi-agency initiative), and a Newnans lake/Prairie Creek cleanup (Celebrate the St. Johns River Cleanup, Water Management District/County initiative). Habitat cleanups help improve the quality of aquatic and wetland environments, for the benefit of fish and wetland wildlife communities and of recreational users. Habitat cleanups are an effective way of enhancing public awareness on the importance of pollution prevention and ecosystem protection. By directly involving citizens in local community restoration actions, habitat cleanups additionally contribute to augment the sense of accomplishment and motivation among the public, at a grass roots level.

Participants: various state, regional, and local governmental agencies and non-governmental organizations.

Status: In progress.

◆ Volunteer monitoring in the OCB

Goals/rationale: Multi-agency effort aimed at organizing and directing volunteer monitoring activities in the basin. The largest existing volunteer monitoring effort active in the Orange Creek Basin is the Lake Watch Program, a water quality monitoring network organized by the Department of Fisheries and Aquatic Sciences of the University of Florida. Other volunteer efforts are planned, such as the volunteer stormwater monitoring of basin tributaries. This effort will monitor concentrations of chemical and physical constituents in tributary streams under high-flow conditions. These measurements are needed to quantify external nutrient loading into basin waterbodies during storm events and to develop external nutrient budgets for these waterbodies. The information from the stormwater monitoring effort will help identify areas of improvement under regulatory projects OCB-402-RG and OCB-403-RG. Stormwater tributary monitoring will also provide information needed to effectively address the problem of organic sediment accumulation in OCB lakes (see project OCB-101-D).

Volunteer bird counts organized by nongovernmental organizations such as the Audubon Society are another example of highly effective volunteer monitoring activities which contribute significantly to the overall goal of maintaining and enhancing fish and wetland wildlife populations in the Orange Creek Basin. By allowing active participation of citizens in the data collection process, volunteer monitoring activities effectively enhance the public's sense of involvement and accomplishment in the basin.

Participants: Local citizens; effort coordinated by governmental agencies (e.g. SJRWMD, FDEP, FGFWFC) or non-governmental organizations.

Status: In progress.

PUBLIC OUTREACH PROGRAM

PROJECT (OCB-603-P): *LOCAL GOVERNMENT COMMISSION UPDATES*

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities, Future Protection of the Basin, Public Outreach

- **City and County Commission meeting updates**

  Goals/rationale: District outreach effort to stay informed regarding items discussed at city and county commission meetings which pertain to basin surface water management and protection issues in the basin. These issues may include stormwater management needs, flood control needs, and aquatic resources protection. The city and county commission meeting updates contribute to the Public Outreach goal of enhancing intergovernmental coordination in the basin.

  Participants: SJRWMD; in-house effort.

  Status: Planned, second priority.

PUBLIC OUTREACH PROGRAM

PROJECT (OCB-604-P): *PUBLIC EDUCATION AND AWARENESS*

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities, Future Protection of the Basin, Public Outreach

◆ Adult awareness program

Goals/rationale: Ongoing District effort aimed at identifying public (adult) education needs with the goal of enhancing awareness of basin issues and/or problems. Several efforts concerning the preparation of informational support material (e.g. fact sheets, portable displays) and presentations at basin and subbasin workshops (OCB-605-P) are currently underway. Increased awareness on the need for natural water level fluctuations and the values and benefits of naturally-occurring low water periods to maintain lake and wetland ecosystem benefits is an important objective within these efforts. Increased awareness of the potential threat exotic aquatic plants represent to the ecological well-being of lakes and wetlands and on ways the public can prevent the spread of exotic species in recreational waterbodies is an important goal of the adult awareness program. Additionally, educational efforts aimed at enhancing public understanding of the values and benefits of currently employed aquatic weed control measures, of native wetland species as fish and wetland wildlife habitats, and on the need to protect and restore lost or threatened native aquatic plant populations are also needed. Another outreach initiative will focus on disseminating information on the role of floating vegetation in lake and wetland ecosystems and on existing problems and solutions concerning floating vegetation in OCB lakes, once pertinent diagnostic and management and restoration efforts are completed.

With regard to pollution issues, public outreach efforts should focus on enhancing awareness on: (a) environmental impacts and public health risks associated with pollutants in stormwater systems and receiving waterbodies and (b) community actions that help reduce or prevent pollutant loading into surface waters. Associated with this will be efforts to: (a) educate the public on the subjects of lake nutrient status and trophic function and on the causes leading to lake eutrophication and muck accumulation, and (b) direct and encourage local communities/residents to participate in programs/activities aimed at reducing anthropogenic nutrient loading into surface waterbodies of the basin (e.g. lake/stream cleanup operations, stormdrain stenciling programs, correction of defective septic system operation, implementation of best management practices for the proper use and disposal of fertilizers). Some of these public participation activities have already been initiated (see project OCB-602-P; Citizen volunteer activities). These education and awareness programs will be closely coordinated with the local government environmental protection ordinance assistance project (OCB-402-RG).

An important area of focus of this adult awareness effort deals with enhancing awareness of the values and benefits of public land acquisition as a means of achieving the goals of (a) conserving and restoring water resources and their associated ecosystem benefits and (b) providing compatible recreational opportunities to the public.

Participants: SJRWMD in-house effort, with possible cooperation from other governmental agencies and private entities (e.g. non-governmental organizations).

Status: In progress (coordinated under the District's Office of Public Information).

- **School education and awareness program**

  Goals/rationale: Planned District effort aimed at evaluating informational needs for local school programs (elementary through highschool) with the goal of increasing the awareness among the resident school population of the need and the means to manage and protect water resources in the Orange Creek Basin and of the public's role in this effort. Specific areas of focus within the school education and awareness program will be similar to those specified above for the adult awareness program.

  Participants: SJRWMD in-house effort, coordinated with public and private schools.

Status: Planned, firstpriority.

PUBLIC OUTREACH PROGRAM

PROJECT (OCB-605-P): *BASIN AND SUBBASIN WORKSHOPS*

ISSUE TOPICS: Hydrology, Aquatic Plant Management, Water Quality, Lake Sediments, Fish and Wildlife Habitats and Communities, Future Protection of the Basin, Public Outreach

- **Presentations at scientific meetings**

  Goals/rationale: Ongoing District effort to inform the scientific and technical community of the results and progress of completed and ongoing projects and project elements identified in the OCB Plan. These presentations serve the purpose of (1) enhancing awareness among members of the scientific community of basin issues and actions being taken to address these issues, and (2) providing input to basin project managers from scientific peer review.

  Participants: SJRWMD, in-house effort.

  Status: In progress.

- **Presentations to local citizen groups**

  Goals/rationale: Ongoing District effort to deliver technical or non-technical presentations to local citizen groups on request. This effort contributes in an important way to the enhancement of public education and awareness on water resource issues in the basin.

  Participants: SJRWMD, in-house effort.

  Status: In progress.

PUBLIC OUTREACH PROGRAM

PROJECT (OCB-606-P): *EDUCATIONAL AND INFORMATIONAL SUPPORT MATERIAL*

ISSUE TOPICS: Public Outreach

- **Fact sheet for the OCB**

  Goals/rationale: District effort to develop informative, multi-purpose fact sheets for general distribution at advisory council, scientific, and local citizen group meetings, or at regional or local community events (e.g. habitat cleanups). A fact sheet containing an overview of the basin and a general description of the main issues currently being addressed in the basin has been completed.

  Participants: SJRWMD, in-house effort.

  Status: In progress.

- **Portable display for the OCB**

  Goals/rationale: District initiative to construct a multi-purpose portable display for the Orange Creek Basin to set up at meetings and events. Currently, the portable display contains graphic and textual information complementary to the fact sheet on the basin. The portable display will be updated in the future on an as-needed basis.

  Participants: SJRWMD; in-house effort.

  Status: In progress.

- **White (fact) sheets for the OCB**

  Goals/rationale: District effort to produce fact sheets for addressing specific issues or topics concerning water resource management in the Orange Creek Basin.

  Participants: SJRWMD, in-house effort.

  Status: Planned, first priority.

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5. GLOSSARY

anthropogenic. Caused or produced by humans- **anthropogenically**, *adv.*

drainage basin. The total land area that drains toward a lake or stream.

ecosystem integrity. The degree to which the structure, function, and native biodiversity of an ecosystem approaches natural conditions.

ecosystem. An interconnected community of living things, including humans, and the physical and chemical environment within which they interact.

ecosystem management[1]. A natural resource management approach aimed at restoring and sustaining the health, productivity, and biological diversity of ecosystems and the overall quality of life in a manner that fully integrates ecological, economic, and social factors. Ecosystem management is applied within a geographic framework defined primarily by ecological boundaries.

enhance. To increase the quality, value, or attractiveness of.

eutrophication. The process by which lakes are enriched with nutrients, increasing the production of rooted aquatic plants and algae. The extent to which this process has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

goal. A desired result or achievement toward which effort is directed. Goals may be general (pertaining to the overall interests for the basin) or specific (pertaining to individual issues or subbasins).

improve. To bring into a more desirable condition.

issue. A point in question or matter of discussion. As used in this report, an issue refers to an area or topic of concern of basin-wide relevance.

maintain. To keep in existence in its present state.

maintenance. the act of maintaining or the state of being maintained.

manage. to implement actions leading to the maintenance or improvement ecosystems and/or of ecosystem components (e.g., communities, species populations, habitats).

management. the act of managing or the state of being managed.

natural. Existing in or formed by nature; un-impacted by human activities.

preserve. To protect from future harm or ecological degradation

program. A coordinated group of projects and project elements that share a common function (e.g., Diagnostic program, Feasibility program).

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[1] From: Interagency Ecosystem Management Task Force (1995). The Ecosystem Approach: Healthy Ecosystems and Sustainable Economies, Volume I - Overview. National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia.

project. An assignment or task of investigation comprised of one or more efforts or project elements, intended for implementing strategies required to achieve issue-related goals.

project element. Individual components or sub-tasks within a project.

rehabilitate: To repair a damaged ecosystem or component of an ecosystem with the purpose of (a) restituting desired attributes or functions, (b) arresting or avoiding further deleterious effects on surrounding systems, and/or (c) attaining a beneficial economic, recreational, and/or aesthetic value.

rehabilitation. The act of rehabilitating or the state of being rehabilitated.

restore[2]**.** The return of an ecosystem or of a component of an ecosystem (e.g. a lake, or a lake's hydrology, aquatic vegetation, fish populations, or sediments) to a close approximation of a more natural and less anthropogenically disturbed condition, with the goal of reestablishing lost ecosystem structures, processes, and functions (i.e., to re-establish ecosystem integrity).

restoration. the act of restoring or the state of being restored.

sedimentation. Accumulation of organic and inorganic matter on a lake's or stream's bottom. Sedimented matter includes decaying algae and weeds, marl, and soil and organic matter eroded from the watershed.

self-maintaining system[3]. An ecosystem that can perform all of its natural ecological functions without human intervention or dependence on engineered structures.

strategy. A plan or method for achieving a specific goal.

sustain. To keep in a healthy self-maintaining condition. Refers to ecosystems or natural resources, or to their attributes or functions.

trophic state or condition. See "eutrophication".

watershed. See "drainage basin".

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[2] Modified from: National Research Council (1992). Restoration of Aquatic Ecosystems; Science, Technology, and Public Policy. National Academy Press, Washington D.C.

[3] From: National Research Council (ibid.).

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A

APPENDIX A

Detailed physiographic description of the Orange Creek Basin

(From Brooks 1982a)

The following description complements the information portrayed in Figure 4. It refers exclusively to that portion of the Orange Creek Basin (the dominant portion) within the Florida Section. Sections are subdivided into districts and subdistricts. Subdistricts are further subdivided into regions.

Florida Section

Ocala Uplift District. The Ocala Uplift District, which occupies the western portion of the basin, is a broad uplift area dating to the Middle and Late Tertiary Period, characterized by Early Tertiary limestones (Ocala limestones) lying mostly at or near the surface. Mixed hardwood forest, pine flatwoods, and sandhills (Myers & Ewel 1990) are characteristic of this area. Topography is varied, but low rolling karst plains are a common feature of the landscape. Most surface elevations are 65 ft above mean sea level or less, although higher elevations associated with erosional remnants of the northeastern upland plateau are also present (Pirkle 1956). Distinctive features of this area include flat-bottomed lakes, level prairies, disappearing streams, and numerous lime sinks. The piezometric surface of the groundwater of the Eocene limestone roughly corresponds with the level of the depressions and lakes (Pirkle and Brooks 1959).

The Ocala Uplift District is comprised of three subdistricts:

1. Northern Peninsular Plains Subdistrict. This area accounts for a substantial part of the Ocala Uplift District. It extends in a northwest to southeasterly direction from Kanapaha Prairie and Paynes Prairie to Orange Creek (just west

of State Road 21) and also includes Orange and Lochloosa lakes. It consists of karst plains mostly between 80 and 100 feet above mean sea level, but with a secondary portion (toward the south) at about 60 ft. Most of the area is contained in the Alachua Prairies Region, where much of the terrain has been reduced to near the present water table due to underground limestone solution (Brooks 1982a, Sellards 1912).

2. Northern Peninsular Slopes Subdistrict This area includes higher elevation lands (up to 195 ft above mean sea level) around the city of Gainesville (San Felasco Hammock Region) and the lower (less than 125 ft) Newnans Lake Basin Region, which contains Newnans Lake and Lochloosa Creek. The soils of this subdistrict are derived from the weathering of Miocene or Pliocene phosphatic, clayey sands of the Hawthorn formation. In areas where the Floridan aquifer is confined by the Hawthorn Formation (e.g. north of Lochloosa Lake), natural discharge can occur in the form of artesian springs (Pyne 1983).

3. Marion Hills subdistrict This subdistrict comprises a minor part of the basin's Ocala Uplift District and is represented primarily by relic hills and hill systems of Miocene and Pliocene clastic sediments with karst terrain intervening. The Fairfield Hills Region to the west of Orange Lake, and the smaller Anthony Hills and Kendrick Hills regions to the south, form part of this subdistrict. The Fairfield Hills Region characteristically has high elevations (up to 200 ft above mean sea level) and is covered primarily with hardwood forests.

Central Lake District. The Central Lake District occupies the easternmost portion of the Orange Creek Basin. It consists of a sandhill karst terrain containing numerous small and medium-sized solution basins. In contrast to the Ocala Uplift District, the Ocala limestones of the Central Lake District are overlain by surficial sands, making this the

region of most active collapsed sinkhole development and of greatest recharge to the Floridan aquifer (Brooks 1982a). Sandhills and sand pine scrub communities are characteristic of the Central Lake District.

The Central Lake District is represented by three subdistricts:

1. Perched Lakes and Prairies Subdistrict. This subdistrict is characterized by the presence of more clayey surficial sand resulting from Miocene limestone influence on the karst development of the area. Maximum elevation is 186 feet. The lower elevations (around 140 feet) are predominantly covered by flatwoods and river swamp vegetation. Sandhill type vegetation occurs on the low hills.

2. Interlachen Sand Hills Subdistrict. Thick sand and gravel deposits provide the numerous lakes in this area with a direct hydraulic connection to the Floridan aquifer. These lakes are at or only slightly above the potentiometric level in the limestone aquifer. Elevations are up to 220 feet. Longleaf pine/turkey oak is the prevalent vegetation association in this subdistrict.

3. St. Johns Offset Subdistrict. Ths portion of the St. Johns River Valley is very ancient. The Eocene limestone is very near the surface and solution has contributed to the development of the broad valley. This subdistrict includes most of Little Orange Creek and Cabbage Creek watersheds. Several large springs exist in the area (e.g. Orange Springs). Flatwoods occur on the Pleistocene terraces and a river swamp forest, generally with many cabbage palms, occurs on the floodplain.

B

APPENDIX B

List of past and current studies in the Orange Creek Basin

Completed Studies

The following is a list of completed studies and reports related to the Orange Creek Basin. Where the water body included in that particular report or study is not apparent from the title, it is indicated parenthetically in italicized text following the citation. For documents that could not be located, the report where they were cited is given in brackets following the entry.

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Baker, L.A., P.L. Brezonik, and C.R. Kratzer. 1981. *Nutrient loading - trophic state relationships in Florida lakes.* Publication 56. Gainesville, Fla.: University of Florida, Water Resources Research Center. (*Bivens Arm, Lake Alice, Kanapaha, Lochloosa, Newnans, and Orange Lakes, and Lake Wauberg*)

Bartholic, J.F., R.G. Bill Jr., and L.H. Allen Jr. 1978. *Measurement and evaporation from lakes and ponds in Florida.* Publication No. 43. Gainesville, Fla.: University of Florida, Water Resources Research Center. (*Orange Lake*)

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Bays, J.S. 1983. Zooplankton-trophic state relationships and seasonality in Florida lakes. M.S. thesis, University of Florida. Gainesville, Fla. (*Newnans Lake and Lake Wauberg*)

Bays, J.S. and T.L. Crisman. 1983. Zooplankton and trophic state relationships in Florida lakes. *Canadian Journal of Fisheries* 40:1813-1819. (*Newnans Lake and Lake Wauberg*)

Beaver, J.R. 1980. The distribution of planktonic ciliated protozoans in 30 Florida lakes of varying trophic state. M.S. thesis, University of Florida. Gainesville, Fla.(*includes Newnans Lake and Lake Wauberg*)

Beaver, J.R. and T.L. Crisman. 1982. The trophic response of ciliated protozoans in fresh water lakes. *Limnology and Oceanography* 27:246-253. *(Newnans Lake and Lake Wauberg)*

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Brezonik, P.L., W.H. Morgan, E.E. Shannon, and H.D. Putnam. 1969. *Eutrophication factors in north central Florida lakes.* Engineering Progress at the University of Florida Bulletin Series No.134. Water Resources Research Center Publication No. 5. Gainesville, Fla.: University of Florida. *(Bivens Arm, Lake Alice and Lochloosa, Kanapaha, Newnans, and Orange Lakes)*

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Canfield, D.E. 1981. *Chemical and trophic state characteristics of lakes in relation to regional geology: Final report.* Gainesville, Fla.: University of Florida, Cooperative Fish and Wildlife Research Unit. *(Includes Lochloosa, Newnans and Orange Lakes and Lake Wauberg)*

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Zeilinga, R. 1975. Some chemical aspects of the impact of effluent from Gainesville municipal sewage treatment plant on the nutrient flows on Paynes Prairie State Preserve. University of Florida, Gainesville. [cited in Gottgens and Montague 1988].

Studies in progress or planned

Alligator egg viability study and hormone levels in eggs. Investigator - Florida Game and Fresh Water Fish Commission. Wildlife Research Laboratory, Gainesville, Fla. *(primarily working on Lake Apopka, but, they will collect some eggs from Orange Lake). (in progress)*

Alligator type preferences, related aquatic faunal assemblages, and effects of alligators on trophic state. Investigator - Jason D. Evert (graduate student). Department of Zoology, University of Florida, Gainesville, Fla. *(planned)*

Annual bald eagle nesting survey - monitoring survey Investigator - Florida Game and Fresh Water Fish Commission. Wildlife Research Laboratory, Gainesville, Fla. *(in progress)*

Arsenic contamination of soils around old cattle dipping vat sites in Paynes Prairie. Investigator - R.D. Rhue, B. Reve, and J.E. Thomas. University of Florida, Soil and Water Science Department, Gainesville, Fla. *(in progress)*

Biological control of hydrilla in Orange Lake. Investigator - J. Cuda. Entomology and Nematology Department, University of Florida, Gainesville, Fla. *(in progress)*

Fungi collections in Paynes Prairie. Investigator - J.W. Kimbrough and L. Li. University of Florida, Department of Plant Pathology, Gainesville, Fla. *(in progress)*

GIS based succession model for Prairie Creek, Paynes Prairie State Preserve. Investigator - G. White. (P.I.- Dr. Paul Zwick, Proj Manager - J.David Lambert). Geoplan Center at the University of Florida, Gainesville, Fla. *(in progress)*

Natural history of queen butterflies, their milkweed hosts, and non-milkweed nectar plants of Paynes Prairie. Investigator - R.A. Moranz (graduate student). Department of Zoology, University of Florida, Gainesville, Fla. *(in progress)*

Nutrient monitoring in Orange and Lochloosa Lakes - Lake Watch Volunteers. Investigator - Dan Canfield. University of Florida, Department of Fisheries and Aquatic Sciences, Gainesville, Fla. *(in progress)*

Role of environmental contaminants in fish infected with the wading bird parasite Eustronogylides ignutus. Investigator - D. Coyner. Department of Infectious Diseases, Veterinary School, University of Florida, Gainesville, Fla. *(in progress)*

Soil characterization of wetlands in Paynes Prairie Investigator - R. Reddy. University of Florida, Soil and Water Science Department, Gainesville, Fla. - *(in progress - an on-going urban program project funded by DEP).*

Spiders in the genera Mastophora, Kaira, and Phoroncidia from Paynes Prairie State Preserve. Investigator - M.Stowe(graduate student - under supervision of Dr. J. Reiskind) University of Florida, Department of Zoology, Gainesville, Fla. *(in progress)*

Vegetation studies and monitoring of exotics in Paynes Prairie. Investigator - Dana Griffin. University of Florida, Botany Department, Gainesville, Fla. *(in progress)*

C

APPENDIX C

REGULATORY REQUIREMENTS

Federal Government

EPA

The National Pollutant Discharge Elimination System (NPDES) permit program is a Federal Regulatory program administered by the Environmental Protection Agency (EPA). NPDES permits typically address point source discharges to surface waters, such as industrial and municipal wastewater discharges. Existing NDPES wastewater permits for the OCB are compiled in Appendix D, Table D-1.

More recently, the NPDES program has expanded to nonpoint source stormwater discharges. NPDES stormwater permits are required for municipalities with a population of 100,000 or more. The city of Gainesville is expected to be required to apply for an NPDES stormwater permit in the near future, once it reaches this population threshold. As of May 1995, the Federal NPDES permit program has been delegated to the Florida Department of Environmental Protection.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACOE) administers the Federal Dredge and Fill permit program for the State of Florida. Federal Dredge and Fill permits (authorized under section 404 of the Federal Clean Water Act) are required for dredge and fill activities in navigable waters of the United States or waters of importance for interstate commerce.

Because the protection of fish and wildlife is a major component of the Dredge and Fill permits, oversight by the U.S. Fish and Wildlife Service is required. Water Quality Certifications (authorized under section 401 of the Clean Water Act) generally accompany 404 Dredge and Fill permits. Traditionally, 401 requirements have been met

through state permit requirements (e.g. Wetland Resources Management permit; now the Environmental Resources Permit).

State and regional government

Through the Environmental Resources Permit (ERP) program effective October 3 1995, FDEP and SJRWMD jointly regulate activities previously covered under two separate permitting programs: the Wetlands Resource Management (WRM) program (formerly Dredge and Fill) and the Management and Storage of Surface Waters (MSSW) program. The ERP program, authorized by the Florida Environmental Reorganization Act of 1993 (known as the Streamlining Act) combines the provisions of these two older programs into a consistent statewide rule. WRM permits and MSSW permits, however, still apply to projects which qualify under the ERP grandfathering provisions.

In addition to the ERP program, the St. Johns River Water Management District administers Consumptive Use permits (CUPs), Agricultural Discharge permits, Well Construction permits, and Stormwater permits. Existing CUPs, Well Construction permits, MSSW permits, Wetlands Resources permits, and Stormwater permits for the Orange Creek Basin are listed in Appendix D, Tables D-2 through D-6. These permit programs are explained below.

- **Consumptive Use Permits (CUPs)**

  The District regulates water use under the authority of part II, Chapter 373, Florida Statutes, according to the provisions of Chapter 40C-2 F.A.C. Essentially this document provided all qualified users equal right to the reasonable use of surface and ground water.

  CUPs are classified according to source of withdrawal, type of use, and the location of the withdrawal. They are required for the following activities: 1) to use, divert, or withdraw water in the District; 2) to construct, repair or

abandon a water well; and 3)to engage in business as a water well contractor. CUPs are issued with compliance conditions, and require a water conservation plan.

- **Stormwater Management Systems**

The discharge of untreated stormwater may reasonably be expected to be a source of pollution to waters of the state and is, therefore, subject to District regulation. A stormwater permit is required for land alterations that contribute to stormwater runoff, including land development projects and most public works projects such as roads and drainage projects. A permit under Chapter 40C-42, Florida Administrative Code (F.A.C.), is required for new or reconstructed stormwater management systems as defined in the rule.

- **Agricultural Surface Water Management Systems**

Chapter 40C-44 (F.A.C.) establishes permit performance standards for agricultural discharges. A permit is required for maintenance and operation of existing agricultural surface water management systems with pump discharges of 10,000 gallons per minute or greater, systems with discharges that cause or contribute to a violation of state water quality standards, and construction/alteration of a system which drains an area greater than 2 acres.

Agricultural Discharge permits include water quality practices that provide reasonable assurance of meeting water quality standards, such as: (a) the reduction of discharge volume, (b) on site recycling, (c) conservation of nutrient and pesticide plans, and (d) installation of treatment systems using wet detention reservoirs.

- **Management and Storage of Surface Waters (MSSW)**

An MSSW permit is required for construction, alteration, operation, maintenance, abandonment or removal of "works", which are broadly defined by Part IV, Chapter 373, F.S., to include most land alterations. Permits are issued when reasonable assurance is provided that the activities are consistent with the objectives of the District and will not harm the water resources. In general, permit review concerns three major areas; these are:

1. Water Quantity. Drainage, flood protection, floodplain management, erosion and sedimentation;
2. Water Quality. Impacts to both surface and groundwater water quality and conformance with applicable state water quality standards; and
3. Wetland Impacts. Functions provided by contiguous and isolated wetlands to aquatic and wetland dependent species.

With the exception of grandfathered projects, the MSSW permit program has largely been replaced by the ERP program.

- **Wetland Resource Management Permitting (WRM)**

The objective of this program is to regulate dredge and fill operations in wetlands and other surface waters and to protect water quality and fish and wildlife habitat values of these waters. Prior to the authorization of the ERP rule, the WRM program (Chapter 373, F.S.) was implemented under a joint interagency agreement by FDEP and SJRWMD.

With the exception of grandfathered projects, WRM permits have been replaced by the Environmental Resource permits (as of October 3, 1995).

FDEP (Bureau of Aquatic Plants) regulates aquatic weed removal activities through the Aquatic Plant Control Permit Program initiated in 1974. Aquatic Plant Control permits are required for aquatic weed removal in all public waters and in private lakes greater than 10 acres in size and with more than one owner. Traditionally, permits have been issued on an annual basis. Starting in May 1996, all permits will have a duration of three years. Active permits for the basin in 1996 include: 22 for Orange Lake, 4 for Lochloosa Lake, and 3 for Cross Creek.

Local Government

Alachua County

Alachua County has regulatory authority over surface waters in the unincorporated area of the county through their Stormwater Management and Surface Waters and Wetlands ordinances.

The Stormwater Management Ordinance (Ordinance 92-17) provides standards for the design, construction, and operation of stormwater management systems in conformance with best overall management practices for the control of runoff volume and treatment of stormwater runoff for the protection of surface and groundwater quality, and for the control and prevention of erosion, sedimentation and flooding. The stormwater Management Ordinance implements the goals, objectives, and policies of the Alachua County Comprehensive Plan.

The purpose of the Surface Waters and Wetlands Ordinance (Ordinance 92-42) is to preserve, protect, and improve the public health, safety, and general welfare of the citizens of Alachua County, and to conserve and protect open bodies of water and flowing streams, wetlands, and the natural and scenic resources of Alachua County, and to implement the Alachua County Comprehensive Plan.

City of Gainesville

The City of Gainesville administers the Stormwater Management Utility Program (CD chapter 27, Article V). through the Stormwater Management Utility Ordinance (Ordinance N. 3444, § 1, 7-25-88). This ordinance authorizes the city of Gainesville to establish stormwater management as a City utility enterprise in accordance with Florida Statute 403.0893 and to establish a program of user charges and connection fees for stormwater management service to be levied against all developed property within the City to accomplish the functions of the said utility.

D

APPENDIX D

List of NPDES permits, Consumptive Use Permits, Management and Storage of Surface Waters Permits, Wetland Resource Management Permits, Stormwater Permits, and Well Construction Permits for the Orange Creek Basin.

Explanatory Notes

Appendix D lists the following permits for the Orange Creek Basin:

- NPDES wastewater permits (Table D-1)
- Consumptive Use permits (CUPs; Table D-2)
- Well Construction Permits (Table D-3)
- Management and Storage of Surface Waters Permits (MSSWs; Table D-4)
- Wetland Resource Management Permits (WRMs; Table D-5)
- Stormwater Permits (Table D-6)

Well construction permits are numbered according to the CUP they apply to and complement the CUP information with site location and source of surface water withdrawal. Information on MSSW permits issued by the Florida Department of Environmental Protection is not provided by the District and is not included in this listing. The permit information included in these tables was retrieved form the Districts database in Feb. 1995, prior to the adoption of Environmental Resource Permit (ERP) (October 2). Some permits which appear to be expired in these tables may have been renewed. Permits were retrieved by Section, Township, and Range. Because the Orange Creek Basin boundaries do not precisely correspond with Section, Township, and Range boundaries, some permits in this listing may lie outside the basin.

Table D-1. NPDES Wastewater Permits in the Orange Creek Basin. Data retrieved by EPA (Atlanta, GA) on 09/07/95.

NPDES-ID#	NAME OF FACILITY	FACILITY ADDRESS	CITY	STATE	ZIP CODI	CONTACT PERSON FOR FACILITY	TEL. #	LAT	LONG	ISSUED	EXP.	RECEIVING WATERS
FLG040020	UNV SHELL CAR WASH/GAINESVILLE	2552-2 NORTHWEST 13TH ST	GAINESVILLE	FL		DON E BACHAND JR-ENV ENGR						
FLG040041	AMOCO STATION NO.432	1255 W. UNIVERSITY AVE.	GAINESVILLE	FL		TIM SMITH-PERMIT ADMIN.	9047351800	293910	822025			TUMBLIN CREEK TO BIVENS ARM
FLG040047	AMOCO SERVICE STATION NO.493	3424 S. W. WILLISTON RD.	GAINESVILLE	FL		TIM SMITH-PERMIT ADMIN.	9047351800	293000				STORM DRAIN TO UNNAMED WETLAND
FLG830085	GATE SERVICE STATION No. 12	905 EAST UNIVERSITY AVE	GAINESVILLE	FL		JEFF MORGAN	8136460366	293900	821824			PAYNES PRAIRIE
FLG830131	SPEEDWAY (F/K/A #9836)	4207 NORTHWEST 13TH STREET	GAINSVILLE	FL		BRIAN FLAHERTY	8135382300	294137	822022	81792	71694	HOGTOWN CREEK
FLG830221	POP-A-TOP II					MR. DEAN A.F. BURGIS, SR				100793		SWEET WATER BRANCH
FLG830237	FL BLDG. 706					MR. ED UNDERWOOD, CHIEF				101593		DITCH SWALE
FLG830350	THOMAS OIL CO/WESRGATE 66	3320 W. UNIVERSITY AVE	GAINESVILLE	FL		DAVID THOMAS		293908	822220		61494	HOGTOWN CREEK
FL0040215	BRITTANY ESTATES MHP WWTP	5010 N.E. WALDO ROAD	GAINESVILLE	FL	32609	MR.ROBERT RISSMAN, PRESIDENT				102292	103197	LITTLE HATCHET CREEK
FL0041076	HAWTHORNE HIGH SCHOOL	602 WEST LAKE AVENUE	HAWTHORNE	FL	32601	ROBERT W. HUGHES, SUPT.SCHOOLS	9049557752	293537	820531	72694	73099	AN UNNAMED MARSH
FL0041700	GAINSVILLE KANAPAHA WWTP					RON DARE	9043342869			51590	53195	LAKE KANAPAHA
FL0042242	WALDO WWTP CITY OF					KURT LANNON-CITY CLERK	9044681001			92990	103195	
FL0042552	YMCA CAMP MCDONNELL	OFF S.R. 441 (NW OF MICANOPY)	MICANOPY	FL	32667	WILLIAM DOVER, MANAGER	9044663587			73091	63096	GEORGE'S POND

Table D-2. Consumptive Use Permits (CUPs)

APPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	GW %	SW %	MAX ALLOC.
2-001-0002ANMR2	FLORIDA BLUEBERRIES, INC. ATTN: PHILIP I. EMMER, PRESIDENT 2801 SW ARCHER ROAD GAINESVILLE, FL 32608	80	1993 2 9	2000 2 9	81.5	18.5	43.2
2-001-0003ANR	GAINESVILLE SUN ATTN: WILLIAM DEAN 2700 S.W. 13TH STREET GAINESVILLE, FL 32602	7.3	1991 115	1998 115			3.45
2-001-0004AURYV	COVERED BRIDGE APARTMENTS 1810 NW 23RD BLVD GAINESVILLE, FL 32605	18	199311 9	200011 9	100		7.4
2-001-0005AUGR	ALACHUA COUNTY SCHOOL BOARD 620 E. UNIV. AVE. GAINESVILLE, FL 32601	7.1	19901113	19971113			1.6
2-001-0006ANGM	GAINESVILLE REGIONAL UTILITIES ATTN: YOLANTA E YONYNAS P.O. BOX 147117 STATION A136 GAINESVILLE	80	19921013	199810 1			9150.6
2-001-0007ANGF	PAYNES PRAIRIE STATE PRESERVE ATTN: JACK GILLEN ROUTE 2 BOX 41 MICANOPY, FL 32667	10	19941011	20011011			1.1
2-001-0010ANGFM	TOWN OF MICANOPY P.O. BOX 137 MICANOPY. FL 32667	1	1994 3 8	2001 3 8			29.2
2-001-0011AUR	RALPH BROWN ROUTE 2 BOX 127 HAWTHORNE, FL 32640	27	1992 7 7	1999 7 7			7.63
2-001-0013ANMR	KINCAID HILLS WATER CO. %BERDELL KNOWLES P O BOX 579 GAINESVILLE, FL 32602	0	1994 6 7	2001 6 7			34.3
2-001-0014AUGF	SANTA FE COMMUNITY COLLEGE 3000 N.W. 83RD STREET GAINESVILLE, FL 32606	52	1994 8 9	2001 8 9	99		21.3
2-001-0016AUR2M	ARREDONDO UTILITY CO., INC. ATTN: THOMAS P. HICKS, JR. 5517 SW 69TH TERRACE GAINESVILLE		1993 9 7	2000 9 7	100		20
2-001-0017AUR	ARREDONDO UTILITY CO., INC. ATTN: TOMMY P. HICKS, JR. 5517 SOUTHWEST 69TH TERRACE GAINESVILLE, FL 32608	67	19921110	19991110			60.936
2-001-0018AUG	RICHARD BOE GAINESVILLE, FL 32611	5	1985 212	1992 212			83.95

Table D-2. Consumptive Use Permits (CUPs)

APPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	GW %	SW %	MAX ALLOC.
2-001-0020ANFM	SMITH BROTHERS P O BOX 35 HAWTHORNE, FL 32640	50	1992 4 7	1999 4 7			12.2
2-001-0021AUR	GAINESVILLE GOLF AND COUNTRY CLUB 7300 SW 35 WAY GAINESVILLE, FL 32608	140	1992 6 9	1999 6 9			90
2-001-0022AUGRM	CITY OF GAINESVILLE REGIONAL UTILITIES P.O. BOX 147117 A136 GAINESVILLE, FL 32614-7117	11	1992 7 7	1999 7 7			253
2-001-0023AURM	PRUSQUIT JOINT VENTURE/OAKS MALL 6419 NEWBERRY ROAD GAINESVILLE, FL 32605	12	1992 6 9	1999 6 9			8.7
2-001-0024ANR	SHELL OIL COMP. P. O. BOX 22086 TAMPA, FL 33607	0.5	1987 4 6	1989 4 6			2.5
2-001-0026ANM2	ALTO STRAUGHN 11322 S.W. 122 STREET GAINESVILLE, FL 32608	0.018	199312 7	200012 7	100		50.9
2-001-0028ANV	MORRIS VERSCHAEVE RT. 4, BOX 495 HAWTHORNE, FL 32640	42	1985 7 8	1992 7 8			16.5
2-001-0029AUSG	RONALD K. WILLEMSEN P.O. BOX 490 GAINESVILLE, FL 32602	3.86	19851112	19921112			120
2-001-0031AUSGF	UNIVERSITY OF FLA ATTN: CHARLES HOGAN PHYSICAL DIVISION GAINESVILLE, FL 32611	2000	1991 7 9	1998 7 9			18.1
2-001-0032AUS	CROSBY & HOLMES DAIRY RT. 2 BOX 417 HAWTHORNE, FL 32640	124	1987 210	1994 210			13.7
2-001-0034ANM	MEADOWBROOK GOLF INVESTORS ATTN: J. MORGAN BRUNSON 1465 SO FORD HARRISON AVE CLEARWATER, FL		19871013	19941013			173.1
2-001-0035ANVGRM	STATE OF FLORIDA TACACHALE WATER PLANT 1621 NE WALDO ROAD GAINESVILLE, FL 32609	225	1993 6 8	2000 6 8	100		105.62
2-001-0036ANVGM	CITY OF HAWTHORNE P.O. BOX 1270 HAWTHORNE, FL 32640	891	1990 911	1997 911			95.5
2-001-0037ANV	JOSEPH KARKOS P. O. BOX 268 MICANOPY, FL 32667	18	1986 311	1993 311			0.701

Table D-2. Consumptive Use Permits (CUPs)

APPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	GW %	SW %	MAX ALLOC.
2-001-0038ANVGRM	SCHOOL BOARD OF ALACHUA COUNTY 1817 EAST UNIVERSITY AVENUE GAINESVILLE, FL 32601-3400	39	1993 9 7	2000 9 7	100		5.9
2-001-0039ANVRM	DELMER W. RAYMER 4000 SW 47TH STREET GAINESVILLE, FL 32608	46.46	19931012	20001012	100		16.8
2-001-0040ANVRM	REGENCY WINDMEADOWS LTD P O BOX 1122 GAINESVILLE, FL 32602	52.4	19931012	19981012	100		35
2-001-0041ANVFM	MOE DHANJI RT. 2 BOX 804 MICANOPY, FL 32667	5	19931012	20001012	100		7.92
2-001-0042ANVRM	LUSSIER DAIRY INC. P.O. BOX 2168 HAWTHORNE, FL 32640	117	1994 111	2001 111	100		27.4
2-001-0043ANV	WIMBERLY ESTATES WATER INC. 7707 S.W. 11TH AVE. GAINESVILLE, FL 32607	13.74	1986 812	1993 812			4.52
2-001-0044ANMR	MORRIS VERSCHAEVE ROUTE 4 BOX 620 HAWTHORNE, FL 32640	3	1994 8 9	2001 8 9	100		2
2-001-0045ANRM	JOHN H. COLLINS ROUTE 3 BOX 71G HAWTHORNE, FL 32640	29	19941011	20011011	100		0.27
2-001-0047ANM	STARWOOD FARMS RT. 2 BOX 139C HAWTHORNE, FL 32640	1531	1990 312	1997 312			618.9
2-001-0048AUV	UNIVERSITY OF FLORIDA ATHLETIC ASSOCIATION ATTN: J. MICHAEL POWELL GAINESVILLE. FL 32604	42	19881115	19951115			22
2-001-0050ANG	KAY ANDERSON MALL STATION # 23 GAINESVILLE, FL 32601	35	1989 2 7	1993 2 7			2.19
2-001-0051ANM	HOYT E. WALDRON, JR. P O BOX 248 CITRA, FL 32113	400	1992 114	1999 114			127.85
2-001-0052AUVG	DEPARTMENT OF CORRECTIONS 2601 BLAIRSTONE RD TALLAHASSEE, FL 32399-2500	3.2	1989 912	1996 912			2.03
2-001-0053ANY	BGR OF HAILE, INC. 5200 NEWBERRY ROAD, E-9 GAINESVILLE, FL 32607	120	1993 6 8	2000 6 8	100		121.2

Table D-2. Consumptive Use Permits (CUPs)

APPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	GW %	SW %	MAX ALLOC.
2-001-0054AN	SANTA FE HEALTH CARE ALACHUA GENERAL HOSPITAL 801 S.W. 2ND AVE GAINESVILLE, FL 32601	2	19901113	19951113			21.9
2-001-0057AN	MGM PETROLEUM 4245 DRAIN FIELD ROAD LAKELAND, FL 33807		1991 212	1997 212			5.26
2-001-0058AN	DAVIS REMBERT P O BOX 5849 GAINESVILLE, FL 32602	0.3	199110 8	199610 8			1.1
2-001-0059ANG	GAINESVILLE REGIONAL UTILITIES ATTN: CHARLES S. HEIDT P O BOX 490, STATION 52 GAINESVILLE, FL 32602	2.6	1991 115	1998 115			10.5
2-001-0060ANM	KENNETH PATTERSON 5700 SE 12TH STREET OCALA, FL 32471	23	199312 7	1998 212	100		38
2-001-0061AUV	PCR, INCORPORATED POST OFFICE BOX 1466 GAINESVILLE, FL 32602	20	1992 811	1999 811			24.9
2-001-0062AN	EDDIE HIGGINBOTHAM ROUTE 3 BOX 59 H HAWTHORNE, FL 32640	80	1991 7 9	1998 7 9			46.71
2-001-0065ANR	UNITED FUELS CORPORATION P.O. BOX 5849 GAINESVILLE, FL 32602	0.5	1994 712	1996 228	100		5.3
2-001-0066AN	UNITED FUELS CORPORATION P O BOX 5849 GAINESVILLE, FL 32602	0.957	1992 4 7	1996 4 7			4.5
2-001-0067AN	MCB OIL COMPANY %DELTA ENVIRONMENTAL CONSULTANTS 4200 W. CYPRESS STREET STE 500 TAMPA, FL 33607	0.33	1992 6 9	1997 6 9			5.26
2-001-0068AN	STEVE TILLMAN 8815 SE 64TH PLACE GAINESVILLE, FL 32601	500	1992 512	1999 512			94.5
2-001-0071ANVG	CITY OF GAINESVILLE IRONWOOD GOLF COURSE GAINESVILLE, FL 32602 GAINESVILLE, FL 32602	120	19921110	19991110			93.8
2-001-0075AN	JON PURCELL 6602 N.W. 44TH PLACE GAINESVILLE, FL 32606	13	1994 111	2001 111	100		11
2-001-0076AN	RISSER PETROLEUM	1.025	1994 510	2001 510	100		7.88

Table D-2. Consumptive Use Permits (CUPs)

APPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	GW %	SW %	MAX ALLOC.
	%DELTA ENVIROMENTAL CONSULTANTS 4200 W CYPRESS STREET STE 500 TAMPA, FL 33607						
2-001-0077AN	HENRY CURRY 15 S.E. 12TH STREET GAINESVILLE, FL 32601	24	1994 8 9	2001 8 9	100		7.2
2-007-0001AU	THE SALVATION ARMY 3101 LAKE ELLEN LANE TAMPA, FL 33618	106	1984 2 7	1991 2 7			4.096
2-007-0003ANVRM	KEYSTONE GOLF AND COUNTRY CLUB P O BOX 245 KEYSTONE HEIGHTS, FL 32656	38	19931012	20001012	100		35.6
2-019-0005ANF	ERVIN S. TRIEST 6866 POST OAK CT. KEYSTONE HEIGHTS, FL 32656	30	1991 311	1998 311			2.1
2-019-0008ANGF	CLAY COUNTY SCHOOL DISTRICT ATTN: CHARLES ALWOOD 900 WALNUT STREET GREEN COVE SPRINGS, FL 32043	20	1992 310	1999 310			18.18
2-019-0010AUG	KEYSTONE WATER COMPANY P. O. BOX 705 KEYSTONE HEIGHTS, FL 32656	1200	19841211	19911211			191.08
2-019-0012AUR	FLORIDA ROCK INDUSTRIES P O BOX 4667 JACKSONVILLE, FL 32201	979.2	1993 713	2000 713			762.85
2-019-0042ANVGRM	SCHOOL BOARD OF ALACHUA COUNTY 1817 EAST UNIVERSITY AVE GAINESVILLE, FL 32601	1	1993 810	2000 810			
2-019-0056AUVG	GOLD HEAD BRANCH STATE PARK 6239 STATE ROAD 21 KEYSTONE HEIGHTS, FL 32656	1562	198910 9	199610 9			7.7
2-019-0057AUVRM	SOUTHERN STATES UTILITIES ENVIRONMENTAL SERVICES DEPARTMENT 1000 COLOR PLACE APOPKA , FL 32703	360	199212 9	199912 9			24.25
2-035-0042AU	MARY L. PELLICER P. O. BOX 52 BUNNELL, FL 32110	80	1985 312	1995 312			61.5
2-083-0013AUF	TEUTON, INC. ATTN: HUGH TEUTON ROUTE 1 BOX 1700 ANTHONY, FL 32617	118	1994 3 8	2001 3 8	100		61.1

Table D-2. Consumptive Use Permits (CUPs)

APPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	GW %	SW %	MAX ALLOC.
2-083-0048ANMF	JONES TURF GRASS FARM, INC. P.O. DRAWER 128 FORT MCCOY, FL 32134	600	1994 3 8	2001 3 8	100		163
2-083-0189AU	GLENN CRAWFORD RT. 1 BOX 36 FORT MCCOY, FL 32134	0.25	1985 312	1982 312			0.087
2-083-0198AU	WILLIAM J. CROSBY P. O. BOX 127 CITRA, FL 32113	300	1985 4 8	1994 4 8			231.9
2-083-0199AU	WILLIAM J. CROSBY P. O. BOX 127 CITRA, FL 32113	50	1985 312	1994 312			28.5
2-083-0205AU	OCALA MANUFACTURING COMPANY P.O. BOX 370 OXFORD, FL 34484	90	1985 312	1992 312			24.4
2-083-0206ANRM	DUPREE FARMS, INC. ATTN: RICHARD J. ENGLISH 3680 W. HIGHWAY 318 CITRA, FL 32113	5	1992 6 9	1999 6 9			5.99
2-083-0207AU	CLEMMONS AND WILLIAMS P. O. BOX 278 CITRA, FL 32113	75	1985 312	1994 312			42.8
2-083-0208AU	CLEMMONS AND WILLIAMS P. O. BOX 278 CITRA, FL 32113	9	1985 312	1994 312			5.14
2-083-0227ANV	WALDRON PRODUCE CO. P. O. BOX 248 CITRA, FL 32113	100	1985 813	1992 813			46.1
2-083-0239ANF	LAKE OKLAWAHA R.V. RESORT, INC. P. O. BOX 2010 24350 NE 160TH AVENUE RD FORT MCCOY, FL 32134	160	1993 3 9	2000 3 9			16.6
2-083-0254AN	GENE WALDRON P.O. BOX 248 CITRA, FL 32113	75	1986 610	1993 610			36.2
2-083-0260ANG	MARION CNTY SCHOOL BOARD 512 S.E. 3RD STREET OCALA, FL 32671	60	1986 9 9	1993 9 9			4.45
2-083-0284AUV	OLLIE HUFF P. O. BOX 208 MCINTOSH, FL 32664	156	1988 913	1995 913			86.4
2-083-0286AN	HOYT WALDRON P. O. BOX 248 CITRA, FL 32113	75	1988 8 9	1995 8 9			32.9
2-083-0287AN	TODD HATFIELD BOX 611 CITRA, FL 32113	38.7	1989 2 7	1996 2 7			8.83

Table D-2. Consumptive Use Permits (CUPs)

APPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	GW %	SW %	MAX ALLOC.
2-083-0289AUFM	TEUTON INC. ATTN: HUGH TEUTON RT. 1 BOX 1700 ANTHONY, FL 32617	400	1994 712	2001 712	100		0.6
2-083-0303AUV	WEEKLEY BROS. SOD AND LANDSCAPING INC. 13300 SE COUNTY HWY 484 BELLEVIEW, FL 32620	708	19891212	19961212			15.35
2-083-0314AUVG	MCINTOSH TOWN OF P.O. BOX 165 MCINTOSH, FL 32664	500	1991 7 9	1998 7 9			37.4
2-083-0319AN	HOYT E. WALDRON, JR. P O BOX 248 CITRA, FL 32113	70	1992 114	1999 114			20.5
2-107-0003ANR	FLORIDA ROCK INDUSTRIES INC. P.O. BOX 4667 JACKSONVILLE, FL 32201	1157	1990 611	1997 611			133.4
2-107-0005AURM	FELDSPAR CORP. P.O. BOX 8 COUNTY RD C20 A SPRUCE PINE, FL 28777	2047	1991 611	1998 611			189
2-107-0034AUM	JOHN W. MCINARNAY JR. RT. 1 BOX 1790 MELROSE, FL 32666	500	1989 410	1996 410			54.7
2-107-0051AUMR	FLORIDA ROCK PROPERTIES P O BOX 4667 JACKSONVILLE, FL 32201	720	1991 611	1998 611			249.7
2-107-0054AUGF	PUTNAM COUNTY DISTRICT SCHOOL BOARD 200 SOUTH 7TH STREET PALATKA, FL 32177	10	19941213	20011213	76.5		9.8
2-107-0067ANF	MELROSE WATER ASSOCIATION P O BOX 220 MELROSE, FL 32666	5	199212 8	199912 8			41.3
2-107-0080ANR	GEORGIA PACIFIC CORPORATION P O BOX 370 HAWTHORNE, FL 32640	133	1992 9 8	1999 9 8			70.4
2-107-0083AU	Z. W. BRANTLEY BOX 95 GRANDIN, FL 32138	3	1985 212	1992 212			1.6
2-107-0131ANVF	TOWN OF INTERLACHEN P O BOX 90 INTERLACHEN, FL 32148	0.5	1993 511	2000 511	100		32.964
2-107-0150AN	LORENE CLAY P. O. BOX 98 GRANDIN, FL 32138	4000	1985 7 8	1992 7 8			1.53

Table D-2. Consumptive Use Permits (CUPs)

APPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	GW %	SW %	MAX ALLOC.
2-107-0151AUSF	SOUTHEASTERN CONFERENCE OF ATTN: JAMES WILLIAMS RT. 1 BOX 134-A HAWTHORNE, FL 32640	45	1989 912	1996 912			30.456
2-107-0152ANV	RICHARD PERRY P. O. D SAN MATEO, FL 32187	4	1985 813	1986 813			84.7
2-107-0153ANR	FLORIDA ROCK PROPERTIES P. O. BOX 4667 JACKSONVILLE, FL 32201	572	1989 2 7	1996 2 7			38.32
2-107-0157ANGF	PUTNAM COUNTY DISTRICT SCHOOL BOARD 200 SOUTH SEVENTH STREET PALATKA, FL 32177	5	19941213	20011213	100		4.6
2-107-0165AUSRM	NORTH FLORIDA COUNCIL BOY SCOUTS OF AMERICA ATTN: JOHN W. DUNCAN, PROPERTY DIR 521 SO EDGEWOOD AVENUE JACKSONVILLE, FL 32205	250	1993 413	2000 413	100		2.7
2-107-0184ANGVF	PUTNAM COUNTY DISTRICT SCHOOL BOARD 200 SOUTH 7TH STREET PALATKA, FL 32177	2	19941213	20011213	100		1.3
2-107-0201ANGR	TOWN OF INTERLACHEN INTERLACHEN, FL 32148 POST OFFICE BOX 90	7.16	19941213	20011213			6.5

Table D-3. Well Construction Permits

APPLICATION No.	WELL No.	PUMP No.	DEPTH	LONG	LAT	SECTION	TOWNSHIP	RANGE	SURFACE WATER SOURCE
2-001-0002ANMR2	A		287'	81 18 06	29 38 11	10	10	20	
2-001-0002ANMR2	B		300'	82 18 17	29 38 07	10	10	20	
2-001-0002ANMR2	C		231'	82 18 12	29 37 54	10	10	20	
2-001-0002ANMR2		D		82 18 03	29 37 59	10	10	20	Reservoir #1
2-001-0002ANMR2		E		82 18 03	29 38 02	10	10	20	Reservoir #1
2-001-0002ANMR2		F		82 17 55	29 38 01	10	10	20	Drainage Canal
2-001-0003ANR	A		120'	82 20 24	29 37 34	18	10	20	
2-001-0004AURY	A		200'	82 20 38	29 40 28	30	92	0	
2-001-0005AUGR	A		189	82 17 09	29 39 30	2	10	20	
2-001-0005AUGR	B		200	82 17 16	29 39 08	2	10	20	
2-001-0006ANG	L			82 18 21	29 42 44	15	92	0	
2-001-0006ANG	M			82 18 20	29 42 50	15	92	0	
2-001-0006ANG	N			82 17 24	29 42 11	15	92	0	
2-001-0006ANGM	A		530	81 27 48	29 42 11	15	92	0	
2-001-0006ANGM	B		475	82 17 57	29 42 11	15	92	0	
2-001-0006ANGM	C		430	82 18 05	29 42 11	15	92	0	
2-001-0006ANGM	D		545	82 18 16	29 42 11	15	92	0	
2-001-0006ANGM	E		500	82 18 20	29 42 18	15	92	0	
2-001-0006ANGM	F		521	82 18 19	29 42 22	15	92	0	
2-001-0006ANGM	G		520	82 17 37	29 42 11	15	92	0	
2-001-0006ANGM	H		538	82 18 20	29 44 28	15	92	0	
2-001-0006ANGM	I		520	82 17 23	29 42 11	15	92	0	
2-001-0006ANGM	J		275	82 18 07	29 42 20	15	92	0	
2-001-0006ANGM	K		460	82 18 20	29 42 52	15	92	0	
2-001-0007ANGF	A		230	82 17 35	29 31 32	Moses Levy Grant	11	20	
2-001-0010ANGFM	A		250	82 17 13	29 30 14	26	11	20	
2-001-0010ANGFM	B		250	82 17 13	29 30 13	26	11	20	
2-001-0011AU	A		200	82 14 16	29 43 06	8	17	21	
2-001-0013ANMR	A		196	82 17 02	29 37 55	11	10	20	
2-001-0013ANMR	B		220	82 17 07	29 37 53	11	10	20	
2-001-0013ANMR	C		215	82 17 01	29 37 54	11	10	20	
2-001-0013ANMR	D		UNKNOWN	82 16 17	29 37 51	12	10	20	
2-001-0013ANMR	E		UNKNOWN	82 16 17	29 37 48	12	10	20	
2-001-0014AUGF	A•		250	82 26 17	29 40 51	29	91	9	
2-001-0014AUGF	B		190	82 26 09	29 40 48	29	91	9	

Table D-3. Well Construction Permits

APPLICATION No.	WELL No.	PUMP No.	DEPTH	LONG	LAT	SECTION	TOWNSHIP	RANGE	SURFACE WATER SOURCE
2-001-0014AUGF	C		120	82 25 56	29 40 50	29	91	9	
2-001-0014AUGF	D		240	82 25 53	29 40 33	29	91	9	
2-001-0016AUR2M	A		150	82 24 59	29 36 18	21	10	19	
2-001-0016AUR2M	B		162	82 24 58	29 36 18	21	10	19	
2-001-0017AUR	A			82 24 52	29 36 05	21	10	19	
2-001-0017AUR	B			82 24 53	29 36 05	28	10	19	
2-001-0018AUGF	A		185'	82 24 54	29 37 26	16	10	19	
2-001-0018AUGF	B		85	82 24 56	29 37 28	16	10	19	
2-001-0020ANFM	A		185'	82 03 59	29 33 30	1	11	22	
2-001-0020AU		B		82 03 55	29 33 34	36	10	2	Retention Pond
2-001-0021AUR	A			82 22 05	29 35 20	4	10	19	
2-001-0021AUR	B		200'	82 22 06	29 35 25	4	10	19	
2-001-0022AUGRM	A		365'	82 19 16	29 38 44	4	10	20	
2-001-0023AURM	A		150'	82 24 55	29 39 24	4	10	19	
2-001-0023AURM	B		130'	82 24 35	29 39 10	4	10	19	
2-001-0024ANR	A		30'	82 20 21	29 39 12	5	10	20	
2-001-0026ANM2	A		160	82 11 13	29 40 48	26	92	1	
2-001-0026ANM2	B		160	82 11 09	29 40 29	26	92	1	
2-001-0026ANM2	C		260	82 11 18	29 41 10	26	92	1	
2-001-0026ANM2	D		250	82 11 15	29 41 02	26	92	1	
2-001-0028ANV	A		200'	82 04 54	29 33 42	2	11	22	
2-001-0028ANV	B		113'	82 04 54	29 33 36	2	11	22	
2-001-0029AUSG	A		400'	82 19 22	29 39 08	5	10	20	
2-001-0029AUSG	B		400'	82 19 23	29 39 07	5	10	20	
02/01/31	AV			82 20 24	29 39 02	6	10	20	
02/01/31	AW			82 21 47	29 38 06	12	10	19	
02/01/31	AX			82 21 50	29 38 31	12	10	19	
02/01/31	AY			82 21 47	29 38 35	12	10	19	
02/01/31	AZ			82 20 52	29 38 26	7	10	20	
02/01/31	BA			82 20 24	29 39 02	6	10	20	
02/01/31	BB			82 20 44	29 38 57	6	10	20	
02/01/31	BC			82 22 38	29 38 58	2	10	19	
02/01/31	BD			82 22 24	29 38 10	11	10	19	
02/01/31	BE			82 22 26	29 39 02	2	10	19	
02/01/31	BF			82 21 49	29 38 34	12	10	19	

Table D-3. Well Construction Permits

APPLICATION No.	WELL No.	PUMP No.	DEPTH	LONG	LAT	SECTION	TOWNSHIP	RANGE	SURFACE WATER SOURCE
2-001-0031AUSG	AB		133'	82 20 31	29 38 51	6	10	20	
2-001-0031AUSG	AC		523'	82 20 24	29 38 48	6	10	20	
2-001-0031AUSG	AD		450'	82 20 42	29 38 49	6	10	20	
2-001-0031AUSG	AG		292'	82 21 17	29 29 04	6	10	20	
2-001-0031AUSG	AL		167'	82 21 44	29 37 43	13	10	19	
2-001-0031AUSG	AM		320'	82 22 08	29 38 56	1	10	19	
2-001-0031AUSG	AN		280'	82 22 09	29 38 54	1	10	19	
2-001-0031AUSG	AO		348'	82 20 25	29 39 05	6	10	20	
2-001-0031AUSG	AP		273'	82 21 02	29 38 54	6	10	20	
2-001-0031AUSG	AQ			82 21 05	29 38 57	6	10	20	
2-001-0031AUSG	AR		427'	82 20 44	29 38 59	6	10	20	
2-001-0031AUSG	AS		427'	82 20 44	29 38 56	6	10	20	
2-001-0031AUSG	AT		232'	82 20 24	29 39 02	6	10	20	
2-001-0031AUSG	F		322'	82 20 49	29 38 58	6	10	20	
2-001-0031AUSG	G•		410'	82 20 52	29 38 42	6	10	20	
2-001-0031AUSG	H		400'	82 20 52	29 38 43	6	10	20	
2-001-0031AUSG	I		200'	82 20 37	29 38 25	7	10	20	
2-001-0031AUSG	J		350'	82 21 00	29 38 45	7	10	20	
2-001-0031AUSG	L		238'	82 20 52	29 38 53	7	10	20	
2-001-0031AUSG	M		194'	82 22 05	29 37 52	12	10	19	
2-001-0031AUSG	Q		56'	82 20 42	29 38 38	7	10	20	
2-001-0031AUSG	R		300'	82 19 54	29 38 16	8	10	20	
2-001-0031AUSG	S		300'	82 19 54	29 38 19	8	10	20	
2-001-0031AUSG	Y		274'	82 21 01	29 38 15	7	10	20	
2-001-0031AUSG	Z		400'	82 20 36	29 38 54	6	10	20	
2-001-0031AUSGF	A			82 20 52	29 38 20	7	10	20	
2-001-0031AUSGF	AA			82 20 36	29 38 57	6	10	20	
2-001-0031AUSGF	AE			82 22 11	29 38 16	12	10	19	
2-001-0031AUSGF	AF			82 20 54	29 38 55	6	10	20	
2-001-0031AUSGF	AH			82 21 07	29 37 57	18	10	20	
2-001-0031AUSGF	AI			82 21 47	29 38 04	12	10	19	
2-001-0031AUSGF	AJ			82 21 47	29 37 03	13	10	19	
2-001-0031AUSGF	AK			82 20 53	29 37 56	18	10	20	
2-001-0031AUSGF	AU			82 20 24	29 39 02	6	10	20	
2-001-0031AUSGF	B			82 20 52	29 38 20	7	10	20	

Table D-3. Well Construction Permits

APPLICATION No.	WELL No.	PUMP No.	DEPTH	LONG	LAT	SECTION	TOWNSHIP	RANGE	SURFACE WATER SOURCE
2-001-0031AUSGF	C			82 20 50	29 38 21	7	10	20	
2-001-0031AUSGF	D			82 20 49	29 38 16	7	10	20	
2-001-0031AUSGF	E			82 26 52	29 38 16	7	10	20	
2-001-0031AUSGF	K			82 20 52	29 38 55	7	10	20	
2-001-0031AUSGF	N			82 22 05	29 37 52	12	10	19	
2-001-0031AUSGF	O			82 20 39	29 38 56	6	10	20	
2-001-0031AUSGF	P			82 21 42	29 37 46	13	10	19	
2-001-0031AUSGF	T			82 19 54	29 38 19	8	10	20	
2-001-0031AUSGF	U			82 21 46	29 37 01	13	10	19	
2-001-0031AUSGF	V			82 21 38	29 37 47	13	10	19	
2-001-0031AUSGF	W			82 22 24	29 38 25	11	10	19	
2-001-0031AUSGF	X			82 22 25	29 38 14	11	10	19	
2-001-0032A	A			82 05 53	29 36 52	22	10	22	
2-001-0032A	B			82 05 51	29 36 53	22	10	22	
2-001-0032A	C			82 05 51	29 36 54	22	10	22	
2-001-0032AUS	D			82 05 50	29 36 52	22	10	22	
2-001-0034ANMR	A		100	82 27 03	29 40 59	30	91	9	
2-001-0034ANMR	B		100	82 27 03	29 40 58	30	91	9	
2-001-0034ANMR		C		82 26 57	29 40 40	30	91	9	Retention Pond
2-001-0034ANMR		D		82 27 18	29 41 07	30	91	9	Retention Pond
2-001-0035ANVGRM	A		360'	82 17 57	29 40 10	34	92	0	
2-001-0035ANVGRM	B		360'	82 17 56	29 40 13	34	92	0	
2-001-0035ANVGRM	C		360'	82 17 53	29 40 15	34	92	0	
2-001-0036ANVG	A			82 05 15	29 35 31	26	10	22	
2-001-0036ANVG	B		298'	82 05 20	29 35 39	26	10	22	
2-001-0036ANVGM	C		305	82 04 51	29 35 09	35	10	22	
2-001-0036ANVGM	D		336	82 05 20	29 35 39	35	10	22	
2-001-0037ANV	A		158'	82 17 36	29 29 45	34	11	20	
2-001-0038ANVGRM	A		280'	82 20 24	29 40 03	31	92	0	
2-001-0039ANVRM	A		125	82 23 48	29 36 50	22	10	19	
2-001-0039ANVRM	B		UNK	82 23 49	29 36 51	22	10	19	
2-001-0040ANVRM	A		191'	82 22 58	29 37 25	14	10	19	
2-001-0040ANVRM	B			82 22 57	29 37 24	14	10	19	
2-001-0041ANVFM	A		180'	82 17 48	29 29 49	34	11	20	
2-001-0041ANVFM	B			82 17 49	29 29 47	34	11	20	

Table D-3. Well Construction Permits

APPLICATION No.	WELL No.	PUMP No.	DEPTH	LONG	LAT	SECTION	TOWNSHIP	RANGE	SURFACE WATER SOURCE
2-001-0042ANVRM	A		90	82 05 12	29 37 02	14	10	22	
2-001-0042ANVRM	B		417	82 05 13	29 36 55	23	10	22	
2-001-0042ANVRM	C•		60	82 05 09	29 36 48	23	10	22	
2-001-0042ANVRM	D		104	82 05 26	29 36 47	22•	10	22	
2-001-0042ANVRM	E		85	82 05 35	29 36 48	22	10	22	
2-001-0042ANVRM	F		UNK	82 05 34	29 36 55	22	10	22	
2-001-0042ANVRM	G		2	82 05 25	29 36 57	22	10	22	
2-001-0043ANV	A		300'	82 22 39	29 41 31	23	91	9	
2-001-0043ANV	B		300'	82 22 39	29 41 31	23	91	9	
2-001-0044ANM		C		82 05 25	29 34 28	34	11	22	Retention Pond
2-001-0044ANMR	A		150'	82 05 19	29 34 40	35	11	22	
2-001-0044ANMR	B			82 05 13	29 34 42	35	11	22	
2-001-0045ANRM	A		180	82 03 24	29 28 56	1	12	22	
2-001-0047AN	A		200	82 04 58	29 39 47	35	92	3	
2-001-0047AN	B		200	82 04 32	29 40 19	35	92	3	
2-001-0047AN	C		200	82 03 57	29 40 18	36	92	3	
2-001-0047AN	D		200	82 03 02	29 40 14	31	92	2	
2-001-0047AN	E		250	82 03 59	29 40 17	36	92	2	
2-001-0047AN	F		250	82 04 18	29 40 19	36	92	3	
2-001-0047AN	G		250	82 03 59	29 40 17	25	92	3	
2-001-0047ANM	E			82 03 59	29 40 17	36	92	2	
2-001-0048AUV	A		175	82 22 09	29 38 53	1	10	19	
2-001-0048AUV	B			82 22 09	29 38 50	1	10	19	
2-001-0050ANG	A			82 19 49	29 38 22	8	10	20	
2-001-0051ANM	A		150	81 04 29	29 38 13	11	10	22	
2-001-0051ANM	B		150	82 04 05	29 38 31	12	10	22	
2-001-0051ANM	C			82 04 22	29 39 02	2	10	22	
2-001-0052AUVG	A			82 15 37	29 39 21		20		
2-001-0053AN	B		200	82 26 58	29 36 23	19	10	19	
2-001-0053ANY	A		200	82 26 52	29 36 47	19	10	19	
2-001-0054AN	A			82 19 49	29 38 57	5	10	20	
2-001-0057AN	A		16	82 18 57	29 39 05	4	10	20	
2-001-0057AN	B		16	82 18 55	29 39 03	4	10	20	
2-001-0058AN	A		19	82 17 40	29 39 07	3	10	20	
2-001-0058AN	B		18	82 17 39	29 39 06	3	10	20	

Table D-3. Well Construction Permits

APPLICATION No.	WELL No.	PUMP No.	DEPTH	LONG	LAT	SECTION	TOWNSHIP	RANGE	SURFACE WATER SOURCE
2-001-0059ANG	A		13	82 19 20	29 38 49	4	10	20	
2-001-0059ANG	B		10	82 19 19	29 38 49	4	10	20	
2-001-0060AN	A		200	82 03 59	29 28 35	1	12	22	
2-001-0060ANM	A		312	82 03 58	29 28 34	1	12	22	
2-001-0060ANM	B		150	82 04 04	29 28 37	1	12	22	
2-001-0060ANM	C		UNK	82 03 59	29 28 36	1	12	22	
2-001-0061AUV	A		222	82 15 54	29 42 23	13	92	0	
2-001-0061AUV	B		252	82 15 59	29 42 21	13	92	0	
2-001-0062AN	1			82 08 05	29 36 44	20	10	22	
2-001-0062AN	B		200	82 08 05	29 36 41	20	10	22	
2-001-0065ANR	A		16.5	82 18 53	29 39 07	4	10	20	
2-001-0065ANR	B		16.5	82 18 52	29 39 07	4	10	20	
2-001-0065ANR	C		16.5'	82 18 52	29 39 07	4	10	20	
2-001-0066AN	A		35	81 21 23	29 38 05	12	10	19	
2-001-0066AN	B		38	82 21 23	29 38 04	12	10	19	
2-001-0066AN	C		36	82 21 23	29 38 05	12	10	19	
2-001-0067AN	A		13	82 19 38	29 41 19	20	92	0	
2-001-0067AN	B		13	82 19 38	29 41 19	20	92	0	
2-001-0068AN	A			82 13 20	29 34 56	33	10	21	
2-001-0068AN	B			82 13 27	29 34 58	32	10	21	
2-001-0071ANVG	A			82 17 50	29 41 23	22	92	0	
2-001-0071ANVG	B		200	82 17 53	29 41 24	22	92	0	
2-001-0071ANVG		C		82 18 02	29 41 26	22	92	0	Pond
2-001-0071ANVG		D		82 18 03	29 41 49	22	92	0	Pond
2-001-0075AN	A		120	82 03 47	29 29 15	36	11	22	
2-001-0075AN	B		300	82 03 44	29 29 09	36	11	22	
2-001-0075AN	C		300	82 03 45	29 29 15	36	11	22	
2-001-0076AN	A		25	82 26 58	29 41 22	19	91	9	
2-001-0076AN	B		25	82 26 58	29 41 21	19	91	9	
2-001-0076AN	C		25	82 26 59	29 41 21	19	91	9	
2-001-0076AN	D		25	82 26 59	29 41 21	19	91	9	
2-001-0076AN	E		25	82 26 58	29 41 21	19	91	9	
2-001-0077AN	A		100	82 26 58	29 34 25	31	10	19	
2-007-0001AU	A		50	82 03 23	29 48 40	12	82	2	
2-007-0001AU	B		50	82 03 22	29 48 38	12	82	2	

Table D-3. Well Construction Permits

APPLICATION No.	WELL No.	PUMP No.	DEPTH	LONG	LAT	SECTION	TOWNSHIP	RANGE	SURFACE WATER SOURCE
2-007-0001AU	C		50	82 03 23	29 48 37	12	82	2	
2-007-0003ANVRM	A		UNK	82 03 05	29 46 55	24	82	2	
2-019-0005ANF	A		200	82 01 32	29 47 03	20	82	3	
2-019-0005ANF	B		100	82 01 31	29 47 03	20	82	3	
2-019-0008ANGF	A		400	82 02 32	29 46 53	19	82	3	
2-019-0010AUM	A		350'	82 03 08	29 46 50	24	82	2	
2-019-0010AUM	B		450'	82 03 13	29 46 46	24	82	2	
2-019-0010AUM	C		492'	82 01 56	29 47 08	19	82	3	
2-019-0010AUM	D			82 01 54	29 47 08	19	82	3	
2-019-0010AUM	E			82 02 12	29 46 38	19	82	3	
2-019-0012AUR	A		460'	81 58 18	29 49 33	2	82	3	
2-019-0012AUR	B		450 '	81 58 21	29 49 35	2	82	3	
2-019-0012AUR	C		460'	81 58 15	29 49 32	2	82	3	
2-019-0012AUR		D		81 58 35	29 49 52	2	82	3	
2-019-0042ANVGRM	A		470	82 02 30	29 50 00	6	82	3	
2-019-0042ANVGRM	B		350	82 02 31	29 49 58	6	82	3	
02/19/56	E			81 57 02	29 49 25	1	82	3	
2-019-0056AUVG	A		560	81 57 43	29 50 49	36	72	3	
2-019-0056AUVG	B		200	81 56 58	29 49 48	1	82	3	
2-019-0056AUVG	C		320	81 57 19	29 49 19	1	82	3	
2-019-0056AUVG	D		150	81 56 29	29 49 14	6	82	4	
2-019-0057AUVRM	A		164	82 00 21	29 45 06	33	82	3	
2-019-0057AUVRM	B		195	82 00 31	29 44 55	33	82	3	
2-035-0042AU	A		315'	81 22 36	29 25 16	33	12	29	
2-035-0042AU	B		285'	81 22 45	29 24 59	33	12	29	
2-083-0013AU		E		82 03 37	29 20 14	25	13	22	
2-083-0013AUF	A		85'	82 04 38	29 19 08	35	13	22	
2-083-0013AUF	B		85	82 04 10	29 19 35	25	13	22	
2-083-0013AUF	C		97	82 03 41	29 19 59	25	13	22	
2-083-0013AUF	D		350	82 04 45	29 19 34	26	13	22	
2-083-0048ANMF	A		320	81 57 37	29 20 15	26	13	23	
2-083-0048ANMF	B		320	81 57 36	29 20 11	26	13	23	
2-083-0189AU	A		111'	81 58 13	29 22 46	11	13	23	
2-083-0198AN	A		200	82 05 57	29 25 25	27	12	22	
2-083-0198AU	B		UNKNOWN	82 05 25	29 25 25	27	12	22	

'able D-3. Well Construction Permits

APPLICATION No.	WELL No.	PUMP No.	DEPTH	LONG	LAT	SECTION	TOWNSHIP	RANGE	SURFACE WATER SOURCE
2-083-0198AU	C		UNKNOWN	82 05 34	29 25 13	27	12	22	
2-083-0198AU	D		UNKNOWN	82 05 04	29 25 34	26	12	22	
2-083-0198AU		E		82 05 31	29 25 30	27	12	22	Dug lake
2-083-0198AU		F		82 05 44	29 25 05	27	12	22	Dug lake
2-083-0199AN	A			82 03 23	29 05 35	13	16	22	
2-083-0199AN	B			82 03 21	29 05 35	13	16	22	
2-083-0199AN	C			82 03 27	29 05 33	13	16	22	
2-083-0205AU	A		200'	82 12 45	29 25 18	28	12	21	
2-083-0206ANRM	A		125'	82 11 18	29 24 14	35	12	21	
2-083-0206ANRM	B		90'	82 11 06	29 24 21	35	12	21	
2-083-0206ANRM	C		90'	82 11 07	29 24 20	35	12	21	
2-083-0206ANRM	D		90'	82 11 21	29 24 34	35	12	21	
2-083-0207AU	A		460'	82 07 45	29 25 55	20	12	22	
2-083-0207AU	B		79'	82 07 46	29 25 37	20	12	22	
2-083-0207AU		C		82 07 44	29 25 57	20	12	22	Orange Lake
2-083-0208AU	A		UNK	82 06 57	29 24 26	33	12	22	
2-083-0227ANV	A		UNKNOWN	81 57 55	29 23 58	35	12	23	
2-083-0239AN	B		150	81 53 32	29 30 26	27	11	24	
2-083-0239ANF	A		135	81 53 32	29 30 26	]27	11	24	
2-083-0239AUM	B		250	82 02 15	29 01 16	17	17	23	
2-083-0254AN	A			82 02 08	29 28 16	6	12	23	
2-083-0260ANG	A		150'	81 58 28	29 23 11	2	13	23	
2-083-0260ANG	B		150'	81 58 26	29 23 11	2	13	23	
2-083-0284AUV	A			82 10 18	29 24 43	25	12	21	
2-083-0284AUV		A		82 13 00	29 27 18	9	12	21	Pasture land
2-083-0286AN	A		150	82 01 10	29 28 26	5	12	23	
2-083-0287AN	A		200	82 10 18	29 24 43	25	12	21	
2-083-0289AUFM	A		250	81 57 07	29 19 11	36	13	23	
2-083-0303AUV	A			81 57 11	29 20 41	24	13	23	
2-083-0303AUV	B			81 57 11	29 20 02	25	13	23	
2-083-0303AUV		C		81 56 33	29 19 50	25	13	23	
2-083-0314AUVG	A			82 13 25	29 26 45	17	12	21	
2-083-0314AUVG	B			82 13 00	29 27 02	16	12	21	
2-083-0314AUVG	C			82 13 23	29 26 49	17	12	21	
2-083-0319AN	A			82 08 03	29 25 55	20	12	22	

Table D-3. Well Construction Permits

APPLICATION No.	WELL No.	PUMP No.	DEPTH	LONG	LAT	SECTION	TOWNSHIP	RANGE	SURFACE WATER SOURCE
2-107-0003ANR	A		700	81 54 42	29 35 40	29	10	24	
2-107-0003ANR	B		700	81 54 43	29 35 39	29	10	24	
2-107-0005AURM	A			81 57 10	29 35 38	25	10	23	
2-107-0005AURM	B			81 57 13	29 35 35	25	10	23	
2-107-0005AURM	C			81 56 49	29 35 19	25	10	23	
2-107-0005AURM		D		81 56 49	29 35 19	25	10	23	
2-107-0005AURM		E		81 56 49	29 35 19	25	10	23	
2-107-0034AUM	A		240	81 55 05	29 45 35	32	82	4	
2-107-0034AUM	B		240	81 54 58	29 45 20	32	82	4	
2-107-0034AUM	C			81 54 52	29 45 35	32	82	4	
2-107-0034AUM	D			81 54 50	29 45 44	32	82	4	
2-107-0051AU	A			81 54 48	29 35 43	29	10	24	
2-107-0051AU	B			81 54 46	29 35 42	29	10	24	
2-107-0054AUGF	A		178'	81 53 07	29 37 55	10	10	24	
2-107-0067ANF	A		348	82 02 09	29 42 32	18	92	3	
2-107-0067ANF	B		350	82 02 09	29 42 28	18	92	3	
2-107-0080ANR	A		260	82 02 14	29 35 39	30	10	23	
2-107-0080ANR	B		250'	82 02 14	29 35 42	30	10	23	
2-107-0083AU	A		96'	81 55 13	29 43 30	8	92	4	
2-107-0131ANVF	A		303'	81 53 45	29 37 23	16	10	24	
2-107-0150AN	A		300'	81 54 21	29 42 13	21	92	4	
2-107-0150ANM	B		300	81 54 25	29 42 47	16	92	4	
2-107-0151ANV	A			81 59 14	29 36 41	22	10	23	
2-107-0151ANV	B			81 59 13	29 36 35	22	10	23	
2-107-0151ANV	C			81 59 16	29 36 33	22	10	23	
2-107-0151ANV	D			81 59 23	29 36 37	22	10	23	
2-107-0152ANV		A		81 55 20	29 36 10	20	10	24	Dewatering
2-107-0153AN	A		700'	81 56 37	29 43 08	7	92	4	
2-107-0153AN	B		UNKNOWN	81 56 41	29 43 13	7	92	4	
2-107-0153AN	C		UNKNOWN	81 56 38	29 43 30	7	92	4	
2-107-0157ANGF	A		210'	81 53 10	29 37 58	10	10	24	
2-107-0157ANGF	B		165'	81 53 01	29 38 04	10	10	24	
2-107-0165AUSRM	A			81 59 17	29 39 06	37	10	23	
2-107-0184ANGVF	A		160'	82 02 36	29 42 33	18	92	3	
2-107-0201ANGR	A		300'	81 54 12	29 37 38	16	10	24	

PROPERTY OF
ST. JOHNS RIVER WATER

Table D-4. Management and Storage of Surface Waters Permits (MSSWs)

APPLICATION No.	APPLICANT	PROG. ACRG.	DATE ISSUED	DATE EXPIRED	WETL. TOTAL ACRG.	MITIG.	RECIEVING WATER BODY
4-001-0001A	HOCKER-SQUITIERI CO.	120	1975 917				
4-001-0003A	JOHN D. ODOM III 2259 NW 14TH AVE. GAINESVILLE, FL 32605	75.5	19841113	19891114		N	LAKE JEFFORDS
4-001-0004AC	HAILE PLANTATION 8325 SW 46 LANE GAINESVILLE, FL 32608	1073.4	1985 212	1905 212		N	GROUNDWATER
4-001-0004ACM	HAILE PLANTATION COPORATION ATTN: BOB KRAMER 4620 SW 75TH STREET GAINESVILLE, FL32608	1073	1992 114	2005 114		N	GROUNDWATER (CLASS III)
4-001-0006A	JERRY MCIVER 224 OVERLOOK DR S E WINTER HAVEN, FL 33880	80	1985 312	1990 312		N	KANAPAHA PRAIRIE
4-001-0007A	PAYNES CROSSING LIMITED PARTNERSHIP 7818 CORNICHE CIRCLE BOCA RATON, FL 32609	45.5	198510 8	199010 8	2	N	PAYNES PRAIRIE
4-001-0008A	WILLIAM MCKIBBIN GAINESVILLE, FL 32609	56	198510 8	199010 8	4.2	N	GROUNDWATER
4-001-0010A	ELMER HEUBECK JR. P. O. BOX 70 OCALA, FL 32678	645	1985 910	1990 910	0	N	PAYNES PRAIRIE
4-001-0013A	JOE FURNARI RT 2 BOX 59 HAWTHORNE, FL 32604	131	1986 311	1991 311	17	N	SALUDA SWAMP
4-001-0013AM	FLORIDA BLUEBERRIES INC. 2801 S.W. ARCHER ROAD GAINESVILLE, FL 32608	15.4	198711 3				
4-001-0020A	JAMES MEEHAN P.O. BOX 1122 GAINESVILLE, FL 32602	13	1986 812	1991 812	0	N	ON-SITE RETENTION POND
4-001-0020AM	CLARK BUTLER P.O. BOX 1122 GAINESVILLE, FL 32602	1	19861111	19911111	0	N	ON-SITE RETENTION POND
4-001-0020AM2	JAMES MEEHAN P.O. BOX 1122 GAINESVILLE, FL 32602	3	1987 4 6	1992 4 6	0	N	ON-SITE RETENTION POND
4-001-0020AM3	CLARK S. BUTLER P.O. BOX 1122 GAINESVILLE, FL 32602	120	1989 912	1994 912	0		GROUNDWATER (CLASS III)
4-001-0020AM4	BUTLER ENTERPRISES P.O. BOX 1122 GAINESVILLE, FL 32601	42	1993 2 9	1998 2 9		N	GROUNDWATER (CLASS III)
4-001-0024AC	FRED HENDERSON 2303 NE 27 AVE GAINESVILLE, FL 32601	97	1988 913	1908 913	0	N	EXISTING ON-SITE
4-001-0025AC	THE HANKIN GROUP OF G'VILLE P. O. BOX 12017 GAINESVILLE, FL 32602	97	1987 310	1907 310	0	N	LAND-LOCKED DEPRESSION AREAS
4-001-0026A	THE HANKIN GROUP OF G'VILLE (same)	97	1987 310	1992 310	0	N	LAND-LOCKED DEPRESSION AREAS
4-001-0026AM	THE HANKIN GROUP, INC. 2811 NW 41ST ST, STE 3C GAINESVILLE, FL 32606	51	1988 3 8	1993 3 8	0	N	NONE
4-001-0026AME	THE HANKIN GROUP, INC. 2772 N.W. 43RD STREET, SUITE GAINESVILLE, FL 32606	51	1993 9 7	1998 9 7			

Table D-4. Management and Storage of Surface Waters Permits (MSSWs)

APPLICATION No.	APPLICANT	PROG. ACRG.	DATE ISSUED	DATE EXPIRED	WETL. TOTAL ACRG.	MITIG.	RECIEVING WATER BODY
4-001-0027AG	UNIVERSITY OF FLORIDA 232 STADIUM RD. GAINESVILLE, FL 32611	6.2	198612 9	199112 9	0	N	LAKE ALICE
4-001-0027AGM	JOHN V. CARLSON 232 STADIUM ROAD GAINESVILLE, FL 32611	4.17	1987 429				
4-001-0028A	THOMAS SIDNEY 4025 NW 14 AVE GAINESVILLE, FL 32605	0.671	198612 3				
4-001-0031A	CUTTER'S RUN APT OF FL, LTD 1805 N WESTSHORE BLVD SUITE 212 TAMPA, FL 33607	40.153	1987 210	1992 210	0	N	LAND LOCKED DEPRESSION AREAS
4-001-0031AMY	EPOCH PROPERTIES, INC. 359 CAROLINA AVENUE WINTER PARK, FL 32789	23	1988 913	1993 913	0	N	GROUNDWATER
4-001-0039AG	FLAD & ASSOC. OF FLORIDA INC 3300 SW ARCHER RD. GAINESVILLE, FL 32608	25	1987 811	1992 811	0.5	N	LAND LOCKED DEPRESSION AREAS AND D.O.T. DRAINAGE DITCH
4-001-0039AGM	UNITED STATES POSTAL SERVICE FACILITIES SERVICE CENTER 1407 UNION AVENUE MEMPHIS, TN 38166	25	19891212	19941212	0	N	PAYNES PRAIRIE (CLASS OFW)
4-001-0040AGC	ROBERT CREMER U.F. PHYSICAL PLANT GAINESVILLE, FL 32611	2100	198712 8	190712 8	103.1	N	LAKE ALICE, HOGTOWN CREEK, AND TUMBLIN CREEK (CLASS III)
4-001-0040AGCM	ROBERT D. CREMER, JR. C/O UF PHYSICAL PLANT DIVISION BUILDING 700 RADIO ROAD GAINESVILLE, FL 32611	1059					LAKE ALICE
4-001-0041A	PRESERVE INC. 5200 NEWBERRY RD. BUILDING E9 GAINESVILLE, FL 32606	115.29	19871013	19921013	0	N	NATURAL DEPRESSION
4-001-0041AM	HAILE PLANTATION CORP. ATTN: BOB KRAMER 4620 SW 75TH ST. GAINESVILLE, FL 32608	13	19881115	19931115		N	NONE
4-001-0041AM10	HAILE PLANTATION CORPORATION 9120 S.W. 46TH BLVD. GAINESVILLE, FL 32608	117	199212 8	199712 8		N	GROUNDWATER (CLASS III)
4-001-0041AM11	H. G. JOINT VENTURE 9120 S.W. 46TH BLVD. GAINESVILLE, FL 32608	0	19931012	19981012		N	GROUNDWATER (CLASS III)
4-001-0041AM12	H. G. JOINT VENTURE 9120 S.W. 46TH BLVD. GAINESVILLE, FL 32608	117	1994 8 9	1999 8 9		N	N/A (CLASS III)
4-001-0041AM2	GREENE & ROWE 5200 NEWBERRY ROAD BLDG E- GAINESVILLE, FL 32607	23.94	19881213	19931213	0	N	GROUNDWATER
4-001-0041AM3	HAILE PLANTATION CORP. ATTN: BOB KRAMER 4620 SW 75TH STREET GAINESVILLE, FL 32608	42.65	1989 2 7	1994 2 7	0	N	GROUNDWATER
4-001-0041AM4	HAILE PLANTATION CORP.	42.3	1989 2 7	1994 2 7	0	N	FNONE

Table D-4. Management and Storage of Surface Waters Permits (MSSWs)

APPLICATION No.	APPLICANT	PROG. ACRG.	DATE ISSUED	DATE EXPIRED	WETL. TOTAL ACRG.	MITIG.	RECIEVING WATER BODY
4-001-0041AM5	MERRILL-LYONS, INC. 2731 NW 41ST STREET GAINESVILLE, FL 32605	10	19891113	19941113	0		GROUNDWATER (CLASS III)
4-001-0041AM6	HAILE PLANTATION CORP. 9120 SW 46TH BLVD GAINESVILLE, FL 32608	217	1990 1 9	1995 1 9	0	N	GROUND WATER (CLASS III)
4-001-0041AM7	BGR OF HAILE INC. 5200 NEWBERRY RD, SUITE E-9 GAINESVILLE, FL 32607	41.45	1990 213	1995 213	0	N	GROUNDWATER (CLASS III)
4-001-0041AM8	HAILE PLANTATION CORPORATION 4620 SW 75TH ST. GAINESVILLE, FL 32608	16.53	1990 8 6	1995 8 6	0	N	GROUND WATER (CLASS III)
4-001-0041AM9	HAILE PLANTATION CORP. 9120 SW 46TH BLVD. GAINESVILLE, FL 32608	22.49	1990 911	1995 911	0	N	GROUND WATER (CLASS III)
4-001-0043AG	UNIVERSITY OF FLORIDA	1521	198712 8	199712 8	98.5	N	LAKE ALICE
4-001-0043AGM	ROBERT D. CREMER, JR. C/O UF PHYSICAL PLANT DIVISION BUILDING 700 RADIO ROAD GAINESVILLE, FL 32611	1059	1993 2 9	1997 2 9		N	LAKE ALICE, GROUNDWATER (CLASS III)
4-001-0050AG	FLORIDA DEPARTMENT OF TRANSPORTATION P. O. BOX 1089 LAKE CITY, FL 32056	34	1989 3 6	1994 3 6	0	N	LAKE KANAPAHA (CLASS III)
4-001-0053A	BUTLER ENTERPRISES P.O. BOX 1122 GAINESVILLE, FL 32602	50	1990 5 8	1995 5 8	0.1	N	HOGTOWN CREEK (CLASS III)
4-001-0054AG	FLORIDA DEPARTMENT OF TRANSPORTATION 1901 S MARION ST LAKE CITY, FL 32056	426	1991 311	1996 311	18.33		
4-001-0054AGM	FLORIDA DEPARTMENT OF TRANSPORTATION 1901 S MARION STREET LAKE CITY, FL 32056	276	1990 8 6	1995 8 6	3.89	N	HOGTOWN CRK., UNNAME CRKS, UNNAME MARSH/SUGARFOOT PR. (CLASS III)
4-001-0054AGM3	FLORIDA DEPARTMENT OF TRANSPORTATION P.O. BOX 1089 LAKE CITY, FL 32056	67.5	1994 412	1999 412		N	UNNAMED DEPRESSIONAL AREAS (CLASS III)
4-001-0056AG	FLORIDA DEPARTMENT OF TRANSPORTATION 1901 S. MARION ST LAKE CITY, FL 32056	37.65	1992 211	1997 211		N	N/A
4-001-0067AG	FLORIDA DEPARTMENT OF TRANSPORTATION P.O. BOX 1089 LAKE CITY, FL 32056	2.7	1993 9 7	1998 9 7	0.04		
4-001-0070AG	FLORIDA DEPARTMENT OF TRANSPORTATION 1901 S. MARION STREET LAKE CITY, FL 32056	150					PRAIRIE CREEK
4-001-0071A	V. E. WHITEHURST & SONS, INC. ROUTE 1, BOX 440 WILLISTON, FL 32696	26	1994 3 8	1999 3 8		N	GROUNDWATER
4-001-0073AG	ALACHUA COUNTY PUBLIC WORKS DEPRTMENT P.O. BOX 1188 GAINESVILLE, FL 32602	55.8					LOCHLOOSA CREEK

Table D-4. Management and Storage of Surface Waters Permits (MSSWs)

APPLICATION No.	APPLICANT	PROG. ACRG.	DATE ISSUED	DATE EXPIRED	WETL. TOTAL ACRG.	MITIG.	RECIEVING WATER BODY
4-083-0007A	DEVINE, JOHN RT. 2 , BOX 603 MICANOPY, FL 32667	0.1	1983 510	1985 511			
4-083-0010A	NANCO, INC. 10624 NW 225 AVE OCALA, FL 32678	204	19831213				
4-083-0017A	HASTINGS, LARUE ROUTE 4 BOX 3900 CITRA, FL 32113	40	1983 712				
4-083-0018A	HASTINGS, LARUE	0	1983 712	00 0000			
4-083-0019A	KENNETH R. MCGURN P.O. BOX 12488 GAINESVILLE, FL 32604	1200	1984 313				
4-083-0020A	TEUTON, H. C. ROUTE 1, BOX 1700 ANTHONY, FL 32617	150	19831011	19851012			
4-083-0023A	ROSE JR, CARL G. P.O. BOX 1090 OCALA, FL 32678	160	1984 5 8	1986 511			
4-083-0023AE	MR. CARL G. ROSE P.O. BOX 1090 OCALA, FL 32678	160	1986 715	1986 715	30	N	
4-083-0023AE2	ROSE PROPERTIES, INC CARL G. ROSE JR. P.O. BOX 1090 OCALA, FL 32678	160	1987 113	1992 113	30	N	OCKLAWAHA RIVER
4-083-0026A	SIEBERT, JAMES R. P.O. BOX 223 ORANGE LAKE,FL 32631	80	19831213				
4-083-0034A	DUNWOODY, ROBERT M. P.O. BOX 280 OCALA, FL 32678	637	19831213	19851213			
4-083-0036A	GLEN C. FIOROLLO P. O. BOX 122 MCINTOSH, FL 32664	48.1	1984 4 9				
4-083-0039A	ALAN K. SCHILLER RT. 2 BOX 478 TAMPA, FL 33610	0.25	1984 110	1985 111			
4-083-0049A	HASTY-GREENE INVESTMENTS INC. P. O. BOX 8 FT. MCCOY, FL 32134	3	1984 2 7	1986 111			
4-083-0062A	CIRCLE FIVE STABLES INC. 707 N.E. 25TH AVE. OCALA, FL 32678	13	1985 5 7	1985 6 1		Y	BLACK SINK PRAIRIE
4-083-0066A	RALPH L. ABEL P. O. BOX 321 LECANTO, FL 32661	0.1	1984 710	1989 710			
4-083-0066AM	HASTINGS & GREENE	0.1	1987 512	1992 512	0	N	BLACK SINK PRAIRIE
4-083-0066AM2E	ANGUS C. HASTINGS P. O. BOX 8 FT. MCCOY, FL 32134	159	1991 611	1996 611	0	N	
4-083-0066AM3E	HASTINGS-GREENE TRUST P.O. BOX 8 FT. MCCOY, FL 32134	178	1991 611	1996 611			SELF CONTAINED ECO-SYSTEM
4-083-0086AC	BETTY BELLAS	442	1985 910	1987 910			
4-083-0089A	CHARLES R. FORMAN P.O. BOX 2944 OCALA, FL 32678	0.71	1985 611	1986 611		N	BLACK SINK PRAIRIE

Table D-4. Management and Storage of Surface Waters Permits (MSSWs)

APPLICATION No.	APPLICANT	PROG. ACRG.	DATE ISSUED	DATE EXPIRED	WETL. TOTAL ACRG.	MITIG.	RECIEVING WATER BODY
4-083-0093A	GARY W PAULEY RT 1 BOX 1425 ANTHONY, FL 32617	0.2	1985 813	1990 813	0	Y	GOOSKIE PRAIRIE
4-083-0110A	MR. FRED HAVERNICK 911 N.E. 2ND STREET OCALA, FL 32678	485	198610 7	199110 7	2		
4-083-0113AG	MARION COUNTY SCHOOL BOARD 512 SE THIRD STREET OCALA, FL 32678	60	1986 925		0	N	MILL CREEK
4-083-0118AC	ORANGE LAKE MUCK FARMS LTD P.O. DRAWER J GAINESVILLE, FL 32602	2500	1987 4 6	1907 4 6	0	N	ORANGE CREEK (CLASS III)
4-083-0119AGY	LARRY W. VARNADORE 2631-D.S.E. 3RD STREET OCALA, FL 32678	24.8	1991 1 8	1996 212	0.1	N	MILL CREEK (CLASS III)
4-083-0120A	WALTER R. BERMAN 2603 S.E. 17TH ST., SUITE B OCALA, FL 32678	72.3	19881014		0		GOOSKI PRAIRIE
4-083-0120AM	WALTER R. BERMAN, TRUSTEE (same)	72.3	1989 613	1994 613	22	N	GOOSKI PRAIRIE, UNNAMED DEPRESSIONAL AREAS (CLASS
4-083-0121A	DON DECONNA P.O. BOX 216 MICANOPY, FL 32667	4.04	1987 6 5				
4-083-0125A	ORANGE LAKE MUCK FARMS LTD	2500	1987 8 4		0	Y	ORANGE CREEK (CLASS III)
4-083-0147A	WEEKLEY BROS. SOD & LANDSCAPING INC. 13300 SE COUNTY HWY 484 BELLEVIEW, FL32620	708	1991 611	1996 611	150	N	N/A
4-083-0153A	CELEBRITY RESORTS INC 3300 SW 34TH STREET SUITE OCALA, FL 32678	0.687	1991 4 9	1996 4 9			ORANGE LAKE
4-083-0162AG	FLORIDA DEPARTMENT OF TRANSPORTATION 101 NORTH WOODLAND BOULEVARD, SUITE A/B DELAND, FL 32720	570	1993 9 7	1998 9 7			
4-107-0008A	F. BROOKS HERMAN RT. 1 BOX 287D9 HAWTHORNE, FL 32604	80	1985 4 8	1990 4 8		N	REDWATER LAKE
4-107-0008AM	FRED HERMAN ROUTE 1 BOX 287 D9 HAWTHORNE, FL 32604	80	1985 813	1990 813	0	N	REDWATER LAKE
4-107-0008AM2	REDWATER LAKE ESTATES ROUTE 1 BOX 287-D-9 HAWTHORNE, FL 32604	80	198612 9	199112 9	0.07	N	REDWATER LAKE
4-107-0012A	THE FELDSPAR CORP. - EPK P.O. BOX 8 EDGAR, FL 32149	515	1985 4 8	1990 4 9		N	CABBAGE CREEK
4-107-0021A	PARADISE ACRES P. O. BOX 310 PALATKA, FL 32177	1	1985 813	1990 813	0	N	LEVY'S PRAIRIE
4-107-0026A	JAMES MEEHAN 7326 SW 17TH PLACE GAINESVILLE, FL 32607	24	1986 812	1991 812	0	N	LADY SLIPPER LAKE

Table D-4. Management and Storage of Surface Waters Permits (MSSWs)

APPLICATION No.	APPLICANT	PROG. ACRG.	DATE ISSUED	DATE EXPIRED	WETL. TOTAL ACRG.	MITIG.	RECIEVING WATER BODY
4-107-0036A	FL ROCK INDUSTRIES, INC. P.O. BOX 4667 JACKSONVILLE,FL 32201	290	1987 512	1992 512	54	N	DEEP CREEK AND CABBAGE CREEK
4-107-0036AE	FLORIDA ROCK PROPERTIES, INC. P. O. BOX 4667 JACKSONVILLE,FL 32201	1157	1993 413	1998 413	55	N	DEEP CREEK AND CABBAGE CREEK
4-107-0043A	WEST PUTNAM LAKES, INC. ATTN: HENRY FRAZEE P.O. BOX 1227 GAINESVILLE, FL 32602	226	19891113	19941113	0		HIGGINBOTHAM LAKE (CLASS III)
40-001-0003A	HAILE PLANTATION	25.869	1985 130	1990 130			
40-001-0003AM	HAILE PLANTATION	7.91	1985 130	1990 130			
40-001-0003AM10	M & A GOLF INC. AND H. G. JOINT VENTURE 9120 S. W. 46TH BLVD. GAINESVILLE, FL 32608	117	199211 2	199711 2	0	N	N/A
40-001-0003AM11	HAILE PLANTATION CORPORATION 9120 SW 46TH BLVD. GAINESVILLE, FL 32608	34.23	199212 2	199712 2	0	N	N/A
40-001-0003AM12	HAILE PLANTATION CORPORATION 9120 SW 46TH BLVD. GAINESVILLE, FL 32608	31.9	1993 415	1998 415	0	N	GROUND WATER (CLASS III)
40-001-0003AM14	H. G. JOINT VENTURE 9120 S.W. 46TH BLVD. GAINESVILLE, FL 32608	3.2	1993 929	1998 929	0	N	GROUNDWATER
40-001-0003AM15	HAILE PLANTATION CORPORATION ATTN: BOB KRAMER 9120 SW 46TH BLVD. GAINESVILLE, FL 32608	12.3	1994 630	1999 630	0	N	N/A
40-001-0003AM2	HAILE PLANTATION	0.78	1985 130	1990 130			
40-001-0003AM3	HAILE PLANTATION	19.92	1985 130	1990 130			
40-001-0003AM4	HAILE PLANTATION	12.71	19861224	19911224	0		
40-001-0003AM5	HAILE PLANTATION INC. 7622 S W 47TH LANE GAINESVILLE, FL 32608	10.1	19861224	19911224	0	N	ON-SITE RETENTION POND
40-001-0003AM9	B.G.R. OF HAILE, INC. 5200 NEWBERRY RD., STE. E-9 GAINESVILLE, FL 32606	36.51	1992 824	1997 824			N/A
40-001-0015A	D HAGAN INC	75	1986 625	1991 625	0	N	RETENTION ON-SITE
40-001-0019A	NATIONAL DEVELOPMENT COMMUN. 1126 PELICAN BAY DRIVE DAYTONA BEACH, FL 32119	51.3	1987 521	1992 521	0	N	LANDLOCKED DEPRESSION AREA
40-001-0019AGM	ALACHUA CNTY PUBLIC WORKS DEPT P. O. BOX 582 GAINESVILLE, FL 32602	4.53	1988 630	1993 630	0	N	N/A
40-001-0021A	WILLIAM J. RENFROE 1810 SE 29 AVE GAINESVILLE, FL 32601	60	1987 324	1992 324	0	N	CALF POND (CLASS III)
40-001-0022A	MRS. E. T. YORK 7911 SW 36TH AVE GAINESVILLE, FL 32608	16.4	1987 3 5	1992 3 5	0	N	ON-SITE RETENTION POND
40-001-0022AM	MRS. E. T. YORK	31.7	198710 9	199210 9	0	N	NONE

Table D-4. Management and Storage of Surface Waters Permits (MSSWs)

APPLICATION No.	APPLICANT	PROG. ACRG.	DATE ISSUED	DATE EXPIRED	WETL. TOTAL ACRG.	MITIG.	RECIEVING WATER BODY
40-001-0023A	ROBINSHORE, INC. 6910 W UNIV. AVE GAINESVILLE, FL 32607	42	1987 423	1992 423	0	N	EXISTING QUARRIES
40-001-0029AG	UNIV. OF FL BOARD OF STATE UNIV. SYSTEM OFFICE COLLINS BUILDING TALLAHASSEE, FL 32339	39.1	1988 420	1993 420	0.25	N	GROUNDWATER (CLASS III)
40-001-0029AGM	UNIVERSITY OF FLORIDA BOARD OF REGENTS STATE UNIVERSITY SYSTEM OFFICE COLLINS BLDG. TALLAHASSEE, FL 32339	39.75	19891110	19941110	0	N	HOGTOWN CREEK (CLASS III)
40-001-0034AG	ROBERT CREMER JR. BLDG. 700 PPD UNIVERSITY OF FLORIDA	0.74	1989 1 5	1994 1 5	0	N	HOGTOWN CREEK
40-001-0035AGM	UNIVERSITY OF FLORIDA GAINESVILLE, FL	1.7	19901011	19951011		Y	BIVENS ARM (CLASS III)
40-001-0035AGM2	GAINESVILLE, FL 32611 ATTN: PHYSICAL PLANT DIRECTOR PHYSICAL PLANT DIV, BLDG. 700 GAINESVILLE, FL 32611	9	1991 822	1996 822	0	N	BIVENS ARM (CLASS III)
40-001-0035AGM4	UNIVERSITY OF FLORIDA PHYSICAL PLANT DIVISION BUILDING 700 GAINESVILLE, FL 32611	9.64	1994 3 7	1999 3 7	0	N	BIVANS ARM
40-001-0037A	PRAIRIE VIEW TRUST 2303 NE 27TH AVENUE GAINESVILLE, FL 32601	0.5	19891114	19941114	0	N	PAYNES PRAIRIE (CLASS OFW)
40-001-0061A	LAKE SURPRISE WATERWAYS INC. 602 N. MAIN ST. GAINESVILLE, FL 32601	35	1992 827	1997 827	0	N	N/A
40-001-0062A	JONATHAN BAMBERG 2801 SW ARCHER ROAD GAINESVILLE, FL 32608	46.33	1992 9 1	1997 9 1	0	N	N/A
40-001-0063AW	CAPSTONE DEVELOPMENT 600 LUCKIE DR., STE. 424 BIRMINGHAM, AL 35223	15.9	1992 914	1997 914	0.48	N	N/A
40-001-0065AG	UNIVERSITY OF FLORIDA DIRECTOR OF CAMPUS PLANNING 232 STADIUM RD. GAINESVILLE, FL 32611	23.64	1993 2 9	1998 2 9	0	N	HOGTOWN CREEK
40-001-0069AW	PRESTON T. GREEN 4528 SW 83RD DR. GAINESVILLE, FL 32608	21.4					N/A
40-001-0070AG	SCHOOL BOARD OF ALACHUA COUNTY C/O ED GABLE 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	55	199411 4	199911 4	0	N	N/A
40-001-0072A	H. G. JOINT VENTURE ATTN: ROBERT R. ROWE 5200 NEWBERRY RD., E-9 GAINESVILLE, FL 32607	42.17	1993 428	1998 428	0	N	GROUND WATER (CLASS IIIIII)
40-001-0077A	DELTA GAMMA SORORITY 808 W. PANHELLENIC DRIVE GAINESVILLE, FL 32601	0.55	1993 825				N/A

Table D-4. Management and Storage of Surface Waters Permits (MSSWs)

APPLICATION No.	APPLICANT	PROG. ACRG.	DATE ISSUED	DATE EXPIRED	WETL. TOTAL ACRG.	MITIG.	RECIEVING WATER BODY
40-001-0078AW	SHANDS HOSPITAL ATTN: BRADLEY S. POLLITT 1600 SW ARCHER RD., BOX J-366 GAINESVILLE, FL, 32610	7.1	199312 1	199812 1	0.58	N	BIVENS ARM (CLASS III)
40-001-0083AGW	SCHOOL BOARD OF ALACHUA COUNTY C/O EDWARD GAGLE 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	3.63	1995 113	2000 113	0.18	N	LAKE ALICE
40-001-0084A	SOUTHEAST LANDHOLDINGS INC. ATTN: PAUL FLORENCE 3003 SE 15TH ST. GAINESVILLE, FL 32601	46.8					NONE
40-001-0086AG	UNIVERSITY OF FLORIDA ATTN: ROBERT D. CREMER, JR. P. O. BOX 117700 GAINESVILLE, FL 32611-7700	3.75					ON-SITE DETENTION BASIN WITH FILTRATION
40-001-0087A	F.L. HENDERSON AS AGENT FOR PRAIRIE VIEW TRUST ATTN: F. L. HENDERSON 3501 S. MAIN ST., STE. 1 GAINESVILLE, FL 32601	69					WILLISTON ROAD PRAIRIE AND WILLISTON ROAD SWALES (CLASS III)
40-083-0004A	FLA. HORSEMANS CHILDREN'S HOME P. O. BOX 336 CITRA, FL 32113	0	1984 614	1989 614			
40-083-0018A	MEDIA ONE PRODUCTIONS 8730 49TH STREET N. PINELLAS PARK, FL 33565	92	19851223	19901223	0		
40-083-0018AEM	LAKE OKLAWAHA R.V. RESORT, INC. 5801 PELICAN BAY BLVD. P.O. BOX 413004 NAPLES, FL 33941-3004	92	19091226	19951226	0	Y	ON-SITE RETENTION
40-083-0018AM	MEDIA ONE PRODUCTIONS	92	1987 520	19901223	0	N	LAKE OCKLAWAHA (CLASS III)
40-083-0030AG	FLORIDA DEPARTMENT OF TRANSPORTATION P.O. BOX 1089 LAKE CITY, FL 32056	33	1986 923	1991 923	0	N	NONE
40-083-0036AG	B. WILLIAM TEM BROECK	55	1987 429	1992 429	0	N	BLACK SINK PRAIRIE, GRASS LAKE, SILVER LAKE (CLASS III)
40-083-0095A	PETRO, INC. C/O TRAVIS ROBERTS 6080 SURETY DR., STE. 110 EL PASO, TX 79905	39.35	1994 831	1999 831	0.05	N	ISOLATED LOW (CLASS III)
40-107-0002A	EDDIE J. HIGGINBOTHAM 1730 NE 23RD AVE. JACKSONVILLE, FL 32609	0	1985 928	1989 925		N	NONE
40-107-0003A	F. BROOKS HERMAN	0	198411 9	198911 6			
40-107-0005A	HENRY M. FRAZEE	64.49	1985 219	1990 219			
6-083-0012A	ROBERT MORRISSEY	0.2	198510 8	199010 8	0	N	OCKLAWAHA RIVER
6-G004	U. S. GEOLOGICAL SURVEY P.O. BOX 1089 LAKE CITY, FL 32056						
6032378GV1	FLORIDA DEPARTMENT OF TRANSPORTATION	1	1978 621	1988 620			

Table D-5. Wetland Resource Management Permits (WRMs)

PPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	TOTAL WETLAND	MITIG.	RECEIVING WATER BODY
2-001-0001A	T.J. HAWES, TRUSTEE 3535 N. MAIN STREET GAINESVILLE, FL 32609	221	1989 613	1994 613	0.2		HOGTOWN CREEK (CLASS III)
2-001-0003A	SOUTHERN SCHOLARSHIP FOUNDATION INC. 322 STADIUM DRIVE TALLAHASSEE, FL 32399	0.22	1991 311	1996 311	0.22		LAKE ALICE
2-001-0004AG	DEPARTMENT OF NATURAL RESOURCES 3900 COMMONWEALTH BLVD TALLAHASSEE, FL 32399		1991 212	1996 212			LOCHLOOSA CREEK (CLASS III)
2-001-0005A	ZACH'S LEVEL BUILDERS 1020 NW 23RD AVE GAINESVILLE, FL 32609		1991 611	1996 611	0.16		HOGTOWN CREEK
2-001-0006A	E.R.B. & ROBERTS, INC. 2383 S.W. ARCHER RD GAINESVILLE, FL 32602		1993 810	1998 810	1.84	N	HOGTOWN CREEK (CLASS III)
2-001-0007A	CAMEO HOMES OF FLORIDA INC P.O. BOX 7131 GAINESVILLE, FL 32605		199110 8	199610 8	0		SMITH CREEK
2-001-0008AG	CITY OF GAINESVILLE REGIONAL AIRPORT AUTH. GAINESVILLE, FL 32609		1992 211	1997 211			LITTLE HATCHETT CREEK (CLASS III)
2-001-0009AG	VAN HUMPHREYS P.O. BOX 1089 LAKE CITY, FL 32056		1992 6 9	1997 6 9	0.35		LOCHLOOSA CREEK (CLASS III)
2-001-0010A	H.K.W. ENTERPRISES INC. 4509 N.W. 23RD AVENUE GAINESVILLE, FL 32606		1992 211	1997 211			EXISTING COUNTY DITCH (CLASS III)
2-001-0011A	EMMER DEVELOPMENT CORP. 2801 SW ARCHER ROAD GAINESVILLE, FL 32608		1992 310	1997 310	0.78		CITY DRAINAGE DITCH TO HOG TOWN CREEK (CLASS III)
2-001-0012AG	ALACHUA COUNTY PAUL HOUSTON GAINESVILLE, FL 32602		1992 7 7	1997 7 7	3.17		LITTLE HATCHET CREEK (CLASS III)
2-001-0013AG	FLORIDA DEPARTMENT OF TRANSPORTATION VAN HUMPHREYS LAKE CITY, FL 32056		1992 811				HOGTOWN CREEK TRIBUTARY

Table D-5. Wetland Resource Management Permits (WRMs)

APPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	TOTAL WETLAND	MITIG.	RECEIVING WATER BODY
12-001-0014AG	FLORIDA DEPARTMENT OF TRANSPORTATION P. O. BOX 1089 LAKE CITY, FL 32056	0	1993 2 9	1998 2 9	0.25	N	N/A
12-001-0016AG	CITY OF GAINESVILLE P.O. BOX 490 GAINESVILLE, FL 32602		1993 2 9	1998 2 9		N	LAKE FOREST CREEK CLASS: III
12-001-0017AG	FLORIDA DEPARTMENT OF TRANSPORTATION P.O. BOX 1089 LAKE CITY, FL 32056		1993 9 7	1998 9 7		N	ORANGE LAKE (CLASS III,OFW); ORANGE CREEK (CLASS: III)
12-001-0018AG	DOT/STATE PROJECT NO. 26080-3522 1901 S. MARION STREET LAKE CITY, FL 32056						PRAIRIE CREEK
12-001-0019A	SANTA FE COMMUNITY COLLEGE 3000 N.W. 83RD STREET GAINESVILLE, FL 32606		1994 412	1999 412	19.03	N	LITTLE HATCHETT CREEK, NEWNANS LAKE (CLASS: III)
12-001-0020AG	CITY OF GAINESVILLE P.O. BOX 490 GAINESVILLE, FL 32602		19941011	19991011		N	UNNAMED TRIBUTARY OF CALF POND
12-001-0021AG	CITY OF GAINESVILLE PUBLIC WORKS DEPARTMENT 306 N.E. 6TH AVENUE ROOM 347 GAINESVILLE, FL 32601		1994 6 7	1999 6 7	0.13	N	HOGTOWN CREEK (CLASS III)
12-001-0022AG	ALACHUA COUNTY PUBLIC WORKS P.O. BOX 1188 GAINESVILLE, FL 32602						LOCHLOOSA CREEK SWAMP
12-001-0023A	ROLAND DANIELS, C/O SATURN OF GAINESVILLE 18025 S.W. 83RD COURT MIAMI, FL 33157						N/A
12-019-0016AG	CITY OF KEYSTONE HEIGHTS P.O. BOX 336 KEYSTONE HEIGHTS, FL 32656		199110 8	199610 8			
12-019-0039AG	CITY OF KESTONE HEIGHTS FLORIDA P.O. BOX 420 KEYSTONE HEIGHTS, FL 32656						KEYSTONE LAKE
12-019-0048AG	CLAY COUNTY BOARD OF COUNTY COMMISSIONERS P.O. BOX 1365 GREEN COVE SPRINGS, FL 32043		1994 412	1999 412		N	ALLIGATOR CREEK

Table D-5. Wetland Resource Management Permits (WRMs)

PPLICATION No.	APPLICANT	PROJ. ACRG.	DATE ISSUED	DATE EXPIRED	TOTAL WETLAND	MITIG.	RECEIVING WATER BODY
2-083-0002AG	MARION COUNTY COMMISSION 601 SE 25TH AVENUE OCALA, FL 32671	0.5	19891212	19941212	0.5		PERRYWELL BRANCH (CLASS III)
2-083-0005AG	MARION COUNTY BOARD COUNTY COMM. 2631- D.S.E. 3RD ST. OCALA, FL 32671		1991 115	1996 115			MILL CREEK (CLASS III)
2-107-0006A	HERMAN E. FUGATE ATTN: KELLY H. JEROME 4131 NW 13TH ST. STE 224 GAINESVILLE, FL 32609	2	1991 5 7	1996 5 7			ETONIA CREEK (CLASS III)
2-107-0006AM	HERMAN E. FUGATE RT 4 BOX 1723 PALATKA, FL 32177		1994 412	1999 412	0.45	N	ETONIA CREEK (CLASS: III)
2-107-0014AG	PUTNAM COUNTY BOARD OF COUNTY COMMISSIONERS P.O. BOX 1647 PALATKA, FL 32178		1993 413	1998 413		N	CABBAGE CREEK (CLASS III)
3-001-0001A	EMMER DEVELOPMENT CORP. 2801 S.W. ARCHER RD. GAINESVILLE, FL 32608	0.03	1992 2 5	1997 2 5			UNNAMED DITCH
3-001-0002A	FLOURNOY DEVELOPMENT CO P.O. BOX 6566 COLUMBUS, GA 31995	0.088	1992 214	1997 214			DITCH
3-001-0004AG	ALACHUA COUNTY SCHOOL BRD. PLANNING & CONSTR. DEPT 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32606	0	1993 4 5	1998 4 5			UNNAMED DRAINAGE DITCH TO HOGTOWN CREEK
3-001-0005A	PAUL WEST MITSUBISHI ATTN: PAUL WEST GAINESVILLE, FL 32609						ROADSIDE DRAINAGE DITCH TO HOGTOWN CREEK

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0001ANG	SCHOOL BOARD OF ALACHUA COUNTY 600 E. UNVI. AVE. GAINESVILLE, FL 32601	0	HOGTOWN CREEK	1986 6 6
42-001-0001ANGM	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	3.63	N/A	19941020
42-001-0002AN	LIL CHAMP FOOD STORES P.O. BOX 8989 JACKSONVILLE, FL 32239	1.03	L. HATCHET CREEK	1986 530
42-001-0002ANM	LIL' CHAMP FOOD STORES, INC.	1.03	L. HATCHET CREEK	1988 912
42-001-0003AN	RICHARD REISINGER 3945 NW 43RD COURT GAINESVILLE, FL 32606	0.98	HOGTOWN CREEK	1986 627
42-001-0004AN	LIL CHAMP FOOD STORES P.O. BOX 8989 JACKSONVILLE, FL 32239	0.69	HATCHET CREEK	1986 530
42-001-0005AN	RICHARD F. BAILEY (TRUSTEE) 6712 NW 18TH DRIVE GAINESVILLE, FL 32607	6.5	HOGTOWN CREEK	1986 7 3
42-001-0007AN	JERROLD MICHAEL SMITH 1031 NW 6TH ST. #C-1 GAINESVILLE, FL 32601	1.03	MONTEREY CREEK	1986 618
42-001-0008AN	BARRY RUTENBERG & ASSOCIATES 907 ELLAMAE AVE. TAMPA, FL 32610	29.17	RIDGEVIEW CREEK	1986 7 2
42-001-0009AN	RAYBRO ELECTRIC SUPPLIES INC. 1752 NE 23RD AVE. GAINESVILLE, FL 32601	2.3	L. HATCHET CREEK	1986 714
42-001-0010AN	RADIATION THERAPY INC. BOX J-326 GAINESVILLE, FL 32610	0.84	HOGTOWN PRAIRIE	1986 820
42-001-0011ANG	ALACHUA COUNTY P.O. BOX 582 GAINESVILLE, FL 32602	14.8	COUNTY DITCH	1986 715
42-001-0012AN	RICHARD BAILEY 6712 NW 18TH DR. GAINESVILLE, FL 32606	2.28	HOGTOWN CREEK	1986 731
42-001-0013AN	H SAXTON, COLLEGIATE HOUSING 1495 NW 13TH ST. GAINESVILLE, FL 32601	4	TUMBLIN CREEK	1986 915
42-001-0013ANM	COLLEGIATE HOUSING, LTD. 1495 NW 13TH ST. GAINESVILLE, FL 32601	5.45	TUMBLIN CREEK	19871027
42-001-0014ANG	ALACHUA COUNTY SCHOOL BOARD 620 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	1.7	HOGTOWN CREEK	1986 915
42-001-0014ANGM	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	3.85	HOGTOWN CREEK	1993 817
42-001-0014ANGM2	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	3.85	HOGTOWN CREEK	1994 531

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0015AN	PAT PANNELL 2419 NW 13TH PLACE GAINESVILLE, FL 32605	2.4	POTATO PATCH BAY	1986 821
42-001-0016ANG	CITY OF GAINESVILLE P.O. BOX 490 GAINESVILLE, FL 32602	0.45	TUMBLIN CREEK	19861023
42-001-0017AN	DOLORES & CHARLES KRAUSCHE P.O. BOX 217 GAINESVILLE, FL 32602	0.95		19861023
42-001-0018AN	KEN MCGURN P.O. BOX 2900 GAINESVILLE, FL 32602	0.8		19861010
42-001-0019AN	JAMES R. MULHEARN 4504 SW 29TH AVE. GAINESVILLE, FL 32608	0.95		19861112
42-001-0019ANM	JAMES R. MULHEARN 4505 S.W. 29TH AVENUE GAINESVILLE, FL 32608	0.82	N/A	1994 712
42-001-0020AN	ALACHUA COUNTY SCHOOL BOARD 620 UNIVERSTIY AVE. E. GAINESVILLE, FL 32601	1.1	NEARBY PRIVATE DITCH	19861119
42-001-0021ANG	UNIVERSITY OF FL ATHLETIC ASSOCIATION 107 STADIUM RD GAINESVILLE, FL 32611	2.32	LAKE ALICE	19861119
42-001-0022AN	MCGURN INVESTMENT COMPANY 112 S. MAIN ST. ATTN: FRED L. VYVERBERG GAINESVILLE, FL 32602	0.735	SWEETWATER BRANCH	1987 120
42-001-0023AN	MALONE & HYDE INC.	0.838	SWEERWATER BRANCH	19861119
42-001-0024ANG	UNIVERSITY OF FLORIDA ATHLETIC ASSOCIATION 107 STADIUM ROAD GAINESVILLE, FL 32611	134	LAKE ALICE	19861119
42-001-0025ANG	UNIVERSITY OF FLORIDA 107 STADIUM RD GAINESVILLE, FL 32611	0.93	LAKE ALICE	19861119
42-001-0026ANG	UNIVERSITY OF FLORIDA ATHLETIC ASSOCIATION 107 STADIUM ROAD GAINESVILLE, FL 32611	999	LAKE ALICE	19861119
42-001-0027AN	ALACHUA GENERAL HOSPITAL 606 SW 3RD AVE. #1 GAINESVILLE, FL 32601	1.5	TUMBLIN CREEK	19861119
42-001-0027ANM	ALACHUA GENERAL HOSPITAL, INC. ATTN: SHARON BREITINGER 801 SW 2ND AVE. GAINESVILLE, FL 32601	11.3	TUMBLIN CREEK	1993 7 8
42-001-0028AN	THE CROM CORPORATION 250 SW 36TH TERRACE GAINESVILLE, FL 32607	0.43	HOGTOWN CREEK	19861211

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0030AN	GARY WILLIAMS 4181 S. MAIN ST. GAINESVILLE, FL 32601	0.34	SWEETWATER BRANCH	19861119
42-001-0031ANM	HAUFLER BROTHERS 3700-A NE 91ST ST. GAINESVILLE, FL 32606	1.68		1990 9 4
42-001-0031ANM2	HAUFLER BROTHERS 3700 A-100 NW 91ST STREET GAINESVILLE, FL 32606	9.36	HAUGLER BROTHERS	1994 9 7
42-001-0032AN	KISH CONSTRUCTION COMPANY 3610 NW 97TH BLVD. GAINESVILLE, FL 32606	3.3	N/A	19861216
42-001-0033ANG	SCHOOL BOARD OF ALACHUA COUNTY 620 E. UNIV. AVE. GAINESVILLE, FL 32601	0.18	HOGTOWN CREEK	19861212
42-001-0034AN	THOMAS ROBINSON 6910 W. UNIVERSITY AVE. GAINESVILLE, FL 32607	1.37	N/A	19861223
42-001-0035AN	SARA K. JEFFERS RT 1 BOX 245-E HAWTHORNE, FL 32640	0.63	N/A	19861223
42-001-0036AN	FERGUSON ENTERPRISES 618 BLAND BLVD. NEWPORT NEWS, VA 23602	1.7		1987 210
42-001-0037AN	THOMAS SIDNEY 4025 NW 14 ST. GAINESVILLE, FL 32605	0.67	BIVENS CREEK	19861216
42-001-0038AN	SCHMIDT, RAYMOND 3580 N. MAIN ST. GAINESVILLE, FL 32601	1.295	N/A	19861216
42-001-0039AN	STEVE SHEY P.O. BOX 14424 GAINESVILLE, FL 32604	1.22		1987 1 9
42-001-0039ANM	HASKELL HESS, STEPHEN SHEY AND JEFF KNACK ATTN: JEFF KNACK P.O. BOX 14424 GAINESVILLE, FL 32604	1.22	DOT STORWMATER SYSTEM	1990 6 6
42-001-0040AN	B, P, G, AND R PARTNERS 5200 NEWBERRY RD STE E-9 GAINESVILLE, FL 32607	11	A MINOR TRIBUTARY OF HOGTOWN CREEK	1987 113
42-001-0040ANM	B,P,G & R PARTNERS	4.73	HOGTOWN CREEK	1988 324

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0041AN	CARL BRICE 6500 SW ARCHER RD. GAINESVILLE, FL 32608	37	ON SITE DEPRESSION (NORMALLY DRY)	1986 716
42-001-0042AN	E. T. YORK 7911 SW 36TH ST. GAINESVILLE, FL 32608	16.381	N/A	1987 126
42-001-0043AN	H.B. FULLER COMPANY 315 S. HICKS RD. PALATINE. IL 60067	9.46	N/A	1987 310
42-001-0044AN	DOUGLAS MARTEL 10827 NW 14TH AVE. GAINESVILLE, FL 32601	5.8	N/A	1987 123
42-001-0045AN	FIRST BAPTIST CHURCH OF GAINESVILLE 425 W. UNIVERSITY AVE. GAINESVILLE, FL 32601	5	N/A	1987 123
42-001-0046ANG	ALACHUA CNTY PUBLIC WORKS DEPT P.O. BOX 582 GAINESVILLE, FL 32602	11.3	PAYNES PRAIRIE	1987 2 4
42-001-0047AN	JOHN V. CARLSON 232 STADIUM GAINESVILLE, FL 32611	100	ULTIMATELY LAKE ALICE	1987 2 4
42-001-0048AN	TRINITY UNITED METHODIST CHURCH 3536 NW 8TH AVE. GAINESVILLE, FL 32605	1	GAINESVILLE STORM SEWERS TO HOGTOWN CREEK	1987 3 9
42-001-0049AN	DOUGLAS MARTEL 10827 NW 14TH AVE. GAINESVILLE, FL 32601	7.87	N/A	1987 4 6
42-001-0050ANG	UNIVERSITY OF FLORIDA' 232 STADIUM RD. GAINESVILLE, FL 32611	1.85	LAKE ALICE	1987 2 4
42-001-0051AN	JOHN CARLSON 232 STADIUM RD. GAINESVILLE, FL 32611	1.21	LAKE ALICE	1987 2 2
42-001-0053ANG	BAKER CO. BOARD OF CO. COMMISSIONERS	0	N/A	
42-001-0057ANG	ALACHUA COUNTY SCHOOL BOARD 620 E. UNIV. AVE. GAINESVILLE, FL 32601	1.7	DEPRESSION	1987 210
42-001-0058AN	EDWIN MCMILLAN 2128 NW 29TH AVE. GAINESVILLE, FL 32605	0.967	CITY OF GAINESVILLE STORMWATER SYSYEM	1987 210
42-001-0059ANG	UNIVERSITY OF FL, DIVISION OF HOUSING CORNER 13TH & MUSEUM RD. GAINESVILLE, FL 32611	0	LAKE ALICE	1987 225

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0060ANG	ROBERT FERNANDEZ, COUNTY ADMINISTRATOR	3	ON SITE LOWLAND	1987 225
42-001-0061ANG	UNIVERSITY OF FLORIDA 232 STADIUM RD. GAINESVILLE, FL 32611	0.14	BIVEN'S ARM	1987 217
42-001-0062AN	MARK V. BARROW 810 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	0.699		1987 324
42-001-0063ANGM	CITY OF GAINESVILLE	7.33	HOGTOWN CREEK	1988 928
42-001-0064AN	LARRY ROSS BUILDERS, INC. RT. 2 BOX 631 NEWBERRY, FL 32669	14.32		1987 318
42-001-0065AN	JAY HERRINGTON 4001 NEWBERRY RD. GAINESVILLE, FL 32605	0.5	CONSTRUCTED BASIN	1987 312
42-001-0066AN	ROBIN WHITTAKER 1204 NW 13TH ST. GAINESVILLE, FL 32601	0.67	HOGTOWN CREEK VIE CITY STORMSEWER	1987 318
42-001-0067AN	TERRY L. TOUGAW 1817 E UNIVERSITY AVE. GAINESVILLE, FL 32601	1	N/A	1987 4 1
42-001-0069AN	KIRKLAND, INC. 2531 NW 41ST ST. SUITE D GAINESVILLE, FL 32607	18.8	POSSUM CREEK	1987 4 3
42-001-0070AN	SCOTTYS, INC. P.O. BOX 939 WINTER HAVEN, FL 33882	11.856	HOGTOWN CREEK	1987 5 4
42-001-0071ANG	THE FLORIDA BOARD OF REGENTS 377 MAITLAND AVE. #112 ALTAMONTE SPRGS, FL 32701	0	N/A	1987 4 3
42-001-0072AN	JOHN KISH, JR. 3610 NW 97TH BLVD. GAINESVILLE, FL 32606	9.09	SWALE TO NATURAL DEPRESSION	1987 416
42-001-0073AN	J.R. SCOTT 301 W. BAY ST. JACKSONVILLE, FL 32202	0.055	HOGTOWN CREEK	1987 4 7
42-001-0074AN	LEROY STRICKLAND 4025 N. MAIN ST. GAINESVILLE, FL 32609	2.525	PINE FOREST CREEK	1987 413
42-001-0076AN	ROBINSHORE, INC. 6910 W. UNIV. AVE. GAINESVILLE, FL 32607	20.87	HOGTOWN CREEK	1987 513
42-001-0077ANGM	FLORIDA DEPARTMENT OF TRANSPORTATION ATTN: VAN HUMPHREYS P.E. P. O. BOX 1089 LAKE CITY, FL 32056	35.6	GROUND WATER	1993 218

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0078AN	TAMMI SMITH 4323 NW 6TH ST. GAINESVILLE, FL 32609	0.73	HOGTOWN CREEK	1987 9 2
42-001-0079AN	SCHOOL BOARD OF ALACHUA COUNTY 620 E UNIVERSITY AVE. GAINESVILLE, FL 32601	2.5	LANDLOCKED DEPRESSION	1987 519
42-001-0079ANG	SCHOOL BOARD OF ALACHUA COUNTY 620 E UNIVERSITY AVE. GAINESVILLE, FL 32601	2.5	LANDLOCKED DEPRESSION	1987 519
42-001-0080ANG	SCHOOL BOARD OF ALACHUA COUNTY 620 E UNIVERSITY AVE. GAINESVILLE, FL 32601	2	N/A	1987 6 3
42-001-0081ANG	JOHN V. CARLSON 232 STADIUM ROAD GAINESVILLE, FL 32611	4.17	ULTIMATELY LAKE ALICE	1987 5 1
42-001-0082ANG	ALACHUA COUNTY SCHOOL BOARD 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	16.5	DEPRESSION	1987 529
42-001-0083AN	REGIONAL PATROLEUM CORP. P.O. BOX 1282 GAINESVILLE, FL 32602	0.95	L. HATCHET CREEK	1987 6 2
42-001-0084ANG	UNIVERSITY ATHLETIC ASSOCIATION, INC. P.O. BOX 14485 GAINESVILLE, FL 32604	2	LAKE ALICE	1987 6 2
42-001-0085AN	WENDELL LEWIS P.O. BOX 1282 GAINESVILLE, FL 32602	0.9	PAYNES PRAIRIE	198710 5
42-001-0085ANM	LEWIS OIL COMPANY, INC. ATTN: WENDELL LEWIS GAINESVILLE, FL 32601	0.07	GROUNDWATER	19941028
42-001-0087AN	BROOKER'S PEST CONTROL 5602 NW 13TH ST. GAINESVILLE, FL 32601	0.06	HOGTOWN CREEK	1987 630
42-001-0087ANM	BROOKER'S PEST CONTROL 5602 NW 13TH ST. GAINESVILLE, FL 32601	0.32	HOGTOWN CREEK	1987 914
42-001-0090ANG	GEORGE COATAS			19911220
42-001-0091AN	GRACE UNITED METHODIST CH. 9325 NEWBERRY RD. GAINESVILLE, FL 32606	4.98		1987 720
42-001-0091ANM	GRACE UNITED METHODIST CHURCH ATTN: RON LINDSAY 1922 NW 133RD TERR. GAINESVILLE, FL 32606	4.96	GROUND WATER	1994 1 6

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0092AN	GEORGE V. CONDA 3217 S. DALE MARBRY HWY. TAMPA, FL 33629	3.1		198710 5
42-001-0093AN	SHANDS HOSPITAL AT THE UNIVERSITY OF FLORIDA 1600 SW ARCHER RD. GAINESVILLE, FL 32610	0	LAKE ALICE	1987 720
42-001-0094AN	THORNBROOK DEVELOPMENT CORP. 3500 SW 2ND AVE. GAINESVILLE, FL 32601	4.6	N/A	1987 727
42-001-0095AN	MRS. E.T. YORK 7911 SW 36TH AVE. GAINESVILLE, FL 32608	0	N/A	1987 812
42-001-0096AN	KAPPA SIGMA FRATERNITY 19 SW 13TH ST. GAINESVILLE, FL 32601	0.057	SWEETWATER BRANCH	1987 810
42-001-0097AN	W.R. WOOD 1002 NW 23RD AVE. GAINESVILLE, FL 32601	0.207	HOGTOWN CREEK VIA CITY OF GAINESVILLE STORM	1987 817
42-001-0098AN	LASH DEVELOPMENT CORP. 2811 NW 41ST ST. GAINESVILLE, FL 32606	1.68	HOGTOWN CREEK	1987 817
42-001-0099AN	CHARLES HOLDEN 1240 NW 11TH AVE. GAINESVILLE, FL 32601	2.2	HOGTOWN CREEK	1987 914
42-001-0100AN	SOUTHERN REALTY, INC. 2421 NW 41ST. ST. #A-1 GAINESVILLE, FL 32605	1.02	HOGTOWN CREEK	1987 825
42-001-0101AN	MR JIM MCCAWLEY	0.22		1987 810
42-001-0102AN	FIRST CHRISTIAN CHURCH 800 SW 2ND AVE. GAINESVILLE, FL 32601	6.44	N/A	1987 831
42-001-0103AN	CLAY ELECTRIC COOPERATIVE P.O. BOX 308 KEYSTONE HGTS., FL 32656	4.9	DEPRESSION	198710 7
42-001-0104AN	FLORIDA BOOK STORE, INC. 1614 WEST UNIV. AVE. GAINESVILLE, FL 32604	0.37		1987 930
42-001-0106AN	JAMES MEEHAN 2113 NEPTUNE BLVD. #A NEPTUNE BCH., FL 32233	2.44	HOGTOWN CREEK	198710 5
42-001-0107ANG	JOHN CHERRY P.O. BOX 1468 GAINESVILLE, FL 32602	1.552		1987 922
42-001-0108AN	BOB ATKINS 3401 SW 40TH BLVD. GAINESVILLE, FL 32608	0.809	NONE	1987 922

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0109ANG	ALACHUA CNTY PUBLIC WORKS DEPT P.O. BOX 582 GAINESVILLE, FL 32602	24	NONE	1987 930
42-001-0110AN	MENTAL HEALTH SERVICES, INC. 4300 SW 13TH ST. GAINESVILLE, FL 32608	1.63	ON-SITE DETENTION	1987 930
42-001-0111AN	MINI-MAXI WAREHOUSE 2150 NE 31 AVE. GAINESVILLE, FL 32607	1.07	ROADSIDE DITCH	198710 5
42-001-0112AN	HARRY M. PERKERSON	1.07	HOGTOWN CREEK	1988 122
42-001-0114AN	MCKINNEY BUILDING COMPANY 914 SW 50TH WAY GAINESVILLE, FL 32606	7.43	HOGTOWN CREEK	198711 7
42-001-0115AN	THE FIRST GAINESVILLE CORP. P.O. BOX 1133 GAINESVILLE, FL 32602	1.9	LAKE ALICE	19871015
42-001-0116AN	THOMAS F. HENDERSON 4129 NW 10TH ST. GAINESVILLE, FL 32609	1.49	HOGTOWN CREEK	19871027
42-001-0116ANM	THOMAS HENDERSON 4129 NW 10TH ST. GAINESVILLE, FL 32609	1.8	HOGTOWN CREEK	1988 115
42-001-0116ANM2	TOM HENDERSON 7326 SW 17TH PLACE GAINESVILLE, FL 32607	0.9	HOGTOWN CREEK	1993 122
42-001-0117AN	EXCHANGE INVESTMENTS, INC. P.O. BOX 789 GAINESVILLE, FL 32602	0.47	HOGTOWN CREEK	19871027
42-001-0118AN	INSURANCE WORLD OF GAINESVILLE, INC. 424 NW 13TH ST. GAINESVILLE, FL 32601	0.45	HOGTOWN CREEK TRIBUTARY	19871027
42-001-0119AN	THE PEARSON COMPANIES 7450 MIDLOTHRAN PIKE RICHMOND, va 23225	2.82	MANMADE DITCH DISCHARGING INTO HOGTOWN CREEK	19871027
42-001-0120AN	CHARLES PAGE RT. 2 BOX 122 NEWBERRY, FL 32669	3.13	HOGTOWN CREEK TRIBUTARIES	19871027
42-001-0121AN	HAROLD MCDAVID 2051 NE 31ST AVE. GAINESVILLE, FL 32609	0.257	L. HATCHET CREEK	19871210
42-001-0122AN	GREENE AND ROWE DEVELOPMENT 5200 NEWBERRY RD #E-9 GAINESVILLE, FL 32607	21.081	N/A	19871110

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0123AN	JOHN O'CONNOR 1300 GULF LIFE DR. 6TH FLOOR, BLDG. 1300 JACKSONVILLE, FL 32207	20.52	HOGTOWN CREEK	19871028
42-001-0124AN	PRESTIGE EQUITIES/ NORTHWOOD, INC. 2233 NW 41 ST. SUITE 100 GAINESVILLE, FL 32606	5.2	HOGTOWN CREEK	19871113
42-001-0124ANM	THE PRESTIGE GROUP 2233 NORTHWEST 41ST ST. PRESTIGE PARK, SUITE 100 GAINESVILLE, FL 32608	6.18	HOGTOWN CREEK	1992 4 2
42-001-0125AI	FLORIDA BLUEBERRIES, INC. 2801 SW ARCHER RD. GAINESVILLE, FL 32608	15.4		19871117
42-001-0126AN	JAMES MEEHAN P.E. 7326 SW 17TH PLACE GAINESVILLE, FL 32607	0.454		19871124
42-001-0127AN	PRESTIGE EQUITIES/S.GATE, INC. 2233NW 41ST SUITE 100 GAINESVILLE, FL 32606	1.57		19871124
42-001-0127ANM	PRESTIGE PROPERTIES, INC., MANAGING AGENT MICHAEL L. STEINBERG 2233 NW 41ST ST, STE. 100 GAINESVILLE, FL 32606	2.33	FDOT DRAINAGE SYSTEM	1992 528
42-001-0128AN	FLA USDA FED CREDIT UNION P.O. BOX 1162 GAINESVILLE, FL 32602	3	SWEETWATER BRANCH	19871210
42-001-0129AN	J. HANNON HUGHES 2731 SW WILLISTON ROAD GAINESVILLE, FL 32608	2.23	HOGTOWN CREEK	19871210
42-001-0130AN	TOM HANLEY AND TOMMY WATERS 277 NW 23RD AVE. GAINESVILLE, FL 32609	0.436	HOGTOWN CREEK VIA GAINESVILLE STORM AND SEWER	19871217
42-001-0132AN	SHONEY'S INC. 1727 ELM HILL PIKE NASHVILLE, TN 37210	0.58	HOGTOWN CREEK	1988 128
42-001-0133ANG	GAINESVILLE HOUSING AUTHORITY ATTN. JOHN CHERRY P.O. BOX 1468 GAINESVILLE, FL 32602	1.564	SWEETWATER BRANCH	1988 122
42-001-0134AN	JAMES MEEHAN	2	SWEETWATER BRANCH	19871229

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0136ANG	ALACHUA CO PUBLIC WORKS DEPT. ATTN: SKIP BAMBARD P. O. BOX 582 GAINESVILLE, FL 32605	0.87	NONE	1988 1 7
42-001-0137AN	ALPHA XI DELTA HOUSE CORP.	0.479	TUMBLIN CREEK	1988 115
42-001-0138AN	N. FL REG. MEDICAL CENTER 6500 NEWBERRY RD. GAINESVILLE, FL 32602	1.38	STORM SEWER SYSTEM	1988 6 3
42-001-0138ANM	HCA REALTY CORPORATION	1.38		1988 6 3
42-001-0139AN	CANDLER DEVELOPMANT COMPANY 2500 WINDY RIDGE PKWY. MARIETTA, GA 30067	10.613	ADJACENT OFF-SITE APPROVED RETENTION FACILITIES	1988 2 4
42-001-0140AN	SOUTHERN SCHOLARSHIP FOUNDATION, INC.	0.848	BIVANS ARM	1988 128
42-001-0141AN	GREEK ORTHODOX CHURCH OF GAINESVILE P.O. BOX 2474 GAINESVILLE, FL 32602	6.98	N/A	1988 422
42-001-0142AN	GAINESVILLE SUPER 8 MOTEL 1910 8TH AVENUE NE ABERDEEN, SD 57401	1.98	N/A	1988 2 4
42-001-0143AN	HARRIS H. GREEN	0.52		1988 3 2
42-001-0144AN	JAMES MEEHAN 7326 SW 17TH PLACE GAINESVILLE, FL	5.4	HOGTOWN CREEK BASIN	1988 3 9
42-001-0145ANG	OAK HALL SCHOOL	0.325	NONE	1988 223
42-001-0145ANGM	OAK HALL SCHOOL 8009 S.W. 14TH AVE. GAINESVILLE, FL 32607	0.18	GROUND WATER	19921118
42-001-0146ANG	CITY OF GAINESVILLE FLORIDA 1031 N.W. SIXTH ST #B-1 GAINESVILLE, FL 32601		TUMBLIN CREEK	1988 321
42-001-0147AN	ACTIVITY CENTER LTD.	4.87	NONE	19881214
42-001-0147ANM	ACTIVITY CENTER, LTD P.O. BOX 13493 GAINESVILLE, FL 32604	9.88	N/A	199011 2
42-001-0148AN	BARRY RUTENBERG AND ASSOCIATES 2441 NW 41ST ST. GAINESVILLE, FL 32606	22.45	HOGTOWN CREEK	1988 4 6

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0149ANG	JOHN V. CARLSON	6.65	HOGTOWN CREEK	1988 3 9
42-001-0150AN	JAMES MEECHAN 7326 SW 17TH PLACE GAINESVILLE, FL 32607	29	HOGTOWN BASIN - NO PLANNED DISCHARGE	1988 6 1
42-001-0152AN	JAMES MEEHAN 7326 SW 17TH PLACE GAINESVILLE, FL 32607	1.2	N/A	1988 3 9
42-001-0153ANM	JAY PRAVADA 832 NW 57TH ST. GAINESVILLE, FL 32606	0.77	PARK AVE SYSTEM	1990 7 2
42-001-0155AN	RONALD R. RAINEY P.E.	0.804	NONE	1988 427
42-001-0156AN	ASSOCIATION OF RETARDED CITIZENS	6.44	NONE	1988 5 6
42-001-0157AN	BRASINGTON CADILLAC-OLDSMOBILE, INC.	4.54	NONE	1988 511
42-001-0158AN	JAMES MEEHAN	0.75	LITTLE HATCHET CK	1988 4 6
42-001-0159AN	RONALD R. RAINEY P. O. BOX 5468 LAKELAND, FL 33807	0.429		19881118
42-001-0160ANG	FLORIDA DEPARTMENT OF TRANSPORTATION	7.447	JOHNSON LAKE	1988 412
42-001-0161AN	HUNTERS RUN APARTMENTS, LTD.	13.25	NONE	1988 422
42-001-0162ANG	CITY OF GAINESVILLE ENGINEERING DEPARTMENT P.O. BOX 490 GAINESVILLE, FL 32602	1.5	NEWMANS LAKE	1988 5 2
42-001-0162ANGM	CITY OF GAINESVILLE, PUBLIC WORKS DEPT. P. O. BOX 490, M.S. #58 GAINESVILLE, FL 32601	0	NEWMANS LAKE	1993 921
42-001-0164AN	RONNIE L. GRUNDSET	0.41	N/A	1988 511
42-001-0165AN	WESTWOOD HILLS CHURCH OF GOD 1520 N.W. 34TH STREET GAINESVILLE, FL 32605	4	HOGTOWN CREEK VIA SR 121 DRAINAGE SYSTEM	1988 816
42-001-0166AN	JOYNER CONSTRUCTION COMPANY	0.88	HOGTOWN CREEK	1988 422
42-001-0167AN	DR. JAY GARLITZ	0.42		1988 6 3

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0168AN	THE HANKIN GROUP 309 NE 1ST STREET GAINESVILLE, FL 32601	12.776	THREE LAKES CREEK VIA FLA. D.O.T. DRAINAGE SYSTEM	1988 427
42-001-0169AN	CHURCH OF GOD OF GAINESVILLE, FL 1001 NE 28TH AVENUE GAINESVILLE, FL 32601	0.04	N/A	1988 5 2
42-001-0170AN	ST. PATRICKS CATHOLIC CHURCH 500 N.E. 16TH AVENUE GAINESVILLE, FL 32601	0.25		1988 523
42-001-0170ANM	ST. PATRICK'S CATHOLIC CHURCH 500 N.E. 16TH AVE. GAINESVILLE, FL 32601	10	UNAMED ISOLATED WETLAND	199411 4
42-001-0171AN	NORWOOD HOPE 158 TURKEY CREEK ALACHUA, FL 32615	1.3		1988 712
42-001-0172ANG	SANTA FE COMMUNITY COLLEGE BOARD OF TRUSTEES	2.05		1988 6 3
42-001-0173ANG	ALACHUA COUNTY PUBLIC WORKS DEPT.	54	MILLHOPPER CREEK	1988 826
42-001-0174AN	SOUTHERN BELL TELEPHONE AND TELEGRAPH 10KK1 SBT 301 WEST BAY STREET JACKSONVILLE, FL 32202	0.429	TOWER CENTER DEVELOPMENT DETENTION LAKES	1988 812
42-001-0175AN	G.W. ROBINSON 7616 N.W. 38TH PLACE GAINESVILLE, FL 32606	16.72	NONE	1993 525
42-001-0176AN	JAMES MEEHAN	0.75	HATCHET CREEK	1988 7 6
42-001-0177AN	GEORGE E. "COTTON" FLETCHER 5715 N.W. 57TH WAY GAINESVILLE, FL 32606	41.8	N/A	
42-001-0178AN	JAMES MEEHAN	5		1988 823
42-001-0179AN	HARRY BECKWITH	1		1988 615
42-001-0180AN	JAMES D. HENDERSON, II, P.E.	5.997	BIVANS ARM	1988 6 1
42-001-0182AN	JAMES MEEHAN	7.5	NEWNANS LAKE	1988 829
42-001-0183AN	PRESTIGE LINCOLN MERCURY	2.22	NONE	1988 615
42-001-0184AN	QUALITY GLASS	1.55	NONE	1988 615

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0185AN	COMMERCIAL CONSULTING CORP. ATTN: ROGER LESLIE P. O. BOX 3886 TALLAHASSEE, FL 32315	0.75		1988 615
42-001-0186AN	THE LAW SOURCE, INC. 2711 NW 6TH STREET STE E GAINESVILLE, FL 32601	0.4	N/A	1988 615
42-001-0187AN	LAKE SURPRISE WATEWAYS INC.	12.5	NONE	1988 912
42-001-0188ANG	SANTA FE COMMUNITY COLLEGE	0.41	NONE	1988 7 5
42-001-0188ANGM2	SANTA FE COMMUNITY COLLEGE 3000 N.W. 83RD STREET GAINESVILLE, FL 32601	2.3	GROUND WATER	1992 824
42-001-0188ANGM3	SANTA FE COMMUNITY COLLEGE 3000 N.W. 83RD STREET GAINESVILLE, FL 32601	2.23	GROUND WATER	1993 216
42-001-0188ANGM4	SANTA FE COMMUNITY COLLEGE/DIST. BD. OF TRUSTEES DIST. BOARD OF TRUSTEES GAINESVILLE, FL 32606	0.3	N/A	1994 825
42-001-0188ANM	SANTA FE COMMUNITY COLLEGE			19901120
42-001-0190AN	GARY TAYLOR	0.31	HOGTOWN CREEK	1988 8 5
42-001-0191ANG	ALACHUA COUNTY SCHOOL BOARD 1817 E. UNIVERSITY AVENUE GAINESVILLE, FL 32601	1.68	N/A	1988 713
42-001-0192AN	MOHAMMAD RAJAEE 2358 NW 16TH AVE GAINESVILLE, FL 32605	0.56		1988 816
42-001-0193AN	BARNETT BANK OF ALACHUA COUNTY	3.4	HOGTOWN CREEK	1988 712
42-001-0194AN	JAMES MEEHAN	0.9	HOGTOWN CREEK	1988 823
42-001-0195AN	ARBOR LIVING CENTERS OF FLORIDA, INC.	5.33	LAKE KANAPAHA	1988 725
42-001-0196ANG	SCHOOL BOARD OF ALACHUA COUNTY 1817 EAST UNIVERSITY AVE. GAINESVILLE, FL 32601	15.31	N/A	1988 912
42-001-0197AN	THE ENCHANTED FLORIST, INC. 6815 NEWBERRY ROAD GAINESVILLE, FL 32605	0.03	N/A	1988 8 2
42-001-0198AN	LOUIS L. HUNTLEY	2.93		19881024
42-001-0199AN	MENTAL HEALTH SERVICES, INC.	12.5	NONE	1988 912
42-001-0200AN	COMMERCE GROUP	0.82	HOGTOWN CREEK	1988 916

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0201ANG	ALACHUA COUNTY SCHOOL BOARD	0.43		1988 916
42-001-0202AN	EDUCATIONAL CREDIT UNION	2		19881020
42-001-0204AN	HAUFLER BROTHERS 3700 NW 91ST ST. GAINESVILLE, FL 32605		HOGSTOWN CREEK	198810 6
42-001-0205ANG	SCHOOL BOARD OF ALACHUA COUNTY	0.465	SPRINGSTEAD CREEK	1988 926
42-001-0205ANGM	ALACHUA COUNTY SCHOOL BOARD	0.465	NONE	1989 418
42-001-0206ANG	FLORIDA DEPARTMENT OF CORRECTIONS	11	NEWMAN'S LAKE	1988 929
42-001-0207AN	FIRST GAINESVILLE CORPORATION		HOGSTOWN CREEK	198811 9
42-001-0208AN	WILLIAM CHARLES WORLEY P.O. BOX 915 HAWTHORNE, FL 32640	2.694	JOHNSON LAKE VIA F.D.O.T. DRAINAGE DITCH	198810 6
42-001-0208ANM	DEBORAH WORLEY POST OFFICE BOX 1764 HAWTHORNE, FL 32640	1.46	GROUNDWATER	1993 929
42-001-0209ANG	FLORIDA DEPARTMENT OF TRANSPORTATION	28.8	LAKE KANAPAHA	19881014
42-001-0210AN	PATRICIA RIDAUGHT		JOHNSON LAKE	19881020
42-001-0211AN	NORTH FLORIDA REGIONAL MEDICAL CENTER	7.1	DOT SYSTEM	198912 8
42-001-0211ANM	NORTH FLORIDA REGIONAL MEDICAL CENTER P.O. BOX NFR GAINESVILLE, FL 32602			198912 8
42-001-0211ANM2	HCA HEALTH SERV OF FL DBA N FL REGIONAL MED CTR. ATTN: TODD GALLATI P. O. BOX 147006 GAINESVILLE, FL 32614-700	14.71	ON-SITE EXISTING RETENTION POND	1995 216
42-001-0212AN	KINGDOM HALL OF JEHOVAH'S WITNESSES		SWEETWATER BRANCH	19881024
42-001-0213AN	MARVIN GRESHAM 7326 SW 17TH PL GAINESVILLE, FL 32607		HOGTOWN CREEK	198811 9
42-001-0214AN	HAUFLER BROTHERS	1.76		19881214
42-001-0214ANMJ	SPRINGHILL OWNERS ASSOC.,INC. 3700 A-100 NW 91ST ST. GAINESVILLE, FL 32606	22.9	GROUND WATER	1991 820
42-001-0215AN	LIL CHAMP FOOD STORES	0.886	NONE	198812 1

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0216AN	FLORIDA COCA COLA BOTTLING COMPANY	7.88		1989 427
42-001-0216ANM	FLORIDA COCA-COLA BOTTLING CO. 3350 PEMBROKE RD. HOLLYWOOD, FL 33021	7.91	N/A	1994 624
42-001-0217AN	KRISPY KREME DOUGHNUT CORP.			19881026
42-001-0218AN	DR. S. H. WEST	36.5		19881221
42-001-0219AN	JULIE JOHNSON	0.32	HOGTOWN CREEK	19881220
42-001-0220AN	SOUTH GEORGIA GROCERY CO. P.O. BOX 311 QUITMAN, GA 31643	0.54	N/A	198812 1
42-001-0221AN	CAM DINH LE	0.015		19881214
42-001-0222AN	NORMA WARD 2131 NW 6TH ST. GAINESVILLE, FL 32609	0.87	UNKNOWN	1989 5 2
42-001-0223AN	SOUTHEASTERN HEALTHCARE	0.29	NONE	19881221
42-001-0224AI	AARON TURNER	5	NONE	1989 3 6
42-001-0225AN	KBN ENGINEERING AND APPLIES SCIENCE, INC.		PARK AVENUE FACILITY	1989 119
42-001-0226AN	FIRST BAPTIST CHURCH, HAWTHORNE, FL 32640	0.36	NONE	1989 315
42-001-0227AN	REV. JAMES W. BRANTLEY 2214 N.E. 16TH TERR. GAINESVILLE, FL 32609	3.41	N/A	1989 2 2
42-001-0227ANM	CHURCH OF GOD 7003 N.W. 39TH AVE. GAINESVILLE, FL 32606	0	N/A	1994 926
42-001-0228AN	JAMES MEEHAN 7326 SW 17TH PL. GAINESVILLE, FL 32607	2.96	HOGTOWN	1989 127
42-001-0229AN	JAMES MEEHAN 7326 SW 17TH PL. GAINESVILLE, FL 32607	1.14	HOGTOWN CREEK	1989 127
42-001-0231AN	CROM CORPORATION 250 SW 36TH TERRACE GAINESVILLE, FL 32607	24.75	N/A	1989 2 2
42-001-0232AN	W.C. QUILLEN	0.46	N/A	1989 330
42-001-0234ANG	CITY OF GAINSEVILLE, DEPT. OF RECREATION & PARKS	14.67	CALF POND	1989 223

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0235ANG	ALACHUA COUNTY HOUSING AUTHORITY 636 N.E. 1ST STREET GAINESVILLE, FL 32601	0.56	NONE	1989 330
42-001-0236ANG	GAINESVILLE HOUSING AUTHORITY	0.567		1989 310
42-001-0237ANG	MILLHOPPER MONTESSORI SCHOOL INC.	4.95	NONE	1989 315
42-001-0237ANM	CHRISTINA J. MILLER 8505 N.W. 39TH AVENUE GAINESVILLE, FL 32606	4.954		1991 8 1
42-001-0238AN	RNI, INC. RT. 1 BOX 3100 GAINESVILLE, FL 32609	1.4	NE 55TH PLACE ROADSIDE SWALE	1989 519
42-001-0239AN	EMMER DEVELOPMENT CORP. ATTN. PHILLIP EMMER GAINESVILLE, FL 32608	18.5	HOGTOWN CREEK	1989 315
42-001-0240ANG	FLORIDA DEPARTMENT OF TRANSPORTATION P.O.BOX 1089 LAKE CITY, FL 32056	11.8	PRINCE STRAPTURE/MONTER EY CREEK	1989 6 2
42-001-0241ANG	FLORIDA DEPARTMENT OF TRANSPORTATION	10.9	HOGTOWN CREEK	1989 323
42-001-0241ANGM	FLORIDA DEPARTMENT OF TRANSPORTATION P O BOX 1089 LAKE CITY, FL 32056	9.25	HOGTOWN CREEK	1992 7 2
42-001-0242AN	DR. WILLIAM MARTIN	0.47	NONE	1989 330
42-001-0242ANM	DR. WILLIAM MARTIN 2841 NW 41ST STREET GAINESVILLE, FL 32606	0.47	COUNTY STORMWATER SYSTEM	1990 523
42-001-0243AN	PARKVIEW	1.73		1989 4 4
42-001-0243ANM	PARKVIEW BAPTIST CHURCH 3403 NW 13TH STREET GAINESVILLE, FL 32609	1.8	HOGTOWN CREEK	19901017
42-001-0244AN	SQUIOERI ASSOCIATES	0.6		1989 330
42-001-0244ANM	SQUITIERI ASSOCIATES P.O.BOX 8009 GAINESVILLE, FL 32605	1.14		1989 616
42-001-0245AN	BOARDWALK HOMEOWNERS ASSOCIATION	6.37	HOGTOWN CREEK	1989 4 4
42-001-0246AN	SIGNATURE PROPERTIES	1.2	HOGTOIWN CREEK	1989 6 2
42-001-0247AN	KAD PARTNERSHIP	1.2	HOGTOWN CREEK	1989 418

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0248AN	MARK & MARY BARROW	0.32		1989 330
42-001-0249AN	THOMAS OIL COMPANY P.O. BOX 5006 GAINESVILLE, FL 32602	1.2	HOGTOWN CREEK	1989 313
42-001-0250AN	DEL AMERICAN PROPERTIES	21.78	NONE	1989 427
42-001-0251AN	LYNN MUELLER 6630 NW 30TH TERRACE GAINESVILLE, FL 32606	0.06	NONE	1989 418
42-001-0252ANG	CITY OF GAINESVILLE	2.05	HOGTOWN CREEK	1989 427
42-001-0253AN	NEIGHBORHOOD HOUSING SERVICES OF GAINESVILLE+B911	0.06	NONE	1989 824
42-001-0254AN	SYSTEMS DYNAMICS, INC. 1211 NW 10TH AVENUE GAINESVILLE, FL 32602	5	NATURAL DEPRESSIONS	1989 622
42-001-0255ANG	ALACHUA COUNTY SCHOOL BOARD 1817 E. UNIVERSITY AVENUE GAINESVILLE, FL 32601	0.38	NONE	1989 5 2
42-001-0256AN	GEORGE DEFFENGAUGH, MARVIN FULGHAM 2505 NW 6TH STREET GAINESVILLE, FL 32609			
42-001-0257AN	TEMPLE SHIR SHALOM 3855 N.W. 8TH AVENUE GAINESVILLE, FL 32605	0.79	N/A	1989 711
42-001-0258AN	R.A. MCKELLIPS ASSICOCIATES 1705 N.W. 6TH STREET GAINESVILLE, FL 32601	0.69	N/A	1989 6 2
42-001-0259AN	SOUTHERN BELL TELEPHONE & TELEGRAPH COMPANY 10KK1 SOUTHERN BELL TOWER 301 WEST BAY STREET JACKSONVILLE, FL 32202	0.27	NONE	1989 614
42-001-0260AN	WAL-MART STORES, INC. MITCHELL BUILDING 701 SOUTH WALTON BLVD BENTONVILLE, AR 72716	22.018	HOGTOWN CREEK	1989 614
42-001-0261AN	CONTEMPORARY MANAGEMENT 8 NW 16TH AVE GAINESVILLE, FL 32602	1	SWEETWATER BRANCH	1989 616
42-001-0263AN	STEVE BUGAN 821 NW 13 TH STREET GAINESVILLE, FL 32602	0.48	HOGTOWN CREEK	1989 616
42-001-0264AN	SOUTHEAST CAR RENTAL 3400 NE 39TH AVE GAINESVILLE, FL 32607			
42-001-0265AN	JAMES MEEHAN 7326 SW 17TH PLACE GAINESVILLE, FL 32607	1.4	HOGTOWN CREEK	1989 629

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APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0266AN	ACCOUNTING PUBLICATIONS INC. POST OFFICE BOX 12848 GAINESVILLE, FL 32604	0.95	NONE	1989 616
42-001-0267AN	MARATHON PETROLEUM COMPANY 3446 PARKWAY CENTER COURT ORLANDO, FL 32808	1.163	NONE	1989 719
42-001-0268AN	GAINESVILLE REGIONAL UTILITIES ATTN: PATRICIA MOORE GAINESVILLE, FL 32602	4.38	SWEETWATER BRANCH	1989 719
42-001-0269ANG	SCHOOL BOARD OF ALACHUA COUNTY 620 EAST UNIVERSITY AVE GAINESVILLE, FL 32601	2.26	NEWMANS LAKE	1989 8 1
42-001-0270AN	SANTA FE HEALTHCARE SYSTEMS INC. 606 S.W. 3RD AVE. SUITE 1 GAINESVILLE, FL 32601	0.88	N/A	1989 711
42-001-0271AN	SYNERGY GAS CORPORATION 3916 DUNAIRE DR. VAIRICO, FL 33594	2	POTATOE PATCH BAY	1989 719
42-001-0272AN	ALSAX CORPORATION DBA ALMOND OIL COMPANY P.O.BOX 1045 GAINESVILLE, FL 32608	1	NONE	1989 719
42-001-0273AN	SILVIO PANONE 8909 SW 8 TH AVE GAINESVILLE, FL 32607	0.57	NONE	1989 8 1
42-001-0274AN	METAL CONTAINER CORPORATION 5909 NORTHWEST 18TH DRIVE GAINESVILLE, FL 32606	0.62	N/A	1989 719
42-001-0274ANM	METAL CONTAINER CORPORATION 5909 NORTHWEST 18TH DRIVE GAINESVILLE, FL 32606	2.1	POTATOE PATCH BAY	1991 313
42-001-0274ANM2	METAL CONTAINER CORPORATION 5909 NORTHWEST 18TH DRIVE GAINESVILLE, FL 32606	2.1	POTATOE PATCH BAY VIA EXISTING DRAINAGE DITCH	1991 5 9
42-001-0275AN	EDGEWOOD PROPERTY VENTURE P.O. DRAWER 1710 PALATKA, FL 32078	14.05	NONE	1989 9 5
42-001-0276AN	JOHN SUNG POST OFFICE BOX 14347 GAINESVILLE, FL 32604	1.06		1989 8 1
42-001-0277AN	FRED LEWIS 4488 N.W. 6TH STR GAINESVILLE, FL 32609	1.31		198910 9
42-001-0279AN	FORTE HABITAT 333 W FORSYTH ST. JACKSONVILLE, FL 32202	23.996	HOGTOWN CREEK	1990 111

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0279ANM	CAMPUS-GREEN GAINESVILLE, LTD SUITE 420 4190 BELFORD ROAD JACKSONVILLE, FL 32216	23.996	HOGTOWN PRAIRIE	1992 220
42-001-0280AN	ROBINSON SHORE, INC. 6910 W UNIVERSITY AVE. SUITE D GAINESVILLE, FL 32607	24.5	HOGTOWN CREEK	1989 921
42-001-0281AN	ROBERT KAPLAN STEIN 13429 NW 32ND PLACE GAINESVILLE, FL 32601	0.676	SWALE TO COUNTY EASEMENT	198910 9
42-001-0282ANG	SANTA FE COMMUNITY COLLEGE 3000 N.W. 83RD STREET GAINESVILLE, FL 32606	1.75		19891110
42-001-0283ANG	CITY OF HAWTHORNE, FL 32640 102 N JOHNSON STREET HAWTHORNE, FL 32640	0.8	LAKE LOCHLOOSA	1989 921
42-001-0284ANG	CITY OF GAINESVILLE ATTN: ROLAND E. DAVIS GAINESVILLE, FL 32602	2.31	PAYNES PRAIRIE	19891127
42-001-0286AN	KOPPERS INDUSTRIES ATTN: NORMAN L. HAWKER P.O. BOX 1067 GAINESVILLE, FL 32602	0.33	HOGTOWN CREEK	19891227
42-001-0287AN	THOMAS AND SARAH SINGLETON 625-C N.W. 60TH STREET GAINESVILLE, FL 32607	0.39	SWEETWATER BRANCH	198910 9
42-001-0288AN	DAVIS REMBERT 2720 N.E. 20TH WAY GAINESVILLE, FL 32602	0.6	SWEETWATER BRANCH	19891110
42-001-0289AN	GATEWARD LIMITED PARTNERSHIP 2269 SOUTH UNIVERSITY DR, SUITE 226 DAVIE, FL 32324	6.38		198910 9
42-001-0290AN	AUDLEY HARRIS 6705 SW 35TH WAY GAINESVILLE, FL 32608	1.8	COUNTY MASTER DRAINAGE	1990 111
42-001-0291AN	DAY SPRINGS MISSIONARY BAPTIST CHURCH 1945 NE 8TH AVENUE GAINESVILLE, FL 32601	0.27	NE 8TH AVENUE	19891212
42-001-0292ANG	ALACHUA COUNTY BOARD OF COUNTY COMMISSIONERS P.O. BOX CC GAINESVILLE, FL 32602	2.31	HOGSTOWN PRAIARE	19891110
42-001-0293AN	ALACHUA COUNTY LIBRARY DISTRICT 222 E UNIVERSITY AVENUE GAINESVILLE, FL 32601	0.34	JOHNSON LAKE	19891212

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0294ANG	ALACHUA COUNTY SCHOOL BOARD 620 EAST UNIVERSITY AVE GAINESVILLE, FL 32601	7.5	NEWMANS LAKE	19891110
42-001-0295AN	CHURCH OF GOD BY FAITH, INC. 135 S.E. 15TH ST. P.O. BOX 121 GAINESVILLE, FL 32601			
42-001-0296AN	ROBINSHORE, INC. 6910 W UNIVERSITY AVE SUITE D GAINESVILLE, FL 32607	13.74	HOGTOWN CREEK	19891127
42-001-0296ANM	ROBINSHORE, INC. 6910 W UNIVERSITY AVE. SUITE D GAINESVILLE, FL 32607	13	HOGTOWN CREEK	1992 511
42-001-0297AN	EDWIN AND THOMAS KIRBY 111 S HARBOUR DR NOBLESVILLE, IN 46060	1	NONE	19891212
42-001-0298AN	BARRY BULLARD 5200 NEW BERRY RD SUITE B-3 GAINESVILLE, FL 32607	0.68	SW 75TH	19891127
42-001-0299AN	P.C.R., INC. P.O. BOX 1466 GAINESVILLE, FL 32602			
42-001-0300AN	CRUISIN CARS 4324 NW 30TH TERR. GAINESVILLE, FL 32605	1.5	POTATO PATCH BAY	1990 110
42-001-0301AN	JAMES MEEHAN 7326 SW 17T PLACE GAINESVILLE, FL 32607	1.4	HOGTOWN CREEK	198912 8
42-001-0302AN	EMPIRE OF AMERICA FEDERAL SAVINGS BANK 1 EMPIRE TOWER BUFFALO, NY 14008	0.32	CITY STORM SYSTEM	198912 8
42-001-0304AN	WILLIAM GATSON 6701 NW 19TH PL GAINESVILLE, FL 32606	2.38	N/A	1990 130
42-001-0305AN	TERRY CUMMINGS 6322 NW 26TH PL GAINESVILLE, FL 32606	0.64	BIVANS ARM	19891219
42-001-0306AN	LOWES COMPANIES, INC. ATTN: MITCHELL FRANKLIN HWY 268 EAST, BOX 1111 N WILKESBORO, NC 28656	5.87	L. HATCHET CREEK	1990 129
42-001-0307AN	P•.C.R., INC. P.O. BOX 1466 GAINESVILLE, FL 32602	19	GUM ROOT SWAMP	1990 523
42-001-0307ANM	P. C. R., INC. P O BOX 1466 GAINESVILLE, FL 32602	19	GROUNDWATER	19911223
42-001-0307ANM2	PCR, INCORPORATED P. O. BOX 1466 GAINESVILLE, FL 32601	19		1993 712

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0309AN	SCOTTY'S INC. P.O. BOX 939 WINTER HAVEN, FL 33882	1.49	HOGTOWN CREEK	1990 118
42-001-0310AN	MANANANTHA CHRISTIAN CHURCH C/O JAMES MEEHAN 7326 SW 17TH PL GAINESVILLE, FL 32607	2.45	HOGTOWN CREEK	1990 227
42-001-0310ANM	JAMES MEEHAN 7376 SW 17TH PL 5816 NW 27TH TERRACE GAINESVILLE, FL 32606	1.35	HOGTOWN CREEK	19911122
42-001-0311AN	K.A.D. C/O JAMES MEEHAN 7326 SW 17TH PL GAINESVILLE, FL 32607	1.66	HOGTOWN CREEK	1990 4 3
42-001-0312AN	DYANN L. VORSTEG P.O. BOX 393 ORANGE SPRINGS, FL 32182	0	N/A	1990 1 3
42-001-0313AN	GAINESVILLE OTOLARYNGOLOTY GROUP 6800 NW 9TH BLVD, SUITE 1 GAINESVILLE, FL 32605	0.82	N. FLORIDA HOSPITAL DEPRESSION	1990 2 2
42-001-0314AN	R. JAMES GLIKES 1221 NW 13TH STREET GAINESVILLE, FL 32601	3.87	8TH AVE. STORM SEWER - EVENTUALLY HOG	1990 1 3
42-001-0315AN	UNITED CHURCH OF GAINESVILLE - REIMER, PASTOR ATTN: LAWRENCE D. REIMER 1624 NW 5TH AVE GAINESVILLE, FL 32603	2.28	CITY STORM SEWER	1990 2 2
42-001-0316ANG	ALACHUA COUNTY BOARD OF COUNTY COMMISSIONERS P.O. DRAWER CC GAINESVILLE, FL 32602	0.6	COUNTY MASTER DRAINAGE SYSTEM	1990 111
42-001-0317AN	MENTAL HEALTH SERVICES INC. OF NORTH CENTRAL FL 4300 SW 13 ST GAINESVILLE, FL 32608	12.96		1990 2 1
42-001-0318AN	MICHAEL LEMIEUX 5901 NE WALDO RD GAINESVILLE, FL 32609	0.8	NEWMAN'S LAKE	1990 2 5
42-001-0319AN	SHELL OIL COMPANY ATTN: GORDON R. CHIZE 4201 W CYPRESS ST TAMPA, FL 33607	1.196	NORTH FLORIDA HOSPITAL LAKE	1990 214
42-001-0321ANG	DEPARTMENT OF CORRECTIONS ATTN: BILL THURBER 1311 WINEWOOD BLVD TALLAHASSEE, FL	0.04	NEWNAN'S LAKE	1990 227
42-001-0322AN	DISCOUNT AUTO PARTS, INC. ATTN: CLIFF WILEY 4900 FRONTAGE RD, SOUTH LAKELAND, FL 33801	0.726	TOWER CENTRE	1990 214

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0323AN	SHELL OIL COMPANY 4201 W CYPRESS ST TAMPA, FL 32610	0.934	HOGTOWN CREEK	1990 215
42-001-0324AN	NONA & CASEY UPSHAW, CHARLES & RAINER PINKOSOM 2320 NW 38TH DR GAINESVILLE, FL 32605	9.34	HOGTOWN CREEK	1990 423
42-001-0324ANM	NONA & CASEY UPSHAW 2320 NW 38TH DR. GAINESVILLE, FL 32605	7.39	HOGTOWN CREEK	1994 822
42-001-0325AN	SUZANNE THIEMS 1204 NW 69TH TERRACE GAINESVILLE, FL 32605	0.68	N/A	1990 517
42-001-0326AN	O'STEEN BROTHERS, INC. 1006 SE 4TH STREET GAINESVILLE, FL 32601		POTATO PATCH BAY	1990 726
42-001-0327AN	HAROLD N. STRINGER 922 NW 36TH DR GAINESVILLE, FL 32607	10.67	DOT SWALE SYSTEM	1990 613
42-001-0328ANG	DEPARTMENT OF GENERAL SERVICES KNIGHT BLDG, SUITE 301 2737 CENTERVIEW DR TALLAHASSEE, FL			1990 3 9
42-001-0329AN	POCAHONTAS FOODSERVICE 4401 NE 53RD RD GAINESVILLE, FL 32609	1.18	HATCHET CREEK	1990 523
42-001-0329ANM	KENNETH O. LESTER CO., INC. 4401 NE 53RD RD. GAINESVILLE, FL 32608	8.19	EXISTNG SWALE IN INDUSTRIAL PARK	1994 712
42-001-0330AN	SCHERER CONSTRUCTION & ENGINEERING ATTN: DOUGLAS WILCOX P.O. BOX 2247 GAINESVILLE, FL 32602	0.64	POTATO PATCH SWAMP	1990 227
42-001-0330ANM	SCHERER CONSTRUCTION & ENG. INC. ATTN: DOUG WILCOX, JR. P. O. BOX 2247 GAINESVILLE, FL 32602	0.38	POTATO PATCH BAY	1992 227
42-001-0331ANG	FLORIDA DEPARTMENT OF AGRICULTURE ATTN: EARL PETERSON PLAZA LEVEL CAPITOL BLDG TALLAHASSEE, FL 32399	5.49	SWEETWATER BRANCH	1990 326
42-001-0332AN	DR. JAY PRAVDA 832 NW 57TH ST. GAINESVILLE, FL 32606	2.39		1990 312
42-001-0333AN	GENE BUSH 2525 NORTH MAIN ST GAINESVILLE, FL 32609	4.7	SPRINGSTEAD CREEK	1990 626

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0334AN	GERALD SWICKERT 9104 SW 81ST WAY GAINESVILLE, FL 32608	0.455	ROSEWOOD BRANCH	1990 523
42-001-0335AN	LARRY W. CALTON 404 SW 4TH AVE GAINESVILLE, FL 32601	0.212	SWEETWATER BRANCH	19901129
42-001-0336AI	ZACH'S LEVEL BUILDERS 1020 NW 23RD AVE GAINESVILLE, FL 32609			1991 611
42-001-0337AN	NAPIER DEVELOPMENT, INC. ATTN: SANDRA SONTAG GAINESVILLE, FL 32606	13.97	BIVANS ARMS	1990 516
42-001-0338AN	PRESTIGE DEVELOPMENT GROUP, INC. 2233 NW 41ST ST, STE 100 GAINESVILLE, FL 32606	1.21	CO. STORWMATER FACILITY	1990 516
42-001-0339AN	SANTA FE HEALTHCARE P.O. BOX 749 GAINESVILLE, FL 32602	36.43	NATURAL DRY DEPRESSIONS - NO SURFACE WATER DRAINS	1990 4 5
42-001-0340AN	D & R RESTAURANTS, INC. 3121 4TH STREET N ST. PETERSBURG, FL 32704	0.3	HOGTOWN CREEK	1990 321
42-001-0340ANM	CHECKERS DRIVE-IN RESTAURANTS ATTN: BARRY L. JENNINGS P. O. BOX 1079 CLEARWATER, FL 436617	0.54	N/A	1993 322
42-001-0341ANK	CHECKERS DRIVE-IN RESTAURANTS, INC. P. O. BOX 1079 CLEARWATER, FL 436617	0		1990 522
42-001-0341ANM	CHECKERS DRIVE-IN RESTAURANTS ATTN: BARRY L. JENNINGS P. O. BOX 1079 CLEARWATER, FL 436617	0.54	SWEETWATER BRANCH	1993 323
42-001-0342ANG	CITY OF GAINESVILLE P.O. BOX 490 GAINESVILLE, FL 32602	0.91	HOGTOWN CREEK	1990 523
42-001-0343AN	GILLEN BROADCASTING CORPORATION 1035 NW 60TH ST GAINESVILLE, FL 32605	5.06	24TH AVE.	1990 423
42-001-0344AN	LAKE FOREST BAPTIST CHURCH 5121 E UNIVERSITY AVE GAINESVILLE, FL 32601	1.3		1990 724
42-001-0345ANG	ALACHUA COUNTY SCHOOL BOARD ATTN: TERRY TOUGAW 1817 E UNIVERSITY AVE GAINESVILLE, FL 32601	0.12	CITY STORM SYSTEM	1990 6 4

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0346AN	DR. MICHAEL J. & LUCY C. AGUIRRE 3540 NW 30TH BLVD GAINESVILLE, FL 32605	0.46	CITY SYSTEM	1990 614
42-001-0347AN	MICHAEL RYALS 3620 NW 43RD ST GAINESVILLE, FL 32606	0.78	HOGTOWN CREEK	1990 5 2
42-001-0348AN	HUGHES ENERGY ATTN: ROGER COMBS P.O. BOX 1566 DAYTONA BEACH, FL 32015	1.59	I-75 DOT SYSTEM	1990 5 4
42-001-0350AI	ERB & ROBERTS, INC. P.O. BOX 657 2383 SW ARCHER RD GAINESVILLE, FL 32611	5		1991 618
42-001-0351AN	ROBINSHORE, INC. 6910 W UNIVERSITY AVE SUITE D GAINESVILLE, FL 32607	28.08	SEASONAL POND ON SITE TO BASIN SOUTH OF NW 39	1990 717
42-001-0353AN	FIRST UNION NATIONAL BANK ATTN: JOHN BOTTARO 6737 SOUTHPOINT DRIVE S. JACKSONVILLE, FL 32216	1.7	OAKS MALL STORMWATER SYSTEM	1990 6 4
42-001-0354ANG	SCHOOL BOARD OF ALACHUA COUNTY ATTN: TERRY TOUGAW 1817 EAST UNIVERSITY AVE. GAINESVILLE, FL 32601			
42-001-0355AN	EDWARD R. BIELLING P. O. BOX 1988 HAWTHORNE, FL 32640	0.22	JOHNSON LAKE	1990 523
42-001-0356ANG	CITY OF HAWTHORNE, FL 32640 P. O. BOX 1270 HAWTHORNE, FL 32640	2.1	ORANGE CREEK	1990 724
42-001-0357AN	JOHN FITZWATER P. O. DRAWER A GAINESVILLE, FL 32602	0.21	BIVENS ARMS	1990 613
42-001-0358AN	UNITED GAINESVILLE COMMUNITY DEVELOPMENT CORP. 1031 N.W. 6TH STREET P. O. BOX 2518 STE B-1 GAINESVILLE, FL 32602	4.334	BIVANS ARMS/TUMBLIN CREEK	1990 7 2
42-001-0359AN	SCHOOL BOARD OF ALACHUA COUNTY 1817 EAST UNIV. AVE. GAINESVILLE, FL 32601	2.5	N/A	1990 626
42-001-0360AN	LAPETITE ACADEMY, INC. 10TH FLOOR CITY CENTER SQ 12TH AND BALTIMORE KANSAS CITY, MO 64196	1	BIVENS ARM	1990 717
42-001-0361ANG	CITY OF HAWTHORNE, FL 32640 P. O. BOX 1270 HAWTHORNE, FL 32640	1	JOHNSON LAKE	1990 613

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0362AN	STAN LIDDELL 1228 S. MAIN STREET GAINESVILLE, FL 32602	0.62	ON SITE RETENTION AND TO SW 42ND WAYSTORMDRAIN	1990 717
42-001-0363AN	LIL' CHAMP FOOD STORES, INC. P. O. BOX 898 JACKSONVILLE, FL 32211	3.43	GROUNDWATER	1990 626
42-001-0365AN	ANDREW KAPLAN P. O. BOX 13893 GAINESVILLE, FL 32605	1.75	NORTHWEST 16TH AVENUE	1990 8 3
42-001-0366AN	WELLNESS, INC. P. O. BOX 749 GAINESVILLE, FL 32602	1.1	ON SITE DISCHARGE	1990 717
42-001-0367AN	CITY OF GAINESVILLE EMPLOYEES CREDIT UNION 412 E. UNIVERSITY AVENUE GAINESVILLE, FL 32601	0.77	SWEETWATER BRANCH	1990 8 1
42-001-0368AN	JAMES MEEHAN 7326 SW 17TH PLACE GAINESVILLE, FL 32607	0.72	TUMBLIN CREEK	1990 8 3
42-001-0369AN	DISCOUNT AUTO PARTS P. O. BOX 3647 LAKELAND, FL 33802	0.89		1990 718
42-001-0372AN	STATE FARM INSURANCE COMPANIES ONE STATE FARM PLAZA BLOOMINGTON, IL 61710	2.019	TOWER ROAD SURFACE WATER SYSTEM	1990 7 2
42-001-0373AN	BLUM, SCHUMACHER AND ASSOCIATES INC. 1204 NW 13TH ST. GAINESVILLE, FL 32605	10.75	HOGTOWN CREEK	1990 717
42-001-0374AN	MCDONALD'S CORP. 4830 W. KENNEDY BLVD. SUITE 395 TAMPA, FL 32610	0.66	GUILLE STORM SYSTEM	1990 8 1
42-001-0375AN	PEARL OF MICANOPY RT. 2 BOX 38 MICANOPY, FL 32667	1.25	MILL POND/HOG POND	1991 5 3
42-001-0377AN	K.A.D. PARTNERSHIP ATTN: JAMES MEEHAN 7326 SW 17TH PLACE GAINESVILLE, FL 32607	1.95	HOGTOWN CREEK	19901228
42-001-0378ANG	ALACHUA COUNTY BOARD OF COUNTY COMMISSIONERS P.O. BOX 1467 GAINESVILLE, FL 32602	4		1990 917
42-001-0379AN	WELLNESS, INC. P.O. BOX 749 GAINESVILLE, FL 32602	1.025	CITY OF GAINESVILLE STORMDRAIN SYSTEM	19901112

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0380AN	PKSAGI CORP. 1010 DREW STREET CLEARWATER, FL 34615	0.691	TUM BLIN CREEK	199010 5
42-001-0381AN	SCOTT SLOAN 232 STADIUM ROAD GAINESVILLE, FL 32611	1.7	DETENTION AREA THEN TO DITCH DISCHARGES BIVENS ARM	1990 918
42-001-0382AN	N. FLORIDA REGIONAL FREESTANDING SURGERY CENTER LP POST OFFICE BOX 550 NASHVILLE, TN 37202	2.63	GROUNDWATER	1990 830
42-001-0383ANG	REGIONAL TRANSIT SYSTEMS C/O CITY OF GAINESVILLE GAINESVILLE, FL 32601	3.8	SWEETWATER BRANCH	19901011
42-001-0383ANGM	REGIONAL TRANSIT SYSTEM, CITY OF GAINESVILLE 100 S.E. 10TH AVE. GAINESVILLE, FL 32601	1.54	CITY OF GAINESVILLE STORM SEWER	1994 317
42-001-0384AN	BLUM, SCHUMACHER AND ASSOC. INC. 2444 NE 1ST BLVD. STE 800 GAINESVILLE, FL 32609	0.4	GROUNDWATER	1990 920
42-001-0385ANM	JAMES MEEHAN 7326 S.W. 17TH PLACE GAINESVILLE, FL 32607	0.6	L. HATCHET CREEK	1992 430
42-001-0386AN	JAMES MEEHAN 7326 SW 17TH PLACE GAINESVILLE, FL 32607	1.73	HOGTOWN CREEK	199011 1
42-001-0387AN	LIL CHAMP FOOD STORES 9 ACME STREET JACKSONVILLE, FL 322111	0.82	DOT SYSTEM	199010 1
42-001-0389ANG	MOORE MAY GRAHAM POOLE/ ARCHITECTS INC. 21 EAST UNIVERSITY AVE. GAINESVILLE, FL 32601	0.75	NEWNANS LAKE VIA A UNAMED DITCH AND A WETLAND	1992 612
42-001-0391AN	MIKE VOZNICK 3841-C KILLEARN COURT TALLAHASSEE, FL 32308		N/A	19901017
42-001-0392AN	ELVIN KELSEY 1334 NW 4TH AVE. GAINESVILLE, FL 32601	0.42	N/A	19901017
42-001-0393AN	DR. MICHAEL SCHOEFFEL % SAND DOLLAR CONDO. HIGHWAY A1A SOUTH CRESCENT BEACH, FL 32085	14.33	GROUND WATER	1991 4 2
42-001-0394AN	SOUTHERN SCHOLARSHIP FOUNDATION JOSEPH B. MIZERECK 322 STADIUM DR. TALLAHASSEE, FL 32304	0.86	LAKE ALICE	1991 227

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0394ANM	SOUTHERN SCHOLARSHIP FOUNDATION, INC. ATTN: JOSEPH B MIZERECK 322 STADIUM DR. TALLAHASSEE, FL 32399	0.86	LAKE ALICE	1993 325
42-001-0395ANG	STATE OF FLORIDA DEPARTMENT OF CORRECTIONS 2601 BLAIRSTONE ROAD TALLAHASSEE, FL 32995	21.694	N/A	19901127
42-001-0397AN	PHIL HUMPHREY 2508 NORTH 4TH STREET BLUE SPRINGS, MO 64014	0.363	PAYNES PRAIRIE VIA ABANDONED JG&G RR SYSTEM	1991 5 1
42-001-0398ANG	ALACHUA COUNTY LIBRARY DISTRICT 222 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	6.13	HOGTOWN PRARIE	19901210
42-001-0399ANG	FACILITIES MANAGER TO ALACHUA COUNTY P.O. BOX 1467 GAINESVILLE, FL 32602	5.9	GROUNDWATER	19901220
42-001-0400AN	EDWIN CULPEPPER RT3 BOX 130 ALACHUA, FL 32615	0.57	GROUNDWATER	19901217
42-001-0401AN	SOUTHERN BELL TELEPHONE AND TELEGRAPH CO. ATTN: DAVID FOUNTAIN 10KK1 SBT 301 W. BAY ST JACKSONVILLE, FL 32201	0.12	HOGTOWN CREEK	1991 215
42-001-0402AI	PCR, INCORPORATED ATTN: WARREN MCCLAIN P.O. BOX 1466 GAINESVILLE, FL 32602	7	N/A	1991 311
42-001-0403AN	FLOURNEY DEVELOPMENT CO. P.O. BOX 6566 COLUMBUS, GA 31995	5.94	NATURAL CLOSED RETENTION BASINS (DEPRESSIONS)	1991 123
42-001-0404AN	BARNETT BANK 250 SOUTH PARK AVE. WINTER PARK, FL 32789	0.052	GROUND WATER	1991 226
42-001-0405AN	FREDERICK HENDERSON 3501 SOUTH MAIN ST STE 1 GAINESVILLE, FL 32601	1.633	COLCLOUGH POND	1991 116
42-001-0406ANG	SCHOOL BOARD OF ALACHUA COUNTY ATTN. TERRY TOUGAW 1817 E UNIVERSITY AVE. GAINESVILLE, FL 32601	15	N/A	1991 426
42-001-0406ANGM	SCHOOL BOARD OF ALACHUA COUNTY ATTN: TERRY TOUGAW 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	15	UNNAMED DRAINAGE DITCH	1993 9 2
42-001-0407AN	MARATHON PETROLEUM COMPANY ATTN: HENRY ENDRIZZI 3446 PARKWAY CENTER CRT ORLANDO, FL 32808	1.82	HOGTOWN CREEK	1991 128

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0408AN	COLLEGE PARK PROPERTIES 334 NW 17TH STREET GAINESVILLE, FL 32603	1.51	GROUND WATER	1991 131
42-001-0409AN	JAMES MEEHAN 7326 SW 17TH PLACE GAINESVILLE, FL 32607	0.29	HOGTOWN CREEK	1991 2 5
42-001-0410AN	GARY WESEMAN BUILDER, INC. 3501 NW 39TH AVENUE GAINESVILLE, FL 32605	15.98		1991 219
42-001-0410ANM	GARY WESEMAN 3501 NW 39TH AVE. GAINESVILLE, FL 32605	9	GROUND WATER	1993 6 4
42-001-0411AN	JAMES MEEHAN 4129 NW 10TH ST. GAINESVILLE, FL 32609	0.44	SWEETWATER BRANCH	1991 227
42-001-0412AN	JAMES MEEHAN 7326 SW 17TH PLACE GAINESVILLE, FL 32607	0.33	HOGTOWN CREEK	1991 410
42-001-0413ANG	ALACHUA COUNTY COMMISSION ATTN: TERESA SCOTT P. O. BOX F F GAINESVILLE, FL 32605	21.51	GROUND WATER	1991 326
42-001-0414AN	JAMES MEEHAN 7326 SW 17TH AVE. GAINESVILLE, FL 32607	0.82	L. HATCHET CREEK	1991 416
42-001-0415AN	TREND MANAGEMENT OF GAINESVILLE 1204 N W 13TH STREET GAINESVILLE, FL 32605	0.25	GROUND WATER	1991 524
42-001-0416AN	JAMES B. DESTEPHENS 3601 SW 2ND AVENUE GAINESVILLE, FL 32607	0.686	HOGTOWN CREEK	1991 627
42-001-0418AN	DISCOUNT AUTO PARTS 4900 FRONTAGE ROAD, SOUTH P. O. BOX 3647 LAKELAND, FL 33802	0.54	SWEETWATER BRANCH	1991 619
42-001-0419ANG	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	12.04	LAKE FOREST CREEK VIA SE 43RD ST.	1991 7 3
42-001-0420AN	KOBLAR CONSTRUCTORS & ENGINEERS 2009 NW 67TH PLACE GAINESVILLE, FL 32606	4.36	GROUND WATER	1991 923
42-001-0420ANM	KOBLAR CONSTRUCTORS & ENGINEERS 2009 NW 67TH PLACE GAINESVILLE, FL 32606	1.03	POTATO PATCH BAY	19921123
42-001-0421AN	C. L. BRICE DAVID M. MILLER 6500 S. W. ARCHER ROAD GAINESVILLE, FL 32608	0.46	NONE	1991 916

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0422AN	JAMES MEEHAN 7326 SW 17TH PLACE ATTN: JAMES MEEHAN GAINESVILLE, FL 32607	2.16	HATCHETT CREEK	1991 820
42-001-0423AN	J.W. TIPTON 4131 NW 6TH STREET GAINESVILLE, FL 32609	0.62	N/A	1991 820
42-001-0424AN	OOO, INC. P. O. BOX 5816 GAINESVILLE, FL 32602	7.18	GROUND WATER	1992 527
42-001-0425AN	MATHESON HISTORICAL CENTER, INC. 810 EAST UNIVERSITY AVE. GAINESVILLE, FL 32601	0.2	SWEETWATER	1991 725
42-001-0426AN	UNITY OF GAINESVILLE P. O. BOX 7004 GAINESVILLE, FL 32605	5.002	N/A	1991 830
42-001-0427AN	ROBERT SAUNDERS 4100 NW 39TH AVENUE GAINESVILLE, FL 32606	2.44	N/A	1991 826
42-001-0428AN	ARTHUR P. SULLIVAN 1749 SW COLLEGE ROAD OCALA, FL 32674	2.9	HOGTOWN CREEK	1991 926
42-001-0429AN	HARRY BECKWITH RT 2, BOX 170 MICANOPY, FL 32667	0.47	GROUND WATER	1991 920
42-001-0430ANG	ALACHUA COUNTY PUBLIC WORKS ATTN: EDWIN E CULPEPPER P O BOX FF GAINESVILLE, FL 32602	11	UNNAMED ISOLATED WETLAND	1991 923
42-001-0431AN	EMMER DEVELOPMENT CORP. & EMMER SUPPLY CORP. 5006 SW 41ST BLVD. GAINESVILLE, FL 32605	6.16	HOGTOWN CREEK	1992 3 4
42-001-0432ANG	ED CULPEPPER P. O. BOX FF GAINESVILLE, FL 32602	22.95	GROUND WATER	1991 820
42-001-0433AN	KBN ENGINEERING & APPLIED SCIENCES, INC. 1034 NW 57TH STREET GAINESVILLE, FL 32604	0.75	HOGTOWN CREEK	1991 926
42-001-0434ANG	SCHOOL BOARD OF ALACHUA COUNTY 620 EAST UNIVERSITY AVE. GAINESVILLE, FL 32601	13.16	HOGTOWN CREEK	1991 9 9
42-001-0435AN	BOYS' CLUB OF ALACHUA COUNTY, INC. 1731 NW 6TH STREET GAINESVILLE, FL 32609	10.5	NONE	1991 912
42-001-0436AN	WELLNESS, INC. 720 SW 2ND AVENUE GAINESVILLE, FL 32602	5.25	TUMBLIN CREEK	19911010
42-001-0436ANM	WELLNESS, INC. ATTN: TIM REARICK 720 SW 2ND AVE. GAINESVILLE, FL 32601	0.79	TUMBLIN CREEK	199412 7

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0437AN	PEP BOYS AL MELORO, SITE DEV. DIR. PHILADELPHIA, PA 19132	3.24	D.O.T. DRAINAGE SYSTEM	19911021
42-001-0439AN	THE ROCK OF GAINESVILLE P O BOX 13532 GAINESVILLE, FL 32604	3.99	N/A	199111 5
42-001-0440AN	CENTER PROPERTIES, INC. 6800 W UNIVERSITY AV EXT GAINESVILLE, FL 32607	0.688	GROUND WATER	19911122
42-001-0441ANG	FLORIDA DEPARTMENT OF TRANSPORTATION P O BOX 1089 LAKE CITY, FL 32056			1992 820
42-001-0442ANG	FLORIDA DEPARTMENT OF TRANSPORTATION P.O. BOX 1089 LAKE CITY, FL 32056	9.25	N/A	
42-001-0443AN	SOUTHERN SCHOLARSHIP FOUNDATION, INC. 322 STADIUM DR. TALLAHASSEE, FL 32304	3.32	TUMBLIN CREEK	19911030
42-001-0444AN	BRADFORD S. FULLER ATTN: BRADFORD S FULLER RT 2 BOX 571 B MICANOPY, FL 32667	0.75	GROUND WATER	199111 4
42-001-0445AN	QUADREX ENVIRONMENTAL 1940 N W 67TH PLACE GAINESVILLE, FL 32606	1.71	POTATO PATCH BAY VIA UNNAMED DRAINAGE DITCH	1992 128
42-001-0446AN	KENTUCKY FRIED CHICKEN NORTHPK TOWN C, BLDG 400 1000 ABERNATHY RD STE 200 ATLANTA, GA 30328	1.015	SWEETWATER BRANCH	199112 5
42-001-0447ANG	SCHOOL BOARD OF ALACHUA COUNTY 1817 EAST UNIVERSITY AVE. GAINESVILLE, FL 32601	10.3	N/A	1992 3 4
42-001-0448AN	JAMES MEEHAN 7326 SW 17TH PL GAINESVILLE, FL 32607	0.12	TUMBLIN CREEK	19911122
42-001-0449AN	JOHN B. KOOGLER, P.E. 4014 NW 13TH ST. GAINESVILLE, FL 32609	0.44	GROUND WATER	1993 9 8
42-001-0450AN	LARRY MITCHELL ATTN: DONALD A YANSKEY 1731 NW 6TH ST., STE. 12 GAINESVILLE, FL 32609	3.47	GROUND WATER	1992 8 3
42-001-0451AN	SVEND OLSEN, SR. AND SVEND OLSEN, JR. 2821 NE 20TH WAY GAINESVILLE, FL 32609	1.07	N/A	1992 130

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0452AN	GAINESVILLE REGIONAL UTILITIES ATTN: JACOB SCHAMBERGER P O BOX 490, MAIL STA #23 GAINESVILLE, FL 32602	1.38	LITTLE HATCHET CREEK VIA UNNAMED DITCH	19911212
42-001-0452ANM	GAINESVILLE REGIONAL UTILITIES ATTN: JACOB SCHAMBERGER P O BOX 490 MAIL STA. 23 GAINESVILLE, FL 32602	3.59	LITTLE HATCHITT CREEK	1992 428
42-001-0452ANM2	GAINESVILLE REGIONAL UTILITIES ATTN: JACOB SCHAMBERGER P O BOX 490, MAIL STA. 23 GAINESVILLE, FL 32602	1.78	L. HATCHET CREEK	1993 422
42-001-0453AN	AMERICAN CANCER SOCIETY/FLORIDA DIV., INC. ATTN: DONALD A. WEBSTER 1001 S. MACDILL AVENUE TAMPA, FL 32610	1.67	BIREN'S ARM	1992 3 5
42-001-0455AN	SANTA FE AUTO SUPPLY ATTN: STEVEN KINSELL 633 N.W. 13TH ST. GAINESVILLE, FL 32601	0.34	NONE	1992 114
42-001-0456AIM	ALLEN ENTERPRISES OF GAINESVILLE, INC. 3535 SW 34TH ST. GAINESVILLE, FL 32608	2.062		
42-001-0457ANG	CITY OF GAINESVILLE P. O. BOX 490, MS #58 GAINESVILLE, FL 32602	3.38	GROUND WATER	19911126
42-001-0458AN	LONNIE ORNS	0.744	STM. RETENT. AREA FOR TARGET CENTER OF GAINESVILLE	1992 3 3
42-001-0461AN	REORGANIZED CHURCH OF JESUS CHRIST OF L.D.S. ATTN: CYNTHIA CAMPBELL 2210 NW 46TH STREET GAINESVILLE, FL 32606	1.51	DOT STORMWATER SYSTEM	19911223
42-001-0462AN	FLOURNOY DEVELOPMENT COMPANY P.O. BOX 6566 COLUMBUS, GA 31995	13.79	N/A	1992 2 5
42-001-0463ANG	UNIVERSITY OF FLORIDA A/E DEPARTMENT BUILDING 700 GAINESVILLE, FL 32611	0.931	N/A	1992 1 7
42-001-0464ANG	SANTA FE COMMUNITY COLLEGE 3000 NW 83RD STREET GAINESVILLE, FL 32606	1.8	GROUNDWATER	1992 221
42-001-0464ANGM	SANTA FE COMMUNITY COLLEGE 3000 N.W. 83RD STREET GAINESVILLE, FL 32601		GROUND WATER	1993 216

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0466AN	CHURCH OF LATTER DAY SAINTS 50 E NORTH TEMPLE STREET SALT LAKE CITY, UA 84150	5.5	N/A	
42-001-0466ANM	CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS ATTN: DALE REMUND 4823 N. ROYAL ATLANTA DR. TUCKER, GA 30084	5.5	GROUND WATER/SW 24TH AVE. DRAINAGE	1994 126
42-001-0467AN	BOYS AND GIRLS CLUBS OF ALACHUA COUNTY, INC. ATTN: NEAL ZIMMERMAN P. O. BOX 532 GAINESVILLE, FL 32602	0.22	GROUND WATER	1992 128
42-001-0468AN	GAINESVILLE GOLF & COUNTRY CLUB ATTN: MILLARD JOYNER 7300 SW 35TH WAY GAINESVILLE, FL 32608	1.07	PAYNES PRAIRIE (OFW)	1992 529
42-001-0469AN	ENVIRONMENTAL CONSULTING AND TECHNOLOGY, INC. 5200 NEWBERRY RD, STE E-1 GAINESVILLE, FL 32607	2.34	GROUND WATER	1992 317
42-001-0470AN	SHONEY'S, INC. HENDERSON, QUINN & ASSOC. GAINESVILLE, FL 32601	1.826	HOGTOWN CREEK	1992 6 3
42-001-0471AN	GAINESVILLE BAPTIST CHURCH 3570 N.W. 16TH BLVD. GAINESVILLE, FL 32606	1.99	GROUND WATER	1992 3 2
42-001-0472ANG	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	0.59	COMPLETE RETENTION	1992 5 1
42-001-0473ANG	PUBLIC WORKS DEPT. ATTN: RON BARLOW P. O. BOX 490, MS #58 GAINESVILLE, FL 32602	5.4	RIDGEVIEW CREEK	1992 9 8
42-001-0474ANG	SCHOOL BOARD OF ALACHUA COUNTY ATTN: TERRY TOUGAW 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	10.6	CITY DITCH	1992 7 7
42-001-0475AN	W.C. WOODBURY, MR. AND MRS. 1114 S.W. 6TH AVE. GAINESVILLE, FL 32601	0.52	LAKE ALICE	1992 412
42-001-0476ANG	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIV. AVE. GAINESVILLE, FL 32601	20.06	GROUND WATER	1992 325
42-001-0477AN	JOSHUA C. AND SARAH B. DICKINSON 519 N.W. 60TH ST., STE D GAINESVILLE, FL 32607	4.54	HOGTOWN PRAIRIE	1992 4 2
42-001-0478AN	DEPT. OF GENERAL SERVICES 2737 CNETERVIEW DR. K. BLDG., STE. 301 TALLAHASSEE, FL 32399	1.4	N/A	1992 6 5

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0480AN	WILLIAMS-THOMAS FUNERAL HOME ATTN: GENE WILLIAMS 404 N. MAIN ST. GAINESVILLE, FL 32612	0.44	CITY DRAINAGE SYSTEM	1992 420
42-001-0481AN	WADE RAULERSON PONTIAC/GMC ATTN: WADE RAULERSON 2101 N. MAIN ST. GAINESVILLE, FL 32601	9.18	HOGTOWN CREEK	1992 619
42-001-0482AN	CIVITAN REGIONAL BLOOD CENTER, INC. ATTN: BRUCE HAGUEWOOD 1221 NW 13TH ST. GAINESVILLE, FL 32601	3.3	HOGTOWN CREEK	1992 6 4
42-001-0483AN	MIKE RYALS 3620 NW 43RD ST. GAINESVILLE, FL 32606	0.6	ALACHUA COUNTY STORMDRAIN SYSTEM	1992 5 8
42-001-0484AN	VETERANS OF FOREIGN WARS ATTN: ED GINNER P. O. BOX 703 GAINESVILLE, FL 32602	4.8	N/A	1992 518
42-001-0484ANM	V.F.W. ALACHUA COUNTY INC. P. O. BOX 703 GAINESVILLE, FL 32602	4.8	GROUND WATER	1994 1 3
42-001-0485AI	BOB ATKINS, ATKINS COMMERCE CENTER ATTN: BOB ATKINS GAINESVILLE, FL 32608	2.28	N/A	
42-001-0486AN	HAWTHORNE, FL 32640 FIRST UNITED METHODIST CHURCH PHASE I 103 NW 1ST AVENUE HAWTHORNE, FL 32640	0.3	GROUND WATER	1992 521
42-001-0487AN	TRINITY CHRISTIAN CHURCH ATTN. DAN BOYKIN 5910 SW ARCHER ROAD GAINESVILLE, FL 32608	2.83	DETENTION OF 100-YR STORM EVENT. EXCESS TO DIVIDES	1992 526
42-001-0488AN	SUNBANK 3814 N.W. 43RD ST. GAINESVILLE, FL 32606	1.18	COUNTY STORMWATER SYSTEMS	1992 7 2
42-001-0489ANG	DOT/FEDERAL AVIATION ADMINISTRATION ATTN ANGEL ARROYO P O BOX 20636 ATLANTA, FL 30320	0.25		1992 728
42-001-0490ANG	SCHOOL BOARD OF ALACHUA COUNTY ATTN: TERRY TOUGAW 1817 E UNIVERSITY AVE GAINESVILLE, FL 32601	15	N/A	1992 812
42-001-0491ANG	GAINESVILLE FLORIDA CAMPUS FEDERAL CREDIT UNION 1900 SW 34TH STREET GAINESVILLE, FL 32607	1.02	HOGTOWN CREEK	1992 717

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0492AN	JOHN SCOTT P.O. BOX 2174 GAINESVILLE, FL 32602	0.4	HOGTOWN CREEK	1992 826
42-001-0493AN	FAITH PRESBYTERIAN CHURCH RT 2 BOX 72A TRENTON, FL 32693	0.3	SMITH CREEK	1992 814
42-001-0494AN	OFFICE DEPOT, INC. 2200 OLD GERMANTOWN ROAD DELRAY BEACH, FL 33445	3.6	HOGTOWN CREEK	1992 819
42-001-0495AN	GEOSOLUTIONS, INC. P.O. BOX 2127 GAINESVILLE, FL 32603	0.69	CITY OF GAINESVILLE STORMSEWER SYSTEM	1992 9 3
42-001-0496AN	THOMAS OIL COMPANY ATTN. JAMES MEEHAN P.O. BOX 5006 GAINESVILLE, FL 32602	0.554	HOGTOWN CREEK	1992 7 6
42-001-0497AN	FIRST UNION NATIONAL BANK OF FLORIDA ATTN: PERRY HAVENER P. O. BOX 44247 JACKSONVILLE, FL 32231	3.4	CITY OF GAINESVILLE STORMWATER SYSTEM	1992 724
42-001-0499AN	DR. WILLIAM CARRICK 802 NW 23RD AVE. GAINESVILLE, FL 32601	1.55	THREE LAKES CREEK	1992 9 9
42-001-0500AN	CAPSTONE DEVELOPMENT 600 LUCKIE DR., STE. 424 BIRMINGHAM, AL 35223	15.9	N/A	1992 715
42-001-0501AN	HORACE N. MOORE 235 S. MAIN ST., STE. 101 GAINESVILLE, FL 32601	0.13	SWEETWATER BRANCH	199210 6
42-001-0502AN	GILBERT SCHAFFNIT & GLORIA FLETCHER 719 N.E. 1ST ST. GAINESVILLE, FL 32601	0.12	GROUND WATER	1992 916
42-001-0503AN	LOWELL O'HARA 7500 NEWBERRY ROAD GAINESVILLE, FL 32606	0.574	TOWER CENTER BASIN	19921016
42-001-0505AN	WILBUR HATCHER 2625 SE HAWTHORNE, FL 32640 RD. GAINESVILLE, FL 32601	0.37	SWEETWATER BRANCH	199210 8
42-001-0506AN	FLOURNOY DEVELOPMENT CO. 900 BROOKSTONE CENTRE PARKWAY COLUMBUS, GA 31995	10.18	GROUND WATER	19921012

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0507AN	FLORIDA CLINICAL PRACTICE ASSOCIATION FRANKLIN SMITH, 100205 J. HILLIS MILLER H CR RMM102 GAINESVILLE, FL 32601	4.72	CITY OF GAINESVILLE STORMWATER SYSTEM	19921012
42-001-0508AN	GIOVANNA HOLBROOK 625 E. UNIV. AVE. GAINESVILLE, FL 32601	0.45	GROUND WATER	19921016
42-001-0509ANG	GAINESVILLE REGIONAL UTILITIES-CITY OF GAINESVILLE P O BOX 147117, STA A-128 GAINESVILLE, FL 32614	15.42	GROUND WATER	199212 2
42-001-0510AN	FEASTERCO, INC. ATTN: DAN FEASTER 1621 N.E. 6TH AVE. OCALA, FL 32670	1	GROUND WATER	19921117
42-001-0511AN	BUFFINGTON ASSOCIATES ATTN: LEONARD BUFFINGTON 4420 NW 36TH AVE., STE. B GAINESVILLE, FL 32606	0.48	HOGTOWN CREEK	19921231
42-001-0513AN	AMJ CONSTRUCTION INC. 1202 NW 9TH AVE. GAINESVILLE, FL 32601	1.1	HOGTOWN CREEK	19921118
42-001-0514AN	SHANDS HOSPITAL FACILITIES PLANNING ATTN: BRAD POLLITT UNIV. OF FL, POB 100366 GAINESVILLE, FL 32610	2.88	BIVANS ARM	1993 222
42-001-0515AN	H. G. JOINT VENTURE 5200 NEWBERRY RD., E-9 GAINESVILLE, FL 32607	42.17		1993 322
42-001-0516AN	HOLY TRINITY EPISCOPAL CHURCH C/O FATHER DAVID PITTMAN 325 MARKET STREET JACKSONVILLE, FL 32202	0.75	CITY OF GAINESVILLE STORM SEWER	1993 218
42-001-0517ANG	ALACHUA COUNTY PUBLIC WORKS DEPARTMENT P. O. BOX 1188 GAINESVILLE, FL 32602	26.89	FDOT BASIN	1993 3 5
42-001-0518ANG	CITY OF GAINESVILLE ATTN: STEWART PEARSON PE P. O. BOX 490 GAINESVILLE, FL 32602	17	LAKE FOREST CREEK	1993 6 2
42-001-0519AN	GERMAIN SANCHEZ 10024 SW 75TH WAY GAINESVILLE, FL 32608	0.172	GROUND WATER	1993 219
42-001-0520AN	TRAVELODGE 3103 NW 13TH ST. GAINESVILLE, FL 32609	0.109	N/A	
42-001-0521AN	GAINESVILLE MALL LIMITED PARTNERSHIP 2552-2 N.W. 13TH ST. GAINESVILLE, FL 32609	9	HOGTOWN CREEK	1993 329

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0522AN	FLORIDA HOME THERAPUTICS INC. 7328 W. UNIVERSITY AVE. GAINESVILLE, FL 32607	0.9	HOGTOWN CREEK	1993 322
42-001-0523AN	HI-GVF, INC. ATTN: HAROLD ZELL 502-1/2 GLOUCESTER ST. #2 BRUNSWICK, GA 31520	2		1993 526
42-001-0523ANM	HI-GVF, INC. ATTN: HAROLD ZELL 502-1/2 CLOUESTER ST STE2 BRUNSWICK, GA 31520	2	N/A	1994 121
42-001-0524AN	METROCORP CENTER, INC. 2700-D NW 43RD ST. GAINESVILLE, FL 32606	6.43	HOGTOWN CREEK	1993 415
42-001-0525AN	CITY OF GAINESVILLE PUBLIC WORKS DEPT. ATTN: RON BARLOW P. O. BOX 490, MS #58 GAINESVILLE, FL 32602	0.5	SWEETWATER BRANCH	1993 331
42-001-0526ANG	ALACHUA CO. SCHOOL BOARD PLANNING & CONSTR. DEPT. 1817 E. UNIVERSTIY AVE. GAINESVILLE, FL 32601	3.75	CITY OF GAINESVILLE DRAINAGE DITCH	1993 4 1
42-001-0527AN	CITY OF GAINESVILLE ATTN: DICK HUDSON P. O. BOX 490 GAINESVILLE, FL 32601	5.2	SWEETWATER BRANCH	1993 311
42-001-0528AN	MINI-MAXI WAREHOUSES, INC. 2150 NE 31ST AVE. GAINESVILLE, FL 32609	3.48	L. HATCHET CREEK	1993 4 6
42-001-0529AN	TOWER ROAD ANNEX CORP. 7213 NW 4TH BLVD. GAINESVILLE, FL 32606	1.377	GROUND WATER	1993 716
42-001-0530AN	J. F. HARTMAN P. O. BOX 227 GAINESVILLE, FL 32602	0.65	GROUND WATER	1993 7 8
42-001-0531AN	ANTIOCH HOLINESS CHURCH ATTN: SAM BANNISTER 2511 NE 8TH AVE. GAINESVILLE, FL 32601	0.3	GROUND WATER	1993 429
42-001-0532AN	WESTWOOD HILLS CHURCH OF GOD 1520 NW 34TH ST. GAINESVILLE, FL 32605	2.2	FDOT RETENTION BASIN	1993 6 9
42-001-0533AN	PCR, INCORPORATED P.O. BOX 1466 GAINESVILLE, FL 32601	19	N/A	1993 4 2
42-001-0534AN	D & R RESTAURANTS, INC. ATTN: RALPH TYNDALL 4702 SW 88TH DR. GAINESVILLE, FL 32608	0.45	HOGTOWN CREEK	

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0535AN	A.M.J. INC. 1202 NW 9TH AVE. GAINESVILLE, FL 32601	1.01	GROUND WATER	1993 722
42-001-0536AN	BROADMOOR HOMEOWNERS ASSOC. P. O. BOX 7131 GAINESVILLE, FL 32605	35	N/A	1993 628
42-001-0537ANG	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	2.2	GROUND WATER	19931112
42-001-0537ANGM	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	0	N/A	
42-001-0538AN	MCDONALD'S CORPORATION 4830 W. KENNEDY BLVD. STE. 395 TAMPA, FL 32610	1.03	EAST UNIVERSITY STORMSEWER SYSTEM	1993 8 5
42-001-0539ANG	CITY OF GAINESVILLE ATTN: RON BARLOW P. O. BOX 490, MS #58 GAINESVILLE, FL 32602	7.75	SWEETWATER BRANCH	1993 810
42-001-0540AN	GAINESVILLE FL CAMPUS FEDERAL CREDIT UNION P. O. BOX 147029 GAINESVILLE, FL 32614	0.29	LAKE ALICE	1993 7 8
42-001-0541AN	GAINESVILLE REGIONAL UTILITIES ATTN: JACOB SCHAMBERGER P. O. BOX 14117 GAINESVILLE, FL 32614	0.5	SWEETWATER BRANCH	1993 8 9
42-001-0542AN	THE BRADLEY COMPANY P. O. BOX 8187 ROANOKE, VA 24014	4.92	HOGTOWN CREEK	19941028
42-001-0543AN	GRACE PRESBYTERIAN CHURCH 3146 NW 13TH STREET GAINESVILLE, FL 32605	3	HOGTOWN CREEK	1993 916
42-001-0544AN	BELLE CONSTRUCTION CO. 6729 S.R. 579 N. SEFFNER, FL 33584	2.23	GROUND WATER	1993 729
42-001-0545AN	PHILLIP H. HEFLIN POST OFFICE BOX 13895 GAINESVILLE, FL 32604	0.248	GROUND WATER	1993 917
42-001-0546AN	RST HUNTERS P. REALTY CORP. 110 EAST 59TH STREET SUITE 600 NEW YORK, NY 10022	1.42	GROUND WATER	1993 720
42-001-0547ANG	UNIVERSITY OF FLORIDA FOUNDATION, INC. POST OFFICE BOX 14425 GAINESVILLE, FL 32604	11.96	GROUND WATER	1993 721
42-001-0548AN	SOUTHERN SCHOLARSHIP FOUNDATION 322 STADIUM ROAD TALLAHASSEE, FL 32304	2.29	TUMBLIN CREEK	1993 820

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0549AN	TOM ROBINSON & HOWARD K. WALLACE 4040 NEWBERRY RD. STE. 1000 GAINESVILLE, FL 32607	21.51	N/A	1993 728
42-001-0550AN	ABIDING SAVIOR LUTHERAN CHURCH P. O. BOX 140217 GAINESVILLE, FL 32614	4.32	S.R. 26 STORMSEWER	1993 917
42-001-0552AN	SPARTAN FOOD SYSTEMS, INC. ATTN: TOMMY DUNAWAY 203 N. MAIN ST. SPARTANBURG, SC 29319	1.49	FDOT OUTFALL DITCH	
42-001-0553AN	WADE RAULERSON HONDA, INC. P. O. BOX 1646 GAINESVILLE, FL 32606	4.81	UNNAMED DITCH	199311 8
42-001-0554AN	MOHAMMAD RAJAEE 2358 NW 16TH AVE. GAINESVILLE, FL 32605	0.6	GROUND WATER	19931025
42-001-0555AN	SOUTHERN LEGAL COUNSEL 115 NE 7TH AVE., STE. A GAINESVILLE, FL 32601	0.45	GROUND WATER	1993 913
42-001-0556AN	SHANDS HOSPITAL 1600 SW ARCHER RD GAINESVILLE, FL 32610	7.1	BIVANS ARM, CLASS III	
42-001-0557AN	MOHAMMAD RAJAEE 2358 NW 16TH AVE. GAINESVILLE, FL 32605	0.56	CITY OF GAINESVILLE STORM SEWER	1994 1 7
42-001-0558AN	BASS & HIGGENBOTHAM P. O. BOX 907 HAWTHORNE, FL 32640	0.61	S.R. 20 DRAINAGE SYSTEM	199311 4
42-001-0559AN	DELTA GAMMA SORORITY 808 W. PANHELLENIC DRIVE GAINESVILLE, FL 32601		N/A	
42-001-0560ANG	SCHOOL BOARD OF ALACHUA COUNTY ATTN: ED GABLE 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	0.55	N/A	1993 921
42-001-0561AN	VENTURE REALTY OF NORTH FLA. 1204 NW 13TH ST. GAINESVILLE, FL 32601	1.4	GROUND WATER	19931025
42-001-0562AN	HOMESTEAD APARTMENTS LIMITED 2040 NW 67TH PLACE GAINESVILLE, FL 32601	2.25	GROUND WATER	19931110
42-001-0563AN	HOLY FAITH CATHOLIC CHURCH 700 NW 39TH RD. GAINESVILLE, FL 32607	0.47	GROUND WATER	19931116
42-001-0564AN	SUMA INC. P. O. BOX 140265 GAINESVILLE, FL 32614	16.3	GROUND WATER	1994 1 3

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0565AN	OASIS LANDSCAPING ATTN: BRENT GAFFNEY 6802 NW 18TH DR. GAINESVILLE, FL 32602	2.5	HATCHET CREEK	199312 9
42-001-0566AN	JOYNER CONSTRUCTION 4404 NW 36TH AVE. GAINESVILLE, FL 32606	0.69	UNNAMED LOW AREA/GROUND WATER	1994 1 6
42-001-0567AN	ALACHUA COUNTY BOARD OF COUNTY COMMISSIONERS 21 EAST UNIVERSITY AVE GAINESVILLE, FL 32601	1.32	GROUND WATER	1994 114
42-001-0568AN	R & R OF GAINESVILLE, INC. ATTN: RANDALL B. CATON 203 S.W. 3RD AVENUE GAINESVILLE, FL 32601	1.069	HOGTOWN CREEK	1994 126
42-001-0569AN	CHARLES & RAINER PINKOSON TRUST 3945 N.W. 30TH PLACE GAINESVILLE, FL 32606	1.295	GROUND WATER	1994 323
42-001-0570AN	CHARLES & RAINER PINKOSON TRUST 3945 N.W. 30TH PLACE GAINESVILLE, FL 32606	1.154	GROUND WATER	1994 223
42-001-0571AN	BUFFINGTON ASSOCIATES LEONARD W. BUFFINGTON GAINESVILLE, FL 32606	11.258	HOGTOWN CREEK	1994 3 3
42-001-0572ANK	MICHAEL D. AND CATHY R. SHANNON 13727 NW 19TH PLACE GAINESVILLE, FL 32606	1	SW 97TH BOULEVARD STORMSEWER	1994 2 7
42-001-0572ANKM	MICHAEL D. & CATHY R. SHANNON ATTN: MICHAEL D. SHANNON 13727 NW 19TH PLACE GAINESVILLE, FL 32606	0.98	LAND-LOCKED	
42-001-0573ANG	FLORIDA DEPARTMENT OF TRANSPORTATION 605 SUWANNEE ST. TALLAHASSEE, FL 32399	0.08	N/A	
42-001-0574ANG	CITY OF GAINES ECONOMIC DEV NEIGH. HOUSING & DEV P. O. BOX 490 STATION 10C GAINESVILLE, FL 32602	2.01	TUMBLIN CREEK/BIVANS ARM	1994 328
42-001-0575AN	GAINESVILLE CRESCENT FOUNDATION, INC. P. O. BOX 921 GAINESVILLE, FL 32602	2	GROUND WATER	1994 318
42-001-0577AN	THE COOKER RESTAURANT CORPORATION ATTN: BILL ESCH 1530 BETHEL ROAD COLUMBUS, OH 43220	0.93	GROUNDWATER	1994 2 7
42-001-0578AN	ST. FRANCIS HOUSE, INC. ATTN: ROBERT TANCIG 15 S. E. 4TH AVE. GAINESVILLE, FL 32604	1.1	GROUND WATER	1994 421

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0579ANG	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	4	NE 15TH STREET STORM SEWER	1994 513
42-001-0580AN	COLLEGE PARK PROPERTIES ATTN: NATHAN COLLIER 1620 W UNIVERSITY AVE S#4 GAINESVILLE, FL 32603	1.25	SWEETWATER BRANCH	1994 218
42-001-0581AN	MORRIS VERSCHAEVE RT. 4, BOX 620 HAWTHORNE, FL 32640	0	GROUND WATER	1994 5 2
42-001-0582AN	FSG PROPERTIES LES GOLDBERG/GENERAL PRT. 1801 CLINT MOORE RD SU104 BOCA RATON, FL 33487	34.86	GROUND WATER	1994 429
42-001-0583AN	COLLEGE PARK APARTMENTS ATTN: NATHAN COLLIER 1620 W UNIVERSITY AVE SU4 GAINESVILLE, FL 32603	0.15	GROUND WATER	1994 218
42-001-0584AN	DR. HERB KAUFMAN, C/O MR. PHILLIP HAWLEY ATTN: PHILLIP HAWLEY 3728 N. MAIN ST. GAINESVILLE, FL 32601	3.49	ISOLATED DEPRESSION	1994 517
42-001-0585AN	GEORGE CONDA 7117 N.W. 20TH PLACE GAINESVILLE, FL 32605	0.58	LAKE ALICE	1994 427
42-001-0586ANG	CITY OF GAINESVILLE ATTN: STEWART E. PEARSON GAINESVILLE, FL 32602	3.46	UNNAMED CREEK TO CALF POND	1994 725
42-001-0587AN	RISSER PETROLEUM PRODUCTS, INC. 205 BURK ST. LAKE CITY, FL 32055	1.27	SW 97TH COURT DRAINAGE SYSTEM	1994 414
42-001-0588AN	SMILEY'S ANTIQUE MALL OF GAINESVILLE, INC. 3465 SW WILLISTON RD. GAINESVILLE, FL 32608	3.43	GROUND WATER	1994 4 5
42-001-0589AN	CENTRAL FLA TILE & MARBLE CO. P. O. BOX 53 GAINESVILLE, FL 32601	1	ISOLATED DEPRESSION	1994 429
42-001-0590AN	INDIA CULTURAL & EDUCATIONAL CENTER 2615 NW 21ST ST. GAINESVILLE, FL 32605	2.66	INDIA CULTURAL & EDUCATIONAL CENTER	1994 815
42-001-0591ANG	GAINESVILLE REGIONAL UTILITIES P. O. BOX 147117 GAINESVILLE, FL 32614	4.29	SWEETWATER BRANCH	1994 415

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0592AN	TUFFY AUTO SERVICE CENTER 3820 SW ARCHER RD. GAINESVILLE, FL 32608	0.89	N/A	1994 329
42-001-0593AN	FIRST ASSEMBLY OF GOD 2925 NW 39TH AVE. GAINESVILLE, FL 32602	1.18	NO DISCHARGE	1994 4 1
42-001-0594AN	JAMES & ELIZABETH POST 303 N.E. 8TH AVE. GAINESVILLE, FL 32601	1.4	GROUND WATER	1994 414
42-001-0595AN	ALLTEL MOBILE COMMUNICATIONS, INC. C/O WILLIAM E. SMITH 6341 N. U.S. HWY. 441 OCALA, FL 34457	4.98	NW 75TH DR DRAINAGE SYSTEM	1994 426
42-001-0596AN	STAFFORD PROPERTIES, INC. 80 W. WEIUCA RD. ATLANTA, GA 30342	11.2	HOGTOWN CREEK	1994 518
42-001-0597ANG	CITY OF GAINESVILLE P. O. BOX 490, M. S. #58 GAINESVILLE, FL 32602	0.13	HOGTOWN CREEK	1994 6 1
42-001-0598AN	PERRY C. MCGRIFF, JR. P. O. BOX 23400 GAINESVILLE, FL 32602	0.91	GROUND WATER	1994 6 1
42-001-0600AN	GREGORY G. LIUZZO 1530 S.W. ARCHER ROAD GAINESVILLE, FL 32608	1.69	N/A	1994 6 2
42-001-0601AN	JAMES E. LEBLANC 4445 SW 35TH TERRACE SUITE 150 GAINESVILLE, FL 32608	0.847	N/A	1994 6 3
42-001-0602AN	FRED HENDERSON 3501 S. MAIN ST., STE. 1 GAINESVILLE, FL 32601	1.18	N/A	1994 6 6
42-001-0603AN	FIRST UNION NATIONAL BANK OF FLORIDA P. O. BOX 40062 JACKSONVILLE, FL 32203	0.184	N/A	1994 512
42-001-0604AN	JERRY & DONNA, INC. 6322 NW 26TH PLACE GAINESVILLE, FL 32606	0.4	HOGTOWN CREEK,	1994 516
42-001-0605AN	UNITED WAREHOUSE OF GAINESVILLE, INC. ATTN: THOMAS REMBERT P. O. BOX 5849 GAINESVILLE, FL 32606	9.64	POTATO PATCH BAY	1994 516
42-001-0606AN	NORTHWEST BAPTIST CHURCH 5514 NW 23RD AVE. GAINESVILLE, FL 32606	6.8	N/A	1994 8 2
42-001-0607AN	DR. KENNETH KNOPF 4108 NW 16TH BLVD. GAINESVILLE, FL 32606	1.93	HOGTOWN CREEK	1994 525
42-001-0608ANG	SANTA FE COMMUNITY COLLEGE ATTN: JOHN TURNER 300 N.W. 83RD ST. GAINESVILLE, FL 32606	1.5	N/A	19941011

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0610AN	EMMER DEVELOPMENT CORP. 2801 SW ARCHER RD. GAINESVILLE, FL 32608	14.01	HOGTOWN CREEK	1994 720
42-001-0611AN	MICHAEL S. RYALS 8620 MILLHOPPER RD. GAINESVILLE, FL 32606	0.42	N/A	1994 6 6
42-001-0612ANG	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIVERSITY AVE GAINESVILLE, FL 32601	7.8	N/A	1994 729
42-001-0613ANG	CITY OF HAWTHORNE, FL 32640 ATTN: JOHN MCFARLIN P. O. BOX 1270 HAWTHORNE, FL 32640	32.93	UNNAMED DITCH	1994 712
42-001-0614AN	FIRST UNION NATIONAL BANK OF FLORIDA 214 NORTH HOGAN STREET JACKSONVILLE, FL 32202	1.794	HOGTOWN CREEK TRIBUTARY	1994 729
42-001-0615AN	IGWT PARTNERSHIP 6821 S.W. ARCHER ROAD GAINESVILLE, FL 32608	5	N/A	1994 9 9
42-001-0616AI	PALM COAST PERFORMANCE, INC. ATTN: SANDY A. SQUITIERI 6743-A NEWBERRY RD. GAINESVILLE, FL 32605	1.22	N/A	1994 8 9
42-001-0617ANG	FDEP/DRP - GAINESVILLE-HAWTHORNE, FL 32640 STATE TRAIL ATTN: FRED HAND 3900 COMMONWLTH BLV MS520 TALLAHASSEE, FL 32399	4.023	DRY CREEK	1994 916
42-001-0618AN	UNITED GAINESVILLE COMMUNITY DEVELOPMENT CORP INC VIAN COCKERHAN-GUINYARD P. O. BOX 2518 GAINESVILLE, FL 32602	1.246	TUMBLIN CREEK	1994 726
42-001-0619AN	ED ELLETT 301 N. MAIN ST. GAINESVILLE, FL 32601	0.5	DIVERT STM. INTO EXISTING STM. MGMNT. SYSTEM	
42-001-0620AN	SOUTHERN EQUITIES INVESTMENTS INC. 4609 NW 6TH ST. NO. B-3 GAINESVILLE, FL 32609	0.94	HOGTOWN CREEK	1994 720
42-001-0621AN	MEADOWS INC. 6053 ARLINGTON EXPRESSWAY JACKSONVILLE, FL 32211	2.1	N/A	1995 117
42-001-0622AN	CHURCH OF JESUS CHRIST OF LATTER-DAY SAINTS, UTAH CORPORATION SOLE 50 E. NORTH TEMPLE ST. SALT LAKE CITY, UT 84150	2.3	N/A	1994 926
42-001-0623AN	ALBEMARLE DEVELOPMENT CORPORATION ATTN: TOM SPAIN 2321 NW 41ST ST. GAINESVILLE, FL 32606	3.41	HOGTOWN CREEK	199410 3

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0624AN	C. H. & LINDA KALLMAN ATTN: C. H. KALLMAN P. O. BOX 14076 GAINESVILLE, FL 32604	0.41	CLAYTON H. KALLMAN	1994 815
42-001-0625AN	NATHAN COLLIER 1620 W. UNIVERSITY AVE. GAINESVILLE, FL 32601	0.58	HOGTOWN CREEK	1994 912
42-001-0626AN	C. H. & LINDA KALLMAN P. O. BOX 14076 GAINESVILLE, FL 32604	0.25	HOGTOWN CREEK	1994 817
42-001-0627AN	C. H. & LINDA KALLMAN ATTN: C. H. KALLMAN P. O. BOX 14076 GAINESVILLE, FL 32604	0.12	HOGTOWN CREEK	1994 817
42-001-0628AN	C. H. & LINDA KALLMAN ATTN: C. H. KALLMAN P. O. BOX 14076 GAINESVILLE, FL 32604	0.56	HOGTOWN CREEK	1994 912
42-001-0629AN	NATHAN COLLIER 1620 W. UNIVERSITY AVE. GAINESVILLE, FL 32601	0.58	HOGTOWN CREEK	1994 912
42-001-0630AN	RICHARD GROENE P. O. BOX 15163 GAINESVILLE, FL 32604	0.55	N/A	19941028
42-001-0631AN	COMPASSIONATE OUTREACH MINISTRIES 1701 LEE RD., APT 317-J WINTER PARK, FL 32789	2	NEWNANS LAKE	1994 926
42-001-0632AN	THE BART PATTERSON GOLF COMPANY ATTN: BART PATTERSON 999 S.W. 16TH AVE., #1 GAINESVILLE, FL 32601	14.59	N/A	1994 9 9
42-001-0633AI	DAVE REGISTER 2335 NW 10TH ST., STE 102 OCALA, FL 32675	0.54	N/A	
42-001-0634AN	NATHAN COLLIER 1620 W. UNIVERSITY AVE. GAINESVILLE, FL 32601	0.9	HOGTOWN CREEK	1994 912
42-001-0635AN	JOHN & SHOANN LI 421 N.W. 13TH ST. GAINESVILLE, FL 32601	1.033	CITY RETENTION AREA	19941129
42-001-0636AN	VENTURE REALTY ATTN: JOHN PLA 7733 W. NEWBERRY RD., STE. B-2 GAINESVILLE, FL 32606	2.26	REGIONAL RETENTION SYSTEM	1995 2 6
42-001-0637AI	GAINESVILLE HARLEY-DAVIDSON, INC. ATTN: RAY LYTLE 3558 NW 97TH BLVD. GAINESVILLE, FL 32606	1.5	N/A	
42-001-0638AN	NATHAN S. COLLIER 1620 W. UNIVERSITY AVE. GAINESVILLE, FL 32601	0.5	N/A	199410 6

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0639AN	JOHN KISH 4421 NW 65TH TERRACE GAINESVILLE, FL 32606	4.54	N/A	199412 7
42-001-0640AN	CAIN STUDIOS INC. ATTN: RICHARD W. CAIN 619 S. MAIN ST. GAINESVILLE, FL 32601	19	MILL POND	1995 2 6
42-001-0641AN	MRS. BEATRICE BEAN 1103 NW 4TH ST. GAINESVILLE, FL 32601	0.43	N/A	19941216
42-001-0643AN	GARY WESEMAN ATTN: GARY WESEMAN 3501 NW 39TH AVE. GAINESVILLE, FL 32605	24.5	N/A	19941229
42-001-0644AN	POSSUM CREEK OWNERS' MAINTENANCE ASSOCIATION ATTN: DR. SHERLIE H. WEST 101 S.W. 23RD TERRACE GAINESVILLE, FL 32607	5.602	N/A	19941129
42-001-0645AN	ALAN MONTANE 3412 NE 2ND ST. GAINESVILLE, FL 32609	1.15	CLASS III, WATER BODY NOT NAMED ON APPLICATION	
42-001-0646AN	PAUL WEST 3333 N. MAIN ST. GAINESVILLE, FL 32609	1.6	ROADSIDE DITCH TO HOGTOWN CREEK, CLASS III	
42-001-0647AN	GAINESVILLE HEALTH & FITNESS ATTN: JOE CIRULLI 3441 W. UNIVERSITY AVE. GAINESVILLE, FL 32605	8.916	BEVILLE CREEK	1995 2 6
42-001-0648AN	ISLAND FOOD STORES, INC. 9551 BAYMEADOWS RD. JACKSONVILLE, FL 32256	0.17	N/A	
42-001-0649AN	WELLS REAL ESTATE FUNDS ATTN: LEO F. WELLS, III 3885 HOLCOMB BRIDGE RD. NORCROSS, GTA 30092	5	STATE ROAD 331 STORMWATER SYSTEM	1995 2 6
42-001-0650AN	FLORIDA CONVALESCENT CENTER, INC. ATTN: CHARLES WYSOCKI 100 VINE ST. MURFREESBORO, TN 37130	3.13	N/A	1995 1 9
42-001-0651ANG	CITY OF GAINESVILLE PAT RYRNE OR ALISON FETNER 306 NE 16TH AVE. GAINESVILLE, FL 32602	0.42	HOGTOWN CREEK, CLASS III	
42-001-0652AN	JOHN W. MARTIN P. O. BOX 37 HAWTHORNE, FL 32640	1.5	N/A	

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-001-0653AN	GATOR PLACE APARTMENTS, INC. ATTN: EDDIE HIGGENBOTHAM P. O. BOX 1185 GAINESVILLE, FL 32602	3.49	N/A	1995 213
42-001-0654AN	SATURN OF GAINESVILLE ATTN: ROLAND DANIELS 18025 SW 83RD COURT MIAMI. FL 33157	2.62	FDOT DRAINAGE DITCH	
42-001-0655ANG	SCHOOL BOARD OF ALACHUA COUNTY 1817 E. UNIVERSITY AVE. GAINESVILLE, FL 32601	1	N/A	
42-001-0656AN	ROYCE WELLS 3026 NW 23RD DRIVE GAINESVILLE, FL 32605	1.1	N/A	
42-007-0002AN	MONTGOMERY CONFERENCE CENTER ATTN: DEAN KELLS RT. 3 BOX 1102 STARKE, FL 32091	0.3	EMERALD LAKE	198912 6
42-007-0003ANG	BRADFORD COUNTY P. O. BOX 1148 STARKE, FL 32091	0.95	GROUNDWATER	1991 2 6
42-007-0004AN	THE SALVATION ARMY 1424 NORTHEAST EXPRESSWAY ATLANTA, GA 30329	3.27	BEDFORD LAKE	
42-007-0005AN	JAY ELLIS P O BOX 271 DOCTORS INLET			
42-007-0009AN	JACK SCOTT P. O. BOX 1338 KEYSTONE HGHTS., FL 32656	18.2	LAKE GENEVA	1993 624
42-007-0010AN	FAITH PRESBYTERIAN CHURCH RT. 2, BOX 2733 MELROSE, FL 32666	0.27	UNKNOWN	1995 131
42-019-0011AN	CLAY ELECTRIC CO-OPERATIVE	10.98		1986 714
42-019-0035AN	L. L. HUNTLEY	0.879	WHITE SAND LAKE	1987 1 5
42-019-0038AN	CLIFFORD J. DUNAWAY ATTN: CLIFFORD DUNAWAY P. O. BOX 3168 SPARTENBURG, SC 29304	1.2	N/A	19861211
42-019-0048AN	JOHN WALDRON	3		1987 2 4
42-019-0055AN	C.E. SUTTERWHITE P. O. BOX 130 KEYSTONE HEIGHT, FL 32656	0.43	NONE (NATURAL LOW)	1987 225
42-019-0097AN	CALVIN E. MCLEOD	0.479		1987 914
42-019-0115AI	COURTNEY CARTER	0.12	LAKE KEYSTONE	1988 112

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-019-0133AN	FIRST ASSEMBLY OF GOD	0.44	NONE	1988 3 2
42-019-0154AN	RICHARD PASSWATER	4		1988 5 5
42-019-0166ANG	CLAY COUNTY SCHOOL BOARD	3.06	LAKE GENEVA	1988 620
42-019-0166ANMG	CLAY COUNTY DISTRICT SCHOOL BOARD	11.218	ROADSIDE SWALES	1988 916
42-019-0173AN	FIRST GENERAL SERVICES	0.69		1988 712
42-019-0174AN	CLAY ELECTRIC	3.51		1988 812
42-019-0181AN	SHANE D. HENRY, DVM			
42-019-0183AN	JIM SMOAK	0.33	BROOKLYN LAKE	1988 913
42-019-0185AN	MILLER ENTERPRISES, INC. 331 CENTRAL AVENUE ATTN: MAX BRIGGS CRESCENT CITY, FL 32012	1.25	LAKE GENEVA	19881024
42-019-0208ANG	CLAY COUNTY SCHOOL BOARD	3.3		1989 2 9
42-019-0212ANG	BHIDE & HALL ORANGE PARK 1329 KINGSLEY AVE.	4.7	N/A	1989 3 8
42-019-0222AN	RAYMOND BREEDLOVE P.O. BOX 845 KEYSTONE HEIGHTS, FL 32656	0.23	BROOKLYN LAKE	1989 531
42-019-0265AN	NORMAN ELDER 6689 SHANDS RD KEYSTONE HEIGHTS, FL 32656	0.81	ETONIA CREEK	19891127
42-019-0272AN	ST. WILLIAMS CATHOLIC CHURCH P.O. BOX 721 KEYSTONE HEIGHTS, FL 32656	1.47	KEYSTONE LAKE	19891127
42-019-0279AN	FREEDOM BAPTIST CHURCH P.O. BOX 1517 KEYSTONE HEIGHTS, FL 32656	4.19	LOCH LOMMOND	1990 213
42-019-0281AN	CLAY COUNTY BOARD OF COUNTY COMMISSIONERS	17.2	LAKE GENEVA	1990 316
42-019-0283ANG	CLAY COUNTY BOARD OF COUNTY COMMISSIONERS P.O. BOX 1365 GREEN COVE SPRINGS, FL 32043	5	KEYSTONE LAKE	1990 330
42-019-0296ANG	CLAY COUNTY BOARD OF COUNTY COMMISIONERS P. O. BOX 1366 GREEN COVE SPRINGS, FL 32043	0.16	LAKE HUTCHINSON	1990 514
42-019-0313ANG	CITY OF KEYSTONE HEIGHTS P.O. BOX 336 KEYSTONE HEIGHTS, FL 32656	6.8	CRYSTAL LAKE	1990 8 8

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-019-0330ANG	CLAY COUNTY BOARD OF COUNTY COMMISSIONERS ATTN: GARY HARVEY P.O. BOX 1365 GREEN COVE SPRINGS, FL 32043	2.15	LAKE GENEVA	1991 1 3
42-019-0345AN	CHURCH OF GOD ATTN AL WADDELL 842 PARKER ST STARKE, FL 32091			1991 412
42-019-0363ANG	CITY OF KEYSTONE HEIGHTS P. O. BOX 420 KEYSTONE HEIGHTS, FL 32656	26.7	LAKE GENEVA	1991 823
42-019-0414ANG	CLAY COUNTY BOARD OF COUNTY COMMISSIONERS P. O. BOX 1365 ROUNDTREE,WALTER GREEN COVE SPRINGS, FL 32043	4.22	LAKE BROOKLYN	1992 7 2
42-019-0433ANG	CLAY CO. BOARD OF COUNTY COMMISSIONERS P. O. BOX 1365 GREEN COVE SPRINGS, FL 32043		LAKE SANTA FE	1992 929
42-019-0455AN	MARINE WORKS REDD TEAM INC. ATTN: KENNETH FEEKEN 107 SW PECAN ST. KEYSTONE HEIGHTS, FL 32656	0.5	LAKE GENEVA	1993 428
42-019-0470ANG	CLAY COUNTY BOARD OF COUNTY COMMISSIONERS JIMMY WEEKS, PUB WKS DIR 5 ESPLANADE AVENUE GREEN COVE SPRINGS, FL 32043	4.7	LAKE PARADISE	1993 716
42-019-0488AN	OMEGA METALS, INC. 6689 SHANDS RD. KEYSTONE HEIGHTS, FL 32656	0.8	GOLDENHEAD BRANCH	199311 9
42-019-0489AN	FIRST BAPTIST CHURCH OF KEYSTONE HEIGHTS ATTN: SANFORD M. MAXWELL 550 S.E. HERON KEYSTONE HEIGHTS, FL 32656	2.2	LAKE GENEVA	199311 9
42-019-0510AN	MELROSE CALVARY TEMPLE CHURCH OF GOD ATTN REV. BEN BLANKENSHIP P. O. BOX 1060 MELROSE, FL 32666	0.537	LAKE GENEVA	1994 4 8
42-019-0518AN	DR. GEORGETTA LATCU 6542 TRIEST AVENUE KEYSTONE HEIGHT	0.45	LAKE GENEVA	1994 7 6
42-019-0531AN	DAVID WASIK P. O. BOX 1175 MELROSE, FL 32666	0.97	KEYSTONE LAKE	1994 831
42-019-0544ANG	CLAY COUNTY SCHOOL BOARD 900 WALNUT ST. GREEN COVE SPRINGS, FL 32043	35	DRY LAKE	1995 215
42-019-0546ANG	CLAY COUNTY SCHOOL BOARD 900 WALNUT ST. ATTN: GEORGE SPEIGHTS GREEN COVE SPRINGS, FL 32043	2.25	LAKE JOHNSON	1995 123
42-083-0007AN	MR. FRED HAVERNICK	485.18		

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-083-0024AN	TOM CURINGTON	0.96		1987 127
42-083-0052AN	C. BARRY GIBSON	2.06		1987 410
42-083-0071ANG	MARION CO. BOARD OF COMM.	1	ORANGE LAKE	1987 5 6
42-083-0100AN	DON DECONNA	4.04		1987 617
42-083-0131AN	LIL CHAMP FOOD STORES INC	1.6	NONE	198710 2
42-083-0167AN	LIL CHAMP FOOD STORES	0.95		1988 128
42-083-0226AN	ALLTEL FLORIDA, INC.	0.595	NONE	1988 721
42-083-0258ANG	JOSEPH L. CONE, MARION COUNTY ADMINISTRATOR	12.57		19881017
42-083-0344ANG	BOARD OF COUNTY COMMISSIONERS, MARION COUNTY ATTN: JOSEPH CONE 111 S.E. 25TH AVENUE OCALA, FL 32671	7.7		1989 717
42-083-0395AN	ROGER C. WOOD 814 E SILVER SPRINGS BLVD OCALA, FL 32670	1.219	NA	1990 3 8
42-083-0500AN	JERRY HARRIS P. O. BOX 107 MCINTOSH, FL 32664	1.37	ORANGE LAKE	1991 8 7
42-083-0549AN	MCINTOSH UNITED METHODIST CHURCH ATTN: A.L. BECK P.O. BOX 689 MCINTOSH, FL 32664	0.12	ORANGE LAKE	1992 121
42-083-0557AN	FLORIDA ORANGE SPRINGS, INC. 910 N.E. 16TH ST. OCALA, FL 32675	6.143	GROUND WATER	1992 417
42-083-0598AN	FIRST BAPTIST CHURCH - ORANGE SPRINGS ATTN: GENE WARREN, PASTOR RT. 2, BOX 1475 PALATKA, FL 32078	3	GROUND WATER	199212 8
42-083-0613AN	COMMUNITY PRESBYTERIAN CHURCH OF NORTH MARION INC ATTN: HOWARD K. WALKUP P. O. BOX 597 MCINTOSH, FL 32664	0.55	GROUND WATER	1993 122
42-083-0617AN	CITRA CHURCH OF GOD ATTN: REV. EDDIE NORRIS 4785 E. HWY. 316 CITRA, FL 32113	1.45	GROUND WATER	1993 2 5
42-083-0627AN	FEASTERCO, INC. ATTN: DAN G. FEASTER 1621 NE 6TH AVE. OCALA, FL 32670	0.62	GROUND WATER	1993 514

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APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-083-0656AN	FEDERAL AVIATION ADMINISTRATION ASO-456 P O BOX 20636 ESTAB ENG BRANCH/DOT/FAA ATLANTA, GA 30329	1.6	GROUNDWATER	1993 921
42-095-0071ANG	ORANGE COUNTY	11.6	LAKE HOLDEN	
42-107-0012AN	C.L. OVERTURF	0.826		1986 820
42-107-0012ANM	CHARLES L. OVERTURF, JR. P. O. BOX 1529 INTERLACHEN, FL 32148	0.828	LAKE CHIPACO	1990 6 6
42-107-0012ANM2	CHARLES L. OVERTURF P.O. BOX 1529 INTERLACHEN, FL 32148	0.828	GROUNDWATER	199011 7
42-107-0017AN	HARRY SHEFFIELD	0.48		1986 926
42-107-0026AN	JOE LISTON	0.41		1986 915
42-107-0038AN	CHARLES E. MIKE	0		19861030
42-107-0047AN	L. L. HUNTLEY	0.515		19861223
42-107-0058AN	DARBY BLOODGOOD	0.5	MILL CREEK	1987 217
42-107-0060AN	GEORGE & CHARLENE KING	0.275		1987 3 9
42-107-0073AN	FL GEN. BAPTIST CONVENTION INC	4.12		1987 514
42-107-0073ANM	FLA GENERAL BAPTIST CONVENTION, INC. C/O NORMAN HAWKINS 5641 CALIFORNIA AVE. JACKSONVILLE, FL 32244	0.27	UNNAMED POND	1994 922
42-107-0075AN	MILLER ENTERPRISES INC.	2.37	ON-SITE LAKE	1987 529
42-107-0075ANM	GEORGE C. MILLER, JR. 331 CENTRAL AVE. CRESCENT CITY, FL 32012	6.3	POND	1994 2 7
42-107-0082AN	BILL CARPENTER	0.1		1987 720
42-107-0099AN	ANGEL RODRIGUEZ	0.03	NONE	19871027
42-107-0121AN	HANDHILL FOREST, LTD.	2.01		1988 6 8
42-107-0121ANM	SANDHILL FOREST, LTD. ATTN WILLIAM R GUNBY, JR. 2415 COSTA VERDE, NO. 317 JACKSONVILLE, FL 32250	2.512	TWOMILE POND	19931115
42-107-0123ANG	DISTRICT SCHOOL BOARD OF PUTNAM COUNTY	1.57		1988 6 8
42-107-0128ANG	DISTRICT SCHOOL BOARD OF PUTNAM COUNTY	12.92		1988 6 1
42-107-0128ANGM	PUTNAM COUNTY SCHOOL BOARD ATTN: MICHAEL D. PRESTON 200 S. 7TH ST. PALATKA, FL 32078	1	N/A	1994 2 7

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-107-0130AN	THELMA M. HENSLEY P. O. BOX 162 GRANDIN, FL 32138	0.67	NONE	1988 615
42-107-0156AN	LITTLE DUKE CONSTRUCTION CO.	0.46		19881214
42-107-0170AN	SOUTH GEORGIA GROCERY COMPANY	0.59	NONE	1989 413
42-107-0175AN	INTERLACHEN UNITED METHODIST CHURCH	1.25	NONE	1989 5 2
42-107-0176AI	FIVE MASTERS CORP. ATTN: CHAS RICHARSON P.O. BOX 57 MELROSE, FL 32666			1990 213
42-107-0176AIM	FIVE MASTERS CORP., INC.	11.78		
42-107-0178AN	16 & 17 VOLUNTEER FIRE DEPARTMENT P.O. BOX 606 INTERLACHEN, FL 32148	0.64		1989 5 2
42-107-0182AN	GEROGE M. COMER P.O. BOX 62 GRANDIN, FL 32138	1.2	NONE	1989 614
42-107-0186AN	FAITH BAPTIST CHURCH ATTN: LARRY LITZELL P.O. BOX 326 INTERLACHEN, FL 32148	3.65	NONE	1989 711
42-107-0196AN	BARON OIL COMPANY 2406 HARPER STREET JACKSONVILLE, FL 32204	0.77		1989 726
42-107-0199ANG	J.D. GRIFFIS P.O. BOX 98 RAIFORD, FL 32083	0.08		1989 9 5
42-107-0199ANGM	SOUTHERN BELL TELEPHONE 6026 N.W. 1ST PLACE GAINESVILLE, FL 32607	0.12	PUTNAM HALL PRAIRIE	1993 225
42-107-0202AN	SUWANEE SWIFTY FOOD STORES P.O. BOX 311 QUITMAN, GA 31643	0.53		19891110
42-107-0211AN	BRUCE THOMAS P.O. BOX 438 INTERLACHEN, FL 32148	0.396	CPIPCO LAKE	1990 125
42-107-0214ANG	CITY OF INTERLACHEN P.O. BOX 90 INTERLACHEN, FL 32148			
42-107-0218AN	HERMAN E. FUGATE RT. 4 BOX 1723 PALATKA, FL 32078	400		
42-107-0221AN	INTERLACHEN CHURCH OF CHRIST RT. 3 BOX 5905 PALATKA, FL 32078	0.65	LAKE CHIPCO	1990 216

Table D-6. Stormwater Permits

APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-107-0227AN	FARRELL-MILLER FOOD SYSTEMS, INC. ATTN: JOHN FARRELL P.O. BOX 135 NEW SMYRNA BCH, FL 32070	0.99	UNNAMED LAKE	1990 423
42-107-0253ANG	PUTNAM COUNTY BOARD OF COUNTY COMMISSIONERS 514 SR. JOHNS AVE PALATKA, FL 32078	0.71	CHIPCO LAKE	1991 2 4
42-107-0258AN	WENDE WILSON FOR GATEWAY GIR SCOUT COUNCIL, INC. ATTN: L. R. FOSTER P. O. BOX 124 ORANGE SPRINGS, FL 32182	2.06	HANKLEY LAKE	1991 318
42-107-0270ANG	PUTNAM COUNTY PUBLIC SCHOOLS C/O C. L. OVERTURF JR C/O C. L. OVERTURF JR. 200 SOUTH 7TH STREET PALATKA, FL 32078	11.85	SOUTH BULL POND AND FOWLERS	1991 813
42-107-0271AN	CHURCH OF THE NAZARENE ATTN: EARL SPURLOCK, MIN. P. O. BOX 1922 INTERLACHEN, FL 32148	1	UNNAMED POND	1991 923
42-107-0283AN	MARANATHA ASSEMBLY OF GOD ATTN: HOWARD WILLIAMS P. O. BOX 210 FLORAHOME	1.89	LAKE GRANDIN	199112 2
42-107-0285AN	HOME FOLKS REAL ESTATE, INC. ATTN: CHARLES M. BARRY 136 E. PLYMOUTH DELAND	0.581	LAKE IDA	1992 1 7
42-107-0295ANM	WESTWOOD VILLAGE APARTMENTS ATTN: RONNIE C. DAVIS 5700 SW 34TH ST. STE 1307 GAINESVILLE, FL	4.52	CHIPCO	1993 8 2
42-107-0296ANG	PUTNAM COUNTY BOARD OF COUNTY COMMISSIONERS P. O. BOX 758 PALATKA, FL 32078	26.8	N/A	
42-107-0298AN	WENDE WILSON FOR GATEWAY GIRL SCOUT COUNCIL ATTN: L.R. FOSTER P.O. BOX 124 ORANGE SPGS	0.3	UNNAMED LAKE	1992 812
42-107-0299ANG	BOARD OF COUNTY COMMISSIONERS ATTN: HARRY LAMPE, DIR. P. O. BOX 310 EAST PALATKA, FL 32078	4.3	UPPER REACH OF CABBAGE CREEK - CLASS III	
42-107-0315AN	PUTNAM COUNTY SCHOOL BOARD	1.81	JEWEL LAKE	1993 224
42-107-0331AN	FIRST BAPTIST CHURCH OF INTERLACHEN POST OFFICE BOX 108 INTERLACHEN, FL 32148	0.11	CHIPCO LAKE	1993 712
42-107-0333AN	STAFFORD EASTERLING 898 STATE ROAD 21 MELROSE, FL 32666	0.07	SANTA FE LAKE	1994 316
42-107-0341AN	WAYNE EDWARD SIEBERT RT. 2, BOX 2799 MELROSE, FL 32666	0.04	N/A	19931217

Table D-6. Stormwater Permits

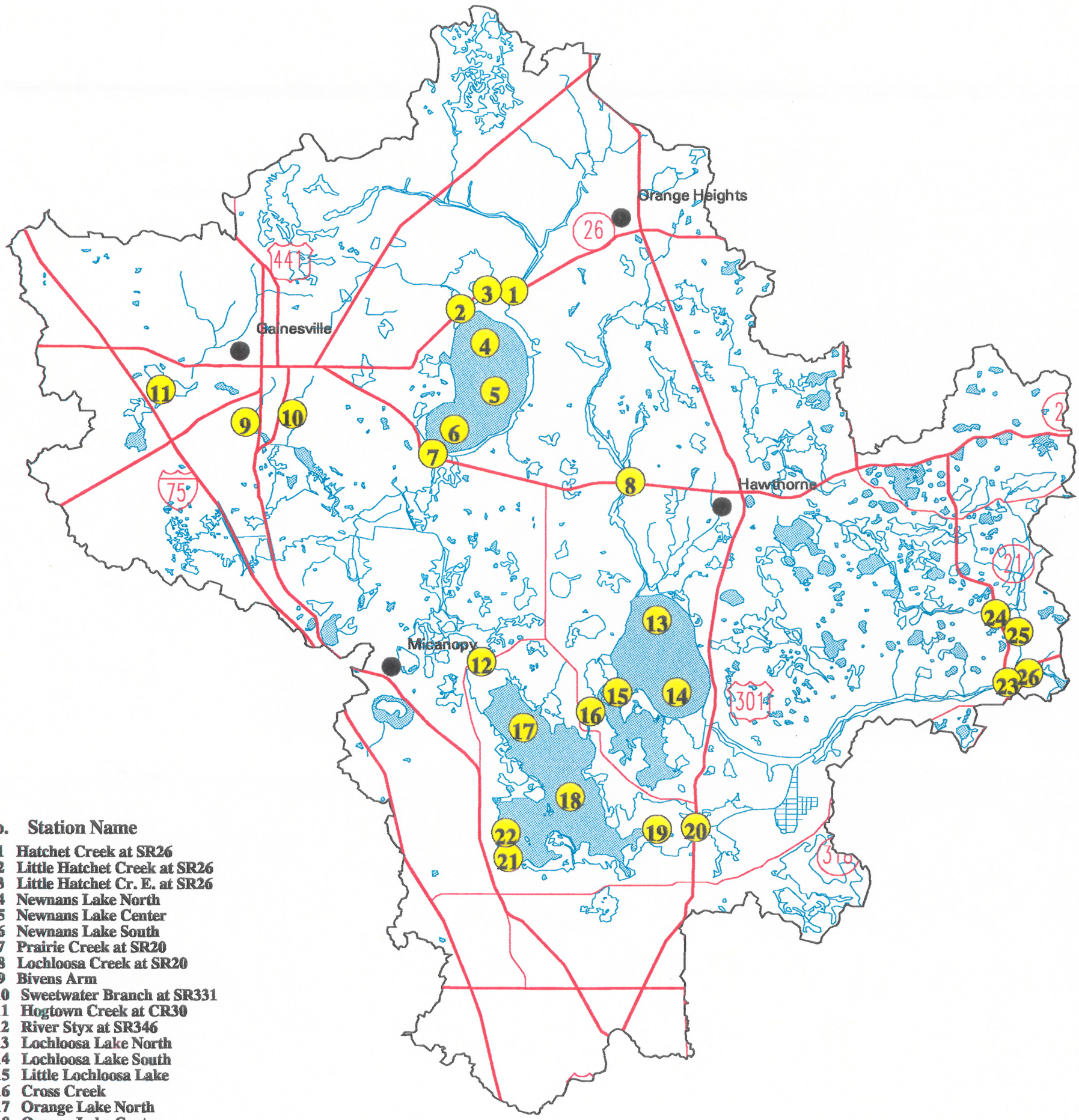
APPLICATION No.	NAME AND ADDRESS	PROJ. ACRG.	RECV. WATER BODY	DATE EXPIRED
42-107-0343ANG	PUTNAM COUNTY SCHOOL BOARD ATTN: MICHAEL D. PRESTON 200 S. 7TH ST. PALATKA, FL 32078	0.25	N/A	1994 2 7
42-107-0343ANGM	PUTNAM COUNTY SCHOOL BOARD 200 S. 7TH ST. PALATKA, FL 32078	0.7	N/A	1994 316
42-107-0343ANGM2	PUTNAM COUNTY SCHOOL BOARD 200 S. 7TH ST. PALATKA, FL 32078	0.29	N/A	1994 523
42-107-0344AN	SOUTHEASTERN CONFER. OF THE SEVENTH DAY ADVENTISTS ATTN: ROY BROWN 180 WESTMONTE DR. ALTAMONTE SPGS., FL 32714	0.97	UNNAMED POND	1994 4 7
42-107-0345AN	CHILD EVANGELISM FELLOWSHIP OF ALACHUA COUNTY 2103 NW 36TH TERRACE GAINESVILLE, FL 32605	0.17	TWIN LAKE	1994 131
42-107-0347AN	HEMPHILL CORPORATION ATTN: E. C. SUMMERS TULSA, OK 74115	0.65	WEST LAKE	1994 314
42-107-0348AN	SAINT JOHNS CATHOLIC CHURCH P. O. BOX 207 ATTN: JOHN HEEREY INTERLACHEN, FL 32148	0.14	N/A	1994 315

E

APPENDIX E

SJRWMD Water Quality Monitoring Sites in the Orange Creek Basin

Appendix E contains Figure E-1, which is a map of the Basin showing the locations of currently active SJRWMD water quality monitoring stations. Table E-1 lists the names and locations of these stations, along with the parameters that are measured. Water quality sampling is conducted on a monthly basis by District personnel.

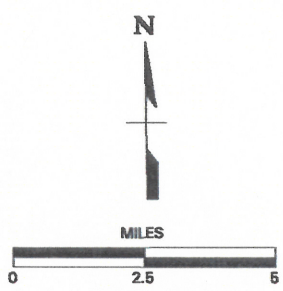


No.	Station Name
1	Hatchet Creek at SR26
2	Little Hatchet Creek at SR26
3	Little Hatchet Cr. E. at SR26
4	Newnans Lake North
5	Newnans Lake Center
6	Newnans Lake South
7	Prairie Creek at SR20
8	Lochloosa Creek at SR20
9	Bivens Arm
10	Sweetwater Branch at SR331
11	Hogtown Creek at CR30
12	River Styx at SR346
13	Lochloosa Lake North
14	Lochloosa Lake South
15	Little Lochloosa Lake
16	Cross Creek
17	Orange Lake North
18	Orange Lake Center
19	Orange Lake Southeast
20	Orange Creek at US301
21	Orange Lake Sinkhole
22	Orange Lake Southwest
23	Orange Creek at SR21
24	Little Orange Creek at SR21
25	Little Orange Creek South
26	Orange Creek at SR315

Figure E-1. Orange Creek Basin Water Quality Monitoring Sites

Refer to Table E-1





Map produced using MAPPER.aml on March 06, 1995

The St. Johns River Water Management District prepares and uses this information for its own purposes and this information may not be suitable for other purposes. This information is provided "as is". Further documentation of this data can be obtained by contacting: St. Johns River Water Management District, Geographic Information Systems, Program Management, P.O. Box 1429, Palatka, Florida 32178-1429. (904)329-4176

Table E-1. SJRWMD Water Quality Monitoring Sites in the Orange Creek Basin; station identification.

NO.	STATION NAME	COUNTY	LATITUDE	LONGITUDE
1	*Hatchet Creek at SR26	Alachua	29 41 17	82 12 24
2	*Little Hatchet Creek at SR26	Alachua	29 40 57	82 13 59
3	*Little Hatchet Cr. E. at SR26	Alachua	29 41 17	82 13 15
4	Newnan's Lake North	Alachua	29 39 53	82 13 11
5	Newnan's Lake Center	Alachua	29 38 43	82 13 12
6	Newnan's Lake South	Alachua	29 37 16	82 14 31
7	Prairie Creek at SR20	Alachua	29 36 40	82 14 54
8	Lochloosa Creek at SR20	Alachua	29 36 01	82 08 44
9	*Biven's Arm	Alachua	29 37 25	82 20 38
10	*Sweetwater Branch at SR331	Alachua	29 37 55	82 19 29
11	*Hogtown Creek at CR30	Alachua	29 38 17	82 23 33
12	River Styx at SR346	Alachua	29 31 02	82 13 20
13	Lochloosa Lake North	Alachua	29 31 32	82 07 38
14	Lochloosa Lake South	Alachua	29 30 36	82 07 12
15	Little Lochloosa Lake	Alachua	29 30 16	82 08 58
16	Cross Creek	Alachua	29 29 28	82 09 58
17	Orange Lake North	Alachua	29 29 12	82 12 03
18	Orange Lake Center	Alachua	29 27 54	82 10 39
19	Orange Lake Southeast	Alachua	29 26 05	82 08 39
20	Orange Creek at US301	Alachua	29 26 36	82 06 31
21	Orangle Lake Sinkhole	Alachua	29 29 40	82 12 26
22	Orange Lake Southwest	Alachua	29 26 03	82 12 18
23	Orange Creek at SR21	Marion	29 30 34	81 56 47
24	Little Orange Creek at SR21	Putnam	29 32 30	81 57 12
25	Little Orange Creek South	Putnam	29 31 21	81 56 24
26	Orange Creek at SR315	Marion	29 30 53	81 56 08

Parameters measured monthly:
Field: water temperature, conductivity, pH, dissolved oxygen, water depth, secchi depth
Laboratory: turbidity, alkalinity, conductivity, color, chloride, sulfate, total dissolved solids, total suspended solids, total organic carbon, chlorophyll a, dissolved phosphate, total phosphorus, total Kjeldahl nitrogen, dissolved ammonium, nitrates (NO3) + nitrites (NO2), dissolved silicate, total hardness
Stations marked with an asterisk (*) include biochemical oxygen demand in addition to above parameters.

F

APPENDIX F

Hydrological conditions on Orange Lake with and without the weir,
based on 50-yr SSARR simulations

Appendix F contains data from the hydrologic modelling work performed by SJRWMD for the Orange Creek Basin (Robison *et al.* 1996). Tables 1 through 4 of this appendix are referred to in Chapter 3.1 of the plan (under Issue # 1: Altered hydrologic regimes).

Table F-1. Ranges of inundation for Orange Lake (from SSAR 50-year hydrological simulations; Robison *et al.* 1996). Range values refer to the difference between maximum and minimum elevations in a given interval.*

PROBABILITY OF INUNDATION INTERVAL* (%)	RANGE OF INUNDATION (ft)		
	existing conditions	weir removed	change
0 to 100	9.22	9.17	-0.05
50 to 95	5.10	4.94	-0.16
10 to 90	3.74	3.54	-0.20
20 to 80	2.16	2.14	-0.02
30 to 70	1.21	1.25	0.04
40 to 60	0.53	0.59	0.06

* - calculated from Table F-2

Table F-2. Probabilities of inundation for Orange Lake (from SSARR 50-year hydrological simulations, Robison *et al.* 1996).

PROBABILITY OF INUNDATION (%)	LAKE LEVEL (ft amsl)	
	existing conditions	weir removed
0	60.12	59.79
5	58.83	58.24
10	58.61	57.94
20	58.34	57.56
30	58.14	57.28
40	57.91	57.00
50	57.67	56.69
60	57.38	56.41
70	56.93	56.03
80	56.18	55.41
90	54.87	54.40
95	53.73	53.30
100	50.90	50.62

Table F3a - Orange Lake, "Remove Orange Lake Weir": lowest mean values (ft), sorted for frequency analysis (SSARR simulation for 1942–91, year ending September 30) . *

Weibull Probability	1	7	30	60	90	120	180	274	365
0.02	50.62	50.67	50.70	50.76	50.83	50.94	51.17	51.64	52.12
0.04	51.54	51.58	51.65	51.71	51.80	51.87	52.00	52.29	52.59
0.06	52.32	52.37	52.52	52.54	52.58	52.68	52.91	53.30	53.83
0.08	53.23	53.25	53.27	53.31	53.35	53.44	53.58	53.84	54.04
0.10	53.24	53.26	53.31	53.35	53.41	53.44	53.99	54.26	54.55
0.12	53.24	53.30	53.48	53.65	53.75	53.83	54.14	54.64	55.01
0.14	53.65	53.70	53.80	53.85	53.95	53.99	54.18	54.77	55.37
0.16	53.84	53.89	53.99	54.08	54.18	54.29	54.79	55.22	55.54
0.18	54.35	54.38	54.43	54.44	54.48	54.58	54.87	55.28	55.64
0.20	54.63	54.66	54.73	54.77	54.81	54.87	54.99	55.35	55.66
0.22	54.69	54.72	54.75	54.78	54.83	54.89	55.09	55.45	55.72
0.24	54.75	54.78	54.83	54.86	54.90	54.92	55.10	55.49	55.84
0.26	54.79	54.81	54.86	54.91	54.93	54.95	55.11	55.53	55.88
0.28	54.80	54.82	54.89	54.95	54.97	54.97	55.21	55.69	55.99
0.30	55.04	55.07	55.14	55.21	55.25	55.32	55.48	55.74	56.02
0.32	55.09	55.11	55.19	55.26	55.31	55.37	55.55	55.81	56.03
0.34	55.26	55.32	55.43	55.56	55.57	55.59	55.75	56.02	56.29
0.36	55.32	55.37	55.49	55.58	55.61	55.63	55.75	56.17	56.45
0.38	55.41	55.46	55.51	55.68	55.79	55.86	56.08	56.32	56.55
0.40	55.47	55.51	55.60	55.68	55.80	55.92	56.14	56.44	56.61
0.42	55.48	55.52	55.62	55.69	55.87	55.94	56.16	56.45	56.64
0.44	55.54	55.58	55.70	55.82	55.88	55.96	56.17	56.45	56.70
0.46	55.70	55.72	55.82	55.94	56.04	56.08	56.27	56.45	56.74
0.48	55.85	55.88	55.93	56.03	56.12	56.18	56.28	56.49	56.87
0.50	55.85	55.90	56.00	56.05	56.13	56.24	56.41	56.54	56.87
0.52	55.90	55.95	56.01	56.12	56.22	56.24	56.49	56.65	56.90
0.54	55.94	55.97	56.04	56.15	56.27	56.34	56.54	56.68	56.97
0.56	55.94	56.15	56.24	56.32	56.40	56.46	56.56	56.76	57.03
0.58	56.15	56.18	56.26	56.32	56.40	56.46	56.58	56.91	57.12
0.60	56.19	56.21	56.32	56.41	56.51	56.55	56.69	57.02	57.14
0.62	56.20	56.24	56.35	56.44	56.51	56.59	56.76	57.02	57.14
0.64	56.28	56.30	56.36	56.44	56.55	56.64	56.78	57.04	57.21
0.66	56.31	56.33	56.40	56.46	56.55	56.69	56.84	57.10	57.24
0.68	56.34	56.36	56.45	56.54	56.63	56.69	56.86	57.12	57.26
0.70	56.36	56.39	56.56	56.67	56.68	56.70	56.87	57.12	57.31
0.72	56.48	56.51	56.59	56.67	56.69	56.71	56.88	57.16	57.38
0.74	56.54	56.56	56.62	56.73	56.79	56.84	56.99	57.23	57.39
0.76	56.55	56.59	56.67	56.76	56.83	56.96	57.17	57.24	57.46
0.78	56.56	56.60	56.68	56.77	56.90	57.00	57.21	57.34	57.50
0.80	56.69	56.72	56.87	56.91	56.96	57.07	57.23	57.36	57.54
0.82	56.84	56.85	56.91	56.94	57.03	57.12	57.27	57.37	57.65
0.84	56.87	56.89	56.95	57.02	57.16	57.23	57.35	57.44	57.68
0.86	56.89	56.90	56.99	57.06	57.16	57.29	57.46	57.50	57.68
0.88	56.90	56.92	57.00	57.12	57.22	57.30	57.46	57.55	57.69
0.90	56.97	57.06	57.10	57.14	57.23	57.33	57.51	57.63	57.71
0.92	57.06	57.07	57.15	57.21	57.26	57.37	57.57	57.70	57.78
0.94	57.06	57.08	57.16	57.28	57.26	57.37	57.59	57.78	57.80
0.96	57.07	57.11	57.17	57.28	57.34	57.39	57.59	57.81	58.04
0.98	57.08	57.11	57.27	57.42	57.50	57.49	57.89	58.07	58.05

* Reproduced from Robison et al., 1996. Water Management Alternatives: Effects on Lake Levels and Wetlands in the Orange Creek Basin. Draft Report, SJRWMD.

Table F-3b. Orange Lake, "Existing Conditions": lowest mean values (ft), sorted for frequency analysis (SSARR simulation for 1942–91, year ending September 30) .*

Weibull Probability	1	7	30	60	90	120	180	274	365
0.02	50.90	50.96	51.00	51.05	51.09	51.20	51.43	51.95	52.49
0.04	51.61	51.64	51.72	51.78	51.88	51.95	52.08	52.38	52.68
0.06	52.53	52.59	52.75	52.78	52.83	52.93	53.16	53.52	54.03
0.08	53.63	53.64	53.66	53.70	53.75	53.86	54.08	54.38	54.62
0.10	53.64	53.71	53.79	53.82	53.88	53.90	54.46	54.76	55.10
0.12	53.70	53.74	53.92	54.11	54.23	54.31	54.55	55.20	55.67
0.14	54.49	54.54	54.65	54.69	54.74	54.76	54.95	55.42	55.83
0.16	54.63	54.67	54.77	54.84	54.91	54.96	55.12	55.45	55.87
0.18	54.81	54.82	54.87	54.92	54.94	55.02	55.45	55.87	56.27
0.20	55.14	55.17	55.22	55.25	55.31	55.44	55.73	56.08	56.38
0.22	55.37	55.40	55.48	55.56	55.60	55.61	55.76	56.20	56.58
0.24	55.44	55.47	55.50	55.56	55.60	55.64	55.76	56.24	56.77
0.26	55.46	55.49	55.57	55.65	55.71	55.80	56.05	56.48	56.77
0.28	55.64	55.67	55.73	55.78	55.83	55.86	56.15	56.63	56.87
0.30	56.06	56.08	56.13	56.15	56.18	56.26	56.40	56.71	56.99
0.32	56.11	56.16	56.23	56.32	56.36	56.38	56.57	56.87	57.07
0.34	56.13	56.16	56.27	56.35	56.37	56.40	56.58	56.98	57.23
0.36	56.15	56.20	56.29	56.41	56.47	56.52	56.69	56.99	57.39
0.38	56.25	56.29	56.41	56.61	56.77	56.84	57.07	57.31	57.45
0.40	56.35	56.46	56.57	56.64	56.77	56.86	57.07	57.35	57.50
0.42	56.42	56.50	56.57	56.66	56.80	56.88	57.11	57.39	57.50
0.44	56.46	56.56	56.72	56.81	56.87	56.97	57.17	57.39	57.59
0.46	56.55	56.60	56.72	56.89	56.98	57.06	57.24	57.39	57.66
0.48	56.65	56.67	56.78	56.92	56.99	57.06	57.27	57.42	57.71
0.50	56.72	56.75	56.80	56.92	57.07	57.12	57.29	57.49	57.77
0.52	56.91	56.94	57.02	57.06	57.08	57.19	57.29	57.68	57.82
0.54	56.94	56.99	57.04	57.11	57.20	57.19	57.50	57.71	57.92
0.56	56.96	57.00	57.11	57.25	57.38	57.45	57.58	57.74	57.95
0.58	57.19	57.24	57.32	57.38	57.45	57.51	57.59	57.85	58.00
0.60	57.26	57.27	57.35	57.39	57.48	57.55	57.69	57.88	58.01
0.62	57.30	57.33	57.38	57.42	57.53	57.60	57.71	57.93	58.04
0.64	57.31	57.33	57.39	57.46	57.55	57.64	57.73	57.97	58.11
0.66	57.32	57.35	57.41	57.48	57.56	57.64	57.80	58.01	58.11
0.68	57.33	57.35	57.46	57.54	57.63	57.70	57.86	58.01	58.11
0.70	57.38	57.40	57.50	57.64	57.69	57.72	57.89	58.02	58.14
0.72	57.48	57.51	57.58	57.68	57.71	57.80	57.89	58.03	58.20
0.74	57.57	57.58	57.64	57.71	57.79	57.82	58.00	58.10	58.21
0.76	57.57	57.61	57.68	57.74	57.80	57.84	58.04	58.12	58.25
0.78	57.58	57.61	57.69	57.75	57.82	57.92	58.08	58.16	58.32
0.80	57.60	57.62	57.72	57.80	57.84	57.93	58.09	58.20	58.34
0.82	57.71	57.72	57.78	57.88	57.96	58.05	58.16	58.22	58.40
0.84	57.76	57.77	57.83	57.89	57.97	58.09	58.22	58.24	58.41
0.86	57.81	57.83	57.88	57.94	58.05	58.12	58.29	58.35	58.41
0.88	57.81	57.84	57.94	57.98	58.06	58.17	58.31	58.35	58.49
0.90	57.92	57.94	58.01	58.09	58.15	58.19	58.31	58.42	58.49
0.92	57.97	57.98	58.05	58.10	58.16	58.21	58.37	58.45	58.51
0.94	57.97	58.01	58.07	58.15	58.17	58.21	58.37	58.49	58.55
0.96	57.99	58.01	58.15	58.28	58.34	58.35	58.39	58.51	58.61
0.98	58.13	58.21	58.24	58.29	58.36	58.47	58.72	58.75	58.73

* Reproduced from Robison et al., 1996. Water Management Alternatives: Effects on Lake Levels and Wetlands in the Orange Creek Basin. Draft Report, SJRWMD.

Table F-4. Computation of hydraulic residence time for Orange Lake based on data from Robison *et al.* (1996).

$$T_R = \frac{VOL^*}{INFLOW} = \frac{[ac-ft]}{\left[\frac{ac-ft}{yr}\right]} = [yr]$$

$$INFLOW = \text{Camps Canal} + \text{Cross Creek} + \text{Basin}$$

$$= 32{,}000 + 20{,}000 + 25{,}000 = 77{,}000 \text{ ac-ft/year}$$

$E_{med\ ec} = 57.7 \rightarrow$ VOL = 70,000 ac-ft **

$E_{med\ wr} = 56.7 \rightarrow$ VOL = 57,000 ac-ft **

$$T_{R\ ec} = \frac{70{,}000}{77{,}000} = 0.91 \text{ yr}$$

$\rightarrow$ Reduction of ~ 20%

$$T_{R\ wr} = \frac{57{,}000}{77{,}000} = 0.74 \text{ yr}$$

* *VOL* defined as volume of lake at median elevation

** derived by interpolation of area-capacity curves - see appendix B of Robison *et al.* (1996)

E_{med} = median elevation (ft amsl)

T_R = hydraulic residence time

$_{ec}$ = existing conditions

$_{wr}$ = weir removed

G

APPENDIX G

Hydrilla: environmental effects and
strategies for its control

NOTE: Literature cited in this appendix is listed in the bibliography for the plan (Chapter 5).

Impacts of hydrilla

Negative impacts of hydrilla. Replacement of open water habitat with hydrilla can negatively impact lake fisheries by reducing the availability of open-water feeding and spawning areas (Shireman et al. 1983b). A study addressing the effects of hydrilla on harvestable sport-fish populations on Orange Lake (Colle et al. 1987) reveals that almost complete coverage of the lake by hydrilla coincided with lower numbers of harvestable bluegill (*Lepomis macrochirus*) and redear sunfish (*Lepomis microlophus*). Extensive hydrilla mats can reduce the availability of prey for forage fish, which may in turn delay age of recruitment to harvestable size in black crappie (Maceina & Shireman 1985) and reduce the coefficients of condition (fatness) of largemouth bass, bluegill, and redear sunfish (Colle & Shireman 1980).

Excessive growth of hydrilla can also result in significant water quality changes, such as decreases in total phosphorus, total nitrogen, and chlorophyll-a, and increases in Secchi transparency (Schmitz & Osborne 1984, Canfield et al. 1983b, Canfield & Hoyer 1992). Dense hydrilla beds tend to impede water circulation (hydrodynamics), promote sedimentation and chemical stratification of the water column, enhance 24-hour fluctuations in dissolved oxygen, pH, and temperature, and induce an oxygen-deficient environment near the bottom of the lake, which can be detrimental to fish and benthic organisms (Canfield et al. 1983a, Canfield et al. 1983b, Shireman et al. 1983a). Additionally, if left untreated, hydrilla plants can contribute significantly (upon senescence) to organic sedimentation (Joyce et al. 1992), thereby increasing nutrient retention and internal recycling, and perpetuating hydrilla growth problems in the lake.

Benefits of hydrilla. Like other submersed plants, hydrilla can provide valuable fish and invertebrate habitat. A study on Orange Lake has shown that hydrilla stands support greater abundance of benthic invertebrates than either open water habitat or emergent or floating-leaved species such as maidencane or spatterdock (Watkins et al. 1983). Because of this positive relationship between aquatic macrophytes and associated faunal communities, Canfield and Hoyer (1992) recommend macrophyte coverages of at least 15% (including emergent, floating-leaved and submersed vegetation) for most Florida lakes. From the point of view of fisheries alone (specifically largemouth bass production), submersed macrophyte coverages between 20% and 40% are considered desirable (Durocher et al. 1984, Wiley et al. 1984). Higher densities, however, could negatively impact water chemistry (e.g. lower dissolved oxygen concentrations near the bottom of the lake) and suppress populations of benthic invertebrate (Scott and Osborne 1981).

Hydrilla control.

Drawbacks to the use of fluridone:

1) At times, it can cause significant mortality of non-target native plant species. Damage to spatterdock stands on Orange and Lochloosa lakes has been reported following recent (1992, 1993, 1994) spring applications of fluridone (Hinkle 1994a). In Lochloosa Lake alone, about 60 acres of spatterdock were inadvertently lost following the 1993 and 1994 hydrilla fluridone treatments (Hinkle 1995).
2) It is easily sequestered and rendered unavailable by organic sediments.
3) Its efficacy tends to be unpredictable (acres controlled per acre treated varies considerably from a high of 1:1 to a low of 1:24; Hinkle 1994a).
4) Because it is not translocated within the plant, it only acts on those parts which are actively growing and photosynthesizing and is therefore relatively ineffective for controlling unsprouted subterranean turions

(tubers). Hydrilla tubers can remain viable in the hydros
of 4 to 6 years (K. Langeland, personal communication).

Hydrilla harvesting on Orange Lake. A 1977 field study carried out on Orange Lake by the U.S. Army Corps of Engineers showed that the use of the Aqua-Trio harvester was successful in maintaining boating access channels in the lake free of hydrilla, for the duration of the growing season and at a cost that was competitive with chemical methods of control (McGehee 1979). About one half of the harvested hydrilla, however, was disposed of in the lake (to reduce operational costs), thus limiting the overall effectiveness of the method as a nutrient reduction tool.