The Green Swamp System

A Scientific Analysis

Green Swamp Task Force

1992

BOARD OF COUNTY COMMISSIONERS

P O L K C O U N T Y

DEPARTMENT OF DEVELOPMENT COORDINATION

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Director

July 1, 1992

Chairperson Neil Combee
Polk County Board of County Commission
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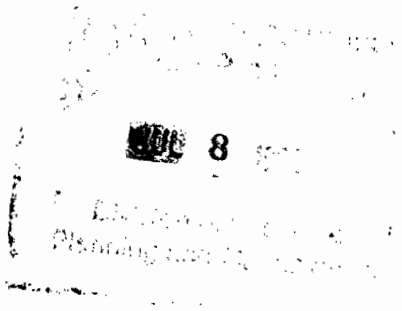

Dear Chairperson Combee,

This report is the final document representing ten months of work by the Green Swamp Task Force. It includes the Task Force's responses to the Charge from the Board of County Commission, the Scientific Analysis, and recommendations from the Green Swamp Task Force for policy changes to the Polk County Comprehensive Plan.

The most basic issue that the Task Force has dealt with is that the Green Swamp is a natural system that needs to be viewed as such and not according to political and agency boundaries as has been done in the past. They suggest, to the Board of County Commissioners, that the Board continue their leadership role in the Green Swamp and establish a group of concerned and knowledgeable persons to begin the process of overseeing the Green Swamp natural system.

The spectrum of issues that have been part of the Task Forces' deliberations spans the entire range of natural resource and planning concerns. Given the time limitations and current scientific information on the Green Swamp area and related topics these recommendations represent the work of the Task Force and their Technical Advisory Committee. In addition to specific recommendations regarding land use and natural resource issues, the report includes areas of research that the Task Force suggest need additional work. The report also includes tasks the Task Force recommends be pursued but for which they did not have the time or expertise to complete, such as writing ordinances or Green Swamp Land Development Regulations.

The spine of these recommendations is the Regional Commission and the Core Concept with it's associated densities. The Regional Commission would join Polk County with other local governments that share the Green Swamp as well as with other agencies and interested parties to oversee it's future. The Core Concept is a recommended plan of

low densities, in the heart of the swamp, with densities increasing towards the periphery which is noted by small towns and the U.S. 27 traffic corridor. This internal core area is recommended as the focus of study for potential public acquisitions. It's designation and densities would not limit growth in Polk County but direct it to suitable areas where centralized services would be economically feasible.

At the same time the Core Concept would: 1 - maintain a large portion of the area of the potentiometric high, 2 - protect the quality and quantity of water associated with the headwaters of the major rivers, especially the Withlachoochee River, that originate in the Green Swamp, 3 - protect, from pollution, a portion of the area where the Floridan Aquifer outcrops to the surface, 4 - provide a large, mosaic of habitat for wildlife as well as opportunities to connect this hub to large areas of habitat outside the Green Swamp, and 5 - protect existing patterns of agriculture.
The Regional Commission and the Core Concept, it's densities and it's associated recommendations are offered as a total plan. Compromising vital components of this plan would make the work of the Task Force less meaningful.

On behalf of all the Task Force members, I thank you for allowing us to be of service in this vital area.

Sincerely,

Dale Jacobs
Green Swamp Task Force Chairperson

This work is dedicated to Bill Sadowski, former Secretary of The Department of Community Affairs, who passed on during the time the Task Force was at work. Secretary Sadowski brought a renewed vision to the Green Swamp and support to the Task Force process.

The Task Force members would like to thank Ellen Hemmert for her help during the Task Force activities.

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Gratitude is extended to many people for their help, advice and support in putting this report together. It could not have been accomplished without their participation and especially their sensitivity to the short time allotted. I especially would like to thank John Tucker for his expertise and support, without which this analysis would not have been possible. I would particularly like to thank Joe Schaefer, Mike Gurr and Brian Sodt for their help and dedication. The maps and color graphics were possible with assistance from Steve Dicks, Margit Crowell, and Dean Rusk of the Southwest Florida Water Management District, Jim Cox and Kevin Pope of Florida Game & Freshwater Fish Commission, Bruce Kries of the St. Johns River Water Management District, Parrish Simmons of the Central Florida Regional Planning Council and Philip K. Whittman of AT&T Microelectronics in Orlando. Nancy Hemmert's work on the glossary is most appreciated.

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Ellen Hemmert

INTRODUCTION

The Green Swamp is an area of approximately a half million acres in central Florida. It is a shallow basin between the Lake Wales Ridge, the Brooksville Ridge and just north of the Lakeland Ridge and the Winter Haven Ridge. The City of Orlando is to the east, Tampa to the west, Lakeland to the south. It is a mosaic of rivers, swamps, uplands and forests that have been used for a variety of economic endeavors since it was settled. It is also known for its role in maintaining the quality and quantity of the regions freshwater and for its wildlife.

Decades ago the forests' of the Green Swamp were clear-cut as part of the settlement of the area. So completely was this area cut that there are not old trees to show how young the forests of today are. The pine and cypress forests are regrowing. Forestry continues in these regenerated areas. Cattle production, mining and other agriculture crops continue to augment the forestry industry. People live in the swamp, people hunt, fish and appreciate nature in the swamp. People outside the area drink clean, inexpensive water in comfortable quantities. They recreate on the rivers born in the Green Swamp, the area slows flood waters that might rise on their property.

In the early 1970's the value of the area was recognized in a temporary State process called the Area of Critical State Concern Program. This program was meant to encourage the people of the area to take steps to assure that the values of the designated area remained in the future. Concern over previous flooding from severe storms, several large land sale ventures, and the beginning of the Disney entertainment complex to the northeast provided some of the impetus for initiating this process.

Adequate steps were not completed. The designation remains. The concerns remain. Since the early 1970's using the swamp for structural flood control was rejected by scientists and decision makers. They recognized that protecting the natural flood control properties of the swamp was more cost effective than building structures. Remnants of the large land sales of the 1960's remain, but local rules, among other factors, have resulted in little construction. Residential growth continues throughout the swamp at a slow, steady pace. The Disney entertainment complex has prospered and continues to grow, but has had little of the predicted impact in the Green Swamp.

Growth management requirements of the 1980's and 1990's have refocused attention on the process that decision makers, at all levels, have avoided. The lack of change and development pressure in the Green Swamp allowed their attention to be focused in other areas of more immediate concern. The mandate of writing local comprehensive plans has given people a second opportunity to plan the Green Swamp's future. Proposals for large, mixed use developments on the swamps' fringe, as well as the cumulative impacts of the slow, steady increase of scattered homes throughout the swamp, have renewed the concern that uncoordinated development in the Green Swamp will be detrimental to future health of the region.

The Polk County Commission, as part of the final stages of their comprehensive planning process, created the Green Swamp Task Force. This a group of Polk County citizens who have volunteered their time and expertise to aid the Commission in planning the future of Polk County's portion of the swamp. The Nature Conservancy, under contract with Polk County, is providing support to the Task Force. A group of technical professionals have participated in a series of educational presentations to the Task Force and is providing the body of this report. Their analysis addresses conditions throughout the hydrologic Green Swamp.

While scientists and other professionals are more knowledgeable today, natural systems do not always lend themselves to absolute answers. For instance, we may have some understanding of the functions of the Floridan Aquifer or the life history of a swallow-tailed kite; we do not know the exact level of impacts that will adversely affect these things. This report reviews much of the available scientific information on

general topics that relate to the Green Swamp as well as specific data on this area. The early hydrologic descriptions of the swamp remain credible. However, Green Swamp specific data is lacking in several areas. Much remains for future scientific work.

The primary recommendation from the Technical Advisory Committee and the Task Force is that the Green Swamp is a system, with an important role in the larger natural system that is Florida. Policy decisions should address the hydrologic Green Swamp as a system rather than a political pie. The contributors hope this document with be helpful to the County Commissioners in their planning for the future of this area.

Ellen Hemmert

COUNTY COMMISSION CHARGE

THE CHARGE: The fifteen (15) member Green Swamp Task Force (GSTF) is established to comply with the requirements of the Polk County Comprehensive Plan Policy (Policy 2.120-F4). This policy states in part "the Task Force shall examine the effects of on-site disposal systems, of all types of site alteration, of existing/future impacts on the natural functions of the Area of Critical State Concern, and other relevant issues." In addition to these considerations, the Board of County Commissioners approved a list of ten specific tasks for the Task Force to examine. This list is open-ended and the task force may add to this list as the membership determines appropriate.

1. Review and evaluate the basis upon which the Green Swamp Area of Critical State Concern (Green Swamp) was designated.

The Green Swamp was designated an Area of Critical State Concern because the area's natural resources were considered to be of regional and state-wide importance and because of concerns that uncoordinated development could endanger these resources. This was based on three major concerns: 1) protection of the natural functions of the Floridan Aquifer including recharge, and protection of the potentiometric high, 2) protection of wetlands, including origins of major rivers and their natural flood protection, 3) protection of the public investment in land for flood protection, as well as educational and recreational purposes. Concern for the investment in public land remains; however, the concept of structural flood control was abandoned for more emphasis on the importance of natural systems for flood storage.

2. Evaluate the importance and uniqueness of the Green Swamp for the following functions:

a. aquifer recharge;

The Green Swamp is a regionally significant area for recharge of the Floridan Aquifer. Recharge in the Green Swamp is unique because the top Floridan Aquifer is at or near the surface. Recharge, though not the highest in terms of rate, is important in maintaining the potentiometric head of the Floridan Aquifer which directly influences the aquifers productivity over a large area of central Florida. The amount of recharge is dependent on the season of the year and existing water levels. Recharge is a continual process, however during times of high rainfall, when the water table is at the surface, discharged in the form of sheet flow increases. The close connection between the Floridan and surficial aquifers support the wetlands of the Green Swamp.

b. wildlife (flora and fauna) habitat;

The wildlife habitat of the Green Swamp is important because: 1) it is a mosaic of diverse, relatively intact habitats, 2) the large number of species which use the area, 3) its proximity to other areas, and 4) it's growing importance to species, particularly wading birds, that are losing habitat in south Florida. It is unique because of its central location, its connectivity to outside river systems, the potential for impacts within the system to affect species outside the area, future potential for preservation, and hydric uplands. Hydric uplands include pine flatwoods that are saturated for a portion of the year.

c. watershed for surface water;

The watershed for surface water is important and unique because the Green Swamp contains the headwaters for several rivers, and occasionally the Floridan Aquifer discharges to these river basins. Proper functioning of the storage capacity of this watershed is important for flood control and water supply throughout the entire Green Swamp area of influence.

d. floodwater detention, retention, and treatment area;

The Green Swamp is an important site for detention and treatment of floodwaters. Floodwater detention is important because the biota of the wetlands and forested floodplain retard surface water flow. This function has decreased in the past as a result of ditching, draining and the loss of trees in the area. This practice resulted in the need for structural remedies. Retention is usually a need resulting from made-man conditions such as impervious surfaces and is not applicable here. Some treatment does occur as water passes through natural river headwaters; however, surface waters from the Green Swamp are naturally of high quality. These circumstances are unique because the area contains the headwaters of five rivers and because of the influence these rivers have throughout their range.

e. the maintenance of the potentiometric surface of the Floridan Aquifer;

The Green Swamp is important because of its role in maintaining the potentiometric surface of the Floridan Aquifer. The Green Swamp is unique because it is the thickest and highest part of the Floridan Aquifer. The maintenance of the potentiometric surface is important in order to keep the balance of the freshwater/saltwater interface that occurs between the coastal and interior parts of Florida. Alterations to the potentiometric surface have the potential to impact freshwater quantity especially at the base and edges of the freshwater interface. Water quality impacts are of concern because a lowered potentiometric surface could increase recharge of contaminants through the shallow, surficial aquifer that is directly connected to the Floridan Aquifer. Biotic impacts are of concern because natural systems are sensitive to altered hydroperiods.

f. the protection of groundwater quality and quantity; and,

Protection of groundwater quality is important because the Green Swamp is a regionally significant water source and because the potentiometric high is located there. Protection of groundwater quantity is important to flood storage and drinking water supplies. These attributes are unique for their value as a regional water source and flood storage area. The quantity of groundwater is directly related to the type and health of surface vegetation.

g. the headwaters of major rivers in central Florida.

The headwaters of the Withlachoochee and Little Withlachoochee, Peace, Oklawaha, Hillsborough and Kissimmee Rivers each form a portion of the Green Swamp and are important and unique as the spine of the region's natural systems. Impacts in this area could be felt downstream of all these rivers.

3. Review the boundaries of the Green Swamp in light of the unique and important qualities identified as a result of task number 1 and 2 above.

The current boundaries of the Area of Critical State Concern do not include all areas important to the functioning of the Green Swamp. The hydrologic Green Swamp (as shown in pre-designation, scientific studies) was not part of the 1974 designation as an Area of Critical State Concern because: 1) the western portion was considered less important to the natural functions of the area, 2) portions in public ownership or proposed for public purchase were excluded as already being protected, 3) areas not experiencing development pressure in the early 1970's were excluded, 4) the remaining areas not designated were existing or proposed urban areas or were not included for political reasons. Since designation, awareness has increased as to the importance of natural systems and maintaining their integrity. This increase in understanding, in addition to greater development pressures, indicate that the hydrologic Green Swamp should be viewed as one system, whose rivers extend beyond.

4. The effect on the ground water quality and quantity by ground water withdrawal from wellfields (e.g. Cone Ranch and Lakeland Wellfields).

The effect of major groundwater withdrawals in or adjacent to the Green Swamp is not yet known. Such withdrawals have the potential to adversely affect the Green Swamp. Prior to withdrawals from wellfields, within or in close proximity to the Green Swamp, it must be clearly demonstrated that the withdrawal amount will not adversely affect the water quality, quantity or the natural systems of the Green Swamp. Date should be collected and analyzed so that minimum flows and levels can be set for the region.

5. Review and chronicle existing land uses and development trends within the Green Swamp.

Existing land uses in the Green Swamp are principally agricultural and residential. Forestry is the primary use, however, cattle production, sod farming, other agriculture uses and mining occur throughout the area on the same acreage or on distinct parcels of land. There has not been a significant change in the proportion of these uses.

Development trends include single family dwelling units, many of which are manufactured homes and low density rural home sites. These occur throughout the Green Swamp, with a concentration on the western side in the area of Rock Ridge Road. Some Planned Unit Developments (PUD's) are within or proposed in the Green Swamp. A couple of Developments of Regional Impact (DRI's) have been proposed in the area, primarily on the fringe of the Green Swamp. North of Interstate 4, with the exception of Polk City and northeast Lakeland, there is little commercial or industrial use.

6. After the unique and important qualities of the Green Swamp are identified, evaluate how existing land uses and development trends affect those qualities.

Existing land uses and development trends have the potential to adversely affect the important and unique qualities of the Green Swamp and current economic endeavors because:

a. site alterations needed to make land suitable for construction may adversely affect the natural hydroperiod of the surficial aquifer, quality and quantity of recharge, natural water treatment, wildlife habitat, flooding downstream and off-site;

b. additional septic tanks, in areas unsuitable for their use, that are unmaintained and\or improperly installed, may adversely affect water quality and public health;

c. further fragmentation of wildlife habitat by additional roads and development may adversely affect the quality and diversity of wildlife and can interfere with wildlife movement throughout the State;

d. alteration of the Floridan and surficial aquifers for forestry, mining and agriculture practices might adversely affect the hydroperiod necessary to sustain native vegetation and the area's native vegetation;

e. fragmentation of the Green Swamp hinders wildlife and forestry management techniques such as controlled burning, as well as efforts to fight wildfires;

f. groundwater withdrawals may adversely impact the natural systems, including wildlife habitat and forestry production, by altering the natural hydroperiod of the area;

g. increase in the area of impervious surface will result in additional stormwater quality and quantity concerns;

h. cumulative impacts of the above may have significant, adverse affects on the natural functions of the Green Swamp.

7. Review existing federal, state, and local regulations and the quality of enforcement of those regulations. Evaluate whether current regulations adequately protect the unique and important qualities identified in task number 2 above.

There are a number of regulations in place which offer varying degrees of protection for many of the unique and important functions of the Green Swamp. However, other than for hydrologic functions within the ACSC, the level of protection for the Green Swamp is no greater than that for surrounding areas. The primary deficiencies in existing regulations include: 1) deficiencies in the content and scope of the Principles for Guiding Development, 2) failure to protect wildlife values, 3) failure to include all of the Green Swamp within the ACSC, 4) designation of inappropriate land uses and intensities of use, 5) inadequate coordination of planning and regulation for the Green Swamp, 6) failure to assess the cumulative adverse effects of activities within the Green Swamp, and 7) no overall comprehensive management plan for the Green Swamp. Inadequate coordination, implementation, and enforcement of existing regulations also undercut the effectiveness of existing regulatory programs.

8. If deficiencies in existing regulatory parameters are determined to exist as a result of task number 7, recommend the amendment of existing regulations or the adoption of new regulations which will provide an adequate level of protection, including:

The deficiencies identified above could be remedied by making a number of regulatory changes. With respect to the Principles for Guiding Development, the following actions should be taken: 1) DCA should amend The Principles for Guiding Development in the Green Swamp ACSC (Rule 28-26.003, FLA. ADMIN. CODE), to provide more guidance for local governments. The Principles should be amended to reflect current technology and treatment methodologies regarding hydrologic resource protection; 2) The statutory designation of the Green Swamp ACSC (Section 380.0551, FLORIDA STATUTES) should be amended to include all areas within the hydrologic Green Swamp and to require protection of all important natural resource values of the Green Swamp, including, but not limited to hydrology, wildlife, wildlife habitat, wildlife corridors, aesthetic values, and rare or unique habitat. DCA should take the lead in pursuing legislative changes; and 3) DCA should amend The Principles for Guiding Development to require local governments to protect other important natural resource values of the Green Swamp, including wildlife, wildlife habitat, wildlife corridors, aesthetic values, and rare or unique habitat. While the rule could be broadened under existing statutory authority, it would be helpful to first amend Chapter 380.0551.

Wildlife could be better protected by 1) amending Rule 28-26 and Chapter 380 as discussed above, 2) amending water management district rules to provide for creation of wildlife protection zones around rivers, lakes, and wetlands, 3) developing local government ordinances to augment the water management district rules and to protect habitat of upland wildlife species, and 4) designating a core area, based on wildlife values, within which intensive development would be prohibited.

If the boundaries of the Green Swamp are not broadened as recommended above, then regulation in areas outside the ACSC, but within the Green Swamp, could be strengthened by 1) increasing the area

of the ACSC to match the hydrologic boundaries of the Green Swamp, 2) requiring local governments to identify and regulate the Green Swamp as an environmentally sensitive area, based on existing requirements in the Growth Management Act, and 3) amending water management district regulations to create resource based criteria applicable to the hydrologic boundaries of the Green Swamp.

Existing requirements of the Growth Management Act should be strictly enforced to require local government jurisdictions which are adjacent to the hydrologic Green Swamp to regulate lands within their jurisdictions in a manner which prevents degradation of the natural resource functions of the Green Swamp. Specifically, adjacent jurisdictions should be required to coordinate planning and regulation which are compatible with protection of the Green Swamp.

a. regulations which may limit the density and intensity of land uses;

The map that shows the Core Area depicts conceptual categories of land resource suitability, outside of current public ownership. These categories include the "Core", agricultural, suburban and potential development areas. Each of these categories should reflect land use densities consistent with their individual resource protection criteria.

The Core should be the object of detailed study to identify public land acquisition sites. Land use densities must be consistent with discouraging further fragmentation or subdivision. In addition, land use densities should discourage new road construction, which would exacerbate impacts to wildlife such as edge effects and wildlife movement, further conflicting with wildlife resources. Reasonable land use densities would be in the **range of 1 unit per 40 acres to 1 unit per 100** acres. These are consistent with other environmentally sensitive areas of the State and other areas of the country.

The agricultural areas are intended to permit continued agricultural and extractive activities, provided they are otherwise consistent with resource preservation criteria within the Green Swamp. This area is not intended to encourage nonagricultural related residential development. Rural farmstead development in the **range of one unit per 20 acres to one unit per 40 acres** would be appropriate.

The suburban area is intended to reflect existing development in areas of the Green Swamp. It is also intended to provide for the large lot rural residential land use. Land use densities of one **unit per five acres to one unit per 20 acres would be appropriate.**

b. the regulation of agricultural activities; and,

Evidence was not found that indicated current agriculture regulatory programs are allowing significant adverse impacts to the Green Swamp. Evidence exists that surface drainage can change the hydroperiod and can affect wetlands. Studies should be conducted to consider the cumulative impacts of forestry practices, sludge disposal, agricultural chemicals and drainage on surface waters, groundwater, wetlands and wildlife.

c. the regulation of mining activities.

Evidence was not found that indicated sand and limerock mining regulatory programs are allowing significant adverse impacts to the Green Swamp. Studies should be conducted to consider the cumulative impacts of mining activities on surface waters, groundwater, wetlands, and wildlife.

need coordinated network of piezometers measuring water levels in wetlands & in aquifer

9. Determine if areas of the Green Swamp should be acquired for preservation and protection of valuable resources and natural functions. Establish criteria for ranking such areas and recommend priorities for acquisition. Also, investigate alternatives for funding acquisitions and make recommendations on securing funding sources.

The Core on Map O-1 is an area that should be further evaluated for potential acquisition sites. This area is recommended primarily for its potential wildlife habitat value. Ranking criteria should be based primarily on resource concerns. This should include overall quality of habitat and protection of water resources including diversity of habitat and species, number of listed species, potential to enlarge existing publicly owned habitat, connectivity, recharge and recreation value. The potential for restoration and management, as well as the problems associated with these issues, should also be taken into consideration.

It is likely that acquisition potential would be significantly enhanced if the local governments associated with the Green Swamp had programs that would provide match funds for other acquisition programs such as the Carl Program or Save Our Rivers or other state and federal programs. This could also provide funding for projects individual to each local government. Funding sources could include, but are not limited to, bonding with ad valorem taxes, a capital improvement program, ad valorem taxes, documentary stamp taxes, donations, and sales taxes.

10. Investigate the desirability of establishing a Land Authority for the Green Swamp Area of Critical State Concern pursuant to Section 380.0663, Florida Statues. Recommend actions such a Land Authority should pursue.

✓ Tac coord group

Chapter 380 provides authority for individual counties to create land authorities to address issues relating to an ACSC. A primary purpose of a land authority is to provide a mechanism whereby lands within an ACSC can be purchased when environmental protection regulations result in undue hardship to a landowner. Land authorities as provided for in Chapter 380 would be of limited value within the Green Swamp ACSC. A regional authority with broader powers could be of great value in protecting the Green Swamp. Such an authority could develop a comprehensive management plan for the entire Green Swamp based on its values and functions as viewed on a regional scale, not simply as they appear to each individual local government considering its case alone. Natural resource features in the Green Swamp do not conform to political boundaries. Most regulatory programs in the Green Swamp do not consider how development in one area affects adjacent or nearby areas. For example, one jurisdiction might restrict development in an upland strand it has identified as an important wildlife corridor while an adjacent jurisdiction might allow more intensive uses in the same area, thereby diminishing the corridor value of the entire area. Similarly, most regulatory programs do not consider the cumulative effects of individual projects on the overall function and integrity of the ecosystem.

These problems could be remedied through development of a single comprehensive plan for the entire Green Swamp which carefully evaluates natural resources and provides for appropriate levels of regulation depending upon the sensitivity and public value of the natural resource involved. Much of the background information needed to develop such a plan already exists in individual local government comprehensive plans. The plan should be developed by a balanced regional authority composed of representatives from each affected local government and state agency. Implementation of the plan could be accomplished through existing local government growth management programs. Oversight of local government implementation could be conducted by the regional authority or by DCA. Development and effective implementation of a comprehensive plan could provide the basis for de-designation of the Green Swamp as an ACSC. Authority for development of a comprehensive plan probably already exists in Chapter 380, although DCA might need to amend its rules. Amendment of Chapter 380 or creation of a new statute would probably be required if local government compliance with the plan was to be mandatory or if a regional authority was established with oversight authority.

GREEN SWAMP TASK FORCE RECOMMENDATIONS

I. REGIONAL COMMISSION

A. Polk County should try to establish a Regional Authority by amending Chapter 380, FS, and if that is not possible, request new Florida Statutes to address the proposed regional authority.

Polk County should set up a review panel within the County to review the implementation of the recommendations of the Green Swamp Task Force. Polk County should approach the other counties within the hydrologic Green Swamp to join with them to approach the legislature, the Department of Community Affairs, and the Water Management Districts to create an on-going, permanent Green Swamp Commission.

Funds should be established for a staff person to coordinate the Green Swamp Review Panel's work and report to the Panel. The staff person's duties should include such things as seeking funding from state and federal funding programs.

II. ACQUISITION/PRESERVATION MECHANISMS

A. The County should take a proactive stand to preserve, conserve and restore the hydrologic Green Swamp through acquisition.

The area designated as the Core should be further evaluated for potential acquisition sites.

A County Acquisition Program should be created with selection committees made up of volunteers appointed by the County Commission. A separate team should be used for real estate negotiations and financial planning. This team should be made up of a county attorney, acquisition staff person, and other staff knowledgeable of such dealings. Both groups should be overseen by the County Commission.

The selection committee should create a ranking system for land acquisition. Ranking criteria should be based primarily on resource concerns. This should include overall quality of habitat and protection of water resources including diversity of habitat and species, number of listed species, potential to enlarge existing publicly owned habitat, connectivity, recharge and recreation value. The potential for problems associated with restoration and management should also be taken into consideration.

The acquisition potential would be significantly enhanced if the local governments associated with the Green Swamp had programs that would provide match funds for other acquisition programs such as the CARL Program or Save Our Rivers. This could also provide funding for projects individual to each local government. Funding sources could include, but are not limited to, bonding with ad valorem taxes, capital improvement program, ad valorem taxes, documentary stamp taxes, sales taxes, donations, conservation easements. Local governments could pursue the establishment of off-site mitigation land banks so that this designation can be considered by DNR as a local matching effort.

Federal, state, regional, and local acquisition programs should establish procedures for joint participation of their programs.

Federal, state, regional, and local acquisition programs should develop alternative funding sources for land acquisition and management in the Green Swamp.

The Florida Legislature should make a significant increase in the funding of the CARL Program and permanently fund Preservation 2000 to facilitate acquisition of the properties recommended in this report which are located in the Green Swamp.

The County Commission should direct the acquisition selection committee to look at various tax incentives for landowners

III. SEPTIC/SEWAGE CONCERNS

A. Current Polk County policy requiring that septic tanks be setback from waterbodies is not adequate to protect the natural resources of the Green Swamp. The current definition of waterbodies should be clarified to specifically include lakes, rivers and wetlands. Placement of septic tanks should also be limited to suitable soils as defined by the Soil Conservation Service.

B. Septic tanks should be allowed in the Green Swamp, providing they are in areas suitable for their use, are maintained and properly installed and do not adversely affect water quality and public health. They should also be properly monitored.

It is suggested that a study and analysis be conducted that includes the following:

- an assessment of the cumulative impact of existing on-site tanks (OST's) on water quality in the Green Swamp;
- an accurate soils map
- a map showing potentiometry and flow systems in the Florida Aquifer;
- a map showing floodplains, flood-prone areas, flooding soils;
- a map showing sorption potentials for the soils (can be derived from the soils map and from IFAS/SCS data, with a few, on-site tests for confirmation and fine tuning;
- a map showing the distribution of and depth of the surficial aquifer, and near surface clays;
- a map showing the thickness and distribution of the surficial aquifer, where it is locally present;
- a map showing the degree of interconnectivity of the surface water and the surficial and Floridan Aquifer;
- a map of sinkholes, other karst features, and fractures;
- maps showing existing population density, land use, wells, and OST density;
- these maps should be interpreted and combined into a single map that shows categories of site specifications, OST densities, design requirements, and site suitability.

It is suggested that changes in design criteria include consideration of the following:

- increased setbacks;
- double design capacities of tank and sorption fields;
- dual sorption fields in order to rest one while the other is operative, thus increasing efficiency and lifespan;
- liners.

It is suggested that the following initiatives be considered:

- require cleaning of the tanks on a regular schedule (two-year schedule regardless of size, use, etc. is recommended);
- require proper disposal of septage, in a way that does not increase the threat to the swamp ecosystem;
- require a Professional Engineer or Professional Geologist sign off on any septic system to be installed in poorly trained soils, risky sites or where mounding is proposed;
- require system installers to be trained in proper techniques;
- fund a study to test design of mounded OSTs in order to improve the design and reduce the failure rate;
- consider a renovation of poorly designed systems at the time of failure and other appropriate times;
- set variable limitations on development density, multiple options for OST designs and requirements for design responsibility;
- offer tax or land use incentives to users who opt for good alternative OST design;
- develop options for "gray water" disposal to reduce loadings on OSTs. This must be in consideration of two constraints. First, the gray water cannot drain directly into surface waters or other systems where adverse consequences will result. Second, the separation of gray and brown water must be carefully done so that no hazardous chemicals, viruses or harmful bacteria enter the gray-water system. Also, the function of the OST with the reduced loading must be considered, so as not to increase OST failure since there is less dilution from diverted gray water. The design of the OST must account for the change use of aeration systems.

Within the Green Swamp, no septic tanks should be allowed in wetlands and/or floodplains.

No mounded septic tanks should be allowed in wetlands and/or floodplains.

C. Sewage treatment plants should be encouraged within the potential development and suburban areas of the Green Swamp as depicted on the Core Map.

D. Sewage treatment plants permitted within potential development and suburban areas of the Green Swamp should have a minimum size of 100,000 gallons per day.

E. The spreading of septage and/or sludge should be prohibited within the hydrologic Green Swamp.

F. If spreading is to be allowed, current regulations are not adequate to protect the natural resources of the Green Swamp. A permitting process under the land development regulations should be established which regulates the sources and movement of materials and requires monitoring of permitted sites. It is suggested that a study and analysis be conducted that includes the following:

- an assessment of the cumulative impact of existing on-site tanks (OST's) on water quality in the Green Swamp;
- an accurate soils map
- a map showing potentiometry and flow systems in the Floridan Aquifer;
- a map showing floodplains, flood-prone areas, flooding soils;

- a map showing sorption potentials for the soils (can be derived from the soils map and from IFAS/SCS data, with a few, on-site tests for confirmation and fine tuning;
- a map showing the distribution of and depth of the surficial aquifer, and near surface clays;
- a map showing the thickness and distribution of the surficial aquifer, where it is locally present;
- a map showing the degree of interconnectivity of the surface water and the surficial and Floridan Aquifer;
- a map of sinkholes, other karst features, and fractures;
- maps showing existing population density, land use, wells, and OST density;
- these maps should be interpreted and combined into a single map that shows categories of site specifications, OST densities, design requirements, and site suitability.

G. Polk County should encourage alternative methods to septic systems, (i.e. aeration units, dry units, etc.) having a higher degree of treatment efficiency.

H. The hydrologic Green Swamp requires special conditions for gray water disposal. It is recommended that options be developed for "gray water" disposal to reduce loadings on OSTs. This must be in consideration of two constraints. First, the gray water cannot drain directly into surface waters or other systems where adverse consequences will result. Second, the separation of gray and brown water must be carefully done so that no hazardous chemicals, viruses or harmful bacteria enter the gray-water system. Also, the function of the OST with the reduced loading must be considered, so as not to increase OST failure since there is less dilution from diverted gray water. The design of the OST must account for the change in composition of the waste water.

IV. LAND-USE ISSUES

A. Any activity which damages water quantity, quality and wildlife habitat should be prohibited within the Green Swamp. Land uses should vary by location.

B. Within the Area of Critical State Concern, it is suggested that projects with certain land use and environmental permits and approvals should be vested until their expiration date and not be subject to the application of rules based on Task Force recommendations. These permits and approvals shall include specifically:

1. development orders approving a Development of Regional Impact;

2. final Planned Unit Developments (PUD) approval with all approvals current;

3. recorded plat approvals:

4. building permits;

5. jurisdictional determinations issued by government agencies; and

6. construction permits or approvals issued by governmental agencies prior to the date of adoption of any such rules.

C. All real estate transactions within the hydrologic Green Swamp should include the following disclosure in their contract:

> **"The County/City Government of _____ County, Florida has not promised or agreed and may not intend to provide streets, drainage, water, utilities, or other improvements to this land. This property is located within an Area of Critical State Concern and the hydrologic Green Swamp and has specific regulations affecting the use of this property."**

This disclosure statement should be required on all real estate deeds, contracts, permits and other official documents.

D. Public incentives should be provided to encourage future land development activity to occur in a manner consistent with restoration of the natural hydroperiod.

Public incentives should be provided to existing landowners to restore disturbed portions of their property to the natural hydroperiod.

V. SURFACE WATER PROTECTION MEASURES

A. Polk County should apply to have the Withlacoochee and Oklawaha River headwaters designated as Outstanding Florida Waters.

B. In addition to existing Comprehensive Plan and existing water regulations, Polk County should adopt the following regulations to adequately protect surface water within the Green Swamp. In addition, regulations relating to water resources should be strictly enforced and enforcement appropriately funded.

1. discontinue platting in the wetlands;

2. eliminate the 10% impact phrasing; and

3. establish a land holding mechanism for wetland areas in the Green Swamp.

C. On-line retention treatment of stormwater in residential rear yard areas may be allowed in accordance with SWFWMD Technical Procedure Number TP/SWD-024, provided additional criteria for setbacks are implemented which are based on slope, soil type and vegetative cover. Wetland buffers should minimize groundwater drawdown in the wetlands (maintenance of natural hydroperiod), minimize the transport of sediment into wetlands, and protect wildlife. Criteria to be used to determine buffer widths should be:

a) adjacent landscape associations;
b) size of wetland;
c) height of surficial aquifer at the center of wetland in wet season;
d) soil type and depth to impervious layer;
e) slope of buffer area from upland to wetland;
f) amount of drawdown at water control structure if involved and;
g) wildlife use including feeding and breeding needs.

D. No low-density rural subdivisions should be permitted within the Green Swamp in a manner consistent with SWFWMD clarification memo number CM/SWP-42.

VI. DENSITY/INTENSITY ISSUES

A. Development density should be restricted.

The map that shows the Core Area depicts conceptual categories of land resource suitability, outside of current public ownership. These categories include the "Core", agricultural, suburban and potential development areas. Each of these categories should reflect land use densities consistent with their individual resource protection criteria.

The Core should be the object of detailed study to identify public land acquisition sites. Land use densities must be consistent with discouraging further fragmentation or subdivision. In addition, land use densities should discourage new road construction, which would exacerbate impacts to wildlife such as edge effects and wildlife movement, further conflicting with wildlife resources. Reasonable land use densities would be in the range of 1 unit per 40 acres to 1 unit per 100 acres. These are consistent with other environmentally sensitive areas of the State and other areas of the country.

The agricultural areas are intended to permit continued agricultural and extractive activities, provided they are otherwise consistent with resource preservation criteria within the Green Swamp. This area is not intended to encourage nonagricultural related residential development. Rural farmstead development in the range of one unit per 20 acres to one unit per 40 acres would be appropriate.

The suburban area is intended to reflect existing development in areas of the Green Swamp. It is also intended to provide for the large lot rural residential land use. Land use densities of one unit per five acres to one unit per 20 acres would be appropriate.

B. With implementation of the Core Area concept, the County no longer needs to require that all new development within the Green Swamp, which creates three or more lots, reserve at least 70% of the land area.

C. With implementation of the Core Area concept, the County no longer needs the interim restriction policies within the negotiated settlement between Polk County and the Department of Community Affairs (DCA).

D. Non-residential development intensities should only be permitted in a manner consistent with the Core map and other recommendations within this report.

E. With implementation of the Core concept, it will not be necessary for the County to petition DCA and/or the state legislature to lower the Development of Regional Impact (DRI) thresholds within the Green Swamp.

VIII. FLOODPLAIN PROTECTION MEASURES

A. The buffers established in the negotiated settlement for 100-year floodplains are not adequate to protect floodplains and wildlife concerns within the Green Swamp.

B. Existing policies are not adequate to protect floodplains within the Green Swamp. Where possible, development should occur outside the 100-year floodplain and be concentrated as far from water bodies as practicable. If development is considered, no net floodplain encroachment (fill) should be permitted within the 100-year floodplain. (as adopted or modified by FEMA).

Implementation of this recommendation should be done by modifying the Districts MSSW rules and local land development codes. All developments in the floodplain should comply with existing buffer requirements and with minimum standards and requirements.

C. The following uses may be allowed in floodplains within the Green Swamp, provided floodplain impacts are unavoidable and floodplain impacts will be properly mitigated. No other uses should be allowed within Green Swamp floodplains.

1. access to the site;

2. internal traffic circulation, where other alternatives do not exist, or for purposes of public safety;

3. utility transmission, distribution and collection lines;

4. pre-treated storm-water management;

5. mining that meets state and federal regulations; or

6. for the purpose of preventing all beneficial use the property from being precluded.

IX. GROUNDWATER AND AQUIFER RECHARGE PROTECTION MEASURES

A. The existing regulations and Comprehensive Plan are not adequate to protect groundwater within the Green Swamp, and specific regulations are needed to protect and enhance surface water and groundwater. They are as follows:

1. Stormwater - Recharge and Flood Protection

a) Pre-Post Development Stormwater Runoff - Peak Rate (Protection from flooding) - The post-development peak rate of discharge shall not exceed the pre-development peak rate of discharge for the 25 year/24 hour storm event.

b) Storage - A system may not cause a net reduction in flood storage within the 100 year floodplain.

c) Pre-Post Development Stormwater Runoff - Volume (Recharge) - Developed sites shall be designed to retain and infiltrate the total run-off generated by a 25 year frequency, 24 hour duration storm event. This volume shall be recovered within 14 days.

d) Maintenance of Stormwater Retention Ponds - Stormwater management facilities must be designed to accommodate maintenance equipment access and to facilitate regular operational maintenance such as underdrain replacement, unclogging filters, sediment removal, mowing and vegetation control. Monitoring and operational maintenance requirements shall include:

- Periodic inspections of the stormwater management system (with written inspection reports to the water management district) to ensure that the system is functioning as designed and permitted.
- Inspection reports shall be submitted 1 year after construction and every year thereafter to the relevant water management district.
- A registered professional (engineer or geologist) must sign and seal the report certifying the stormwater management system is operation as designed.
- The following operational maintenance activities shall be performed on all permitted systems on a regular basis or as needed:

a) removal of trash and debris,
b) inspection of inlets and outlets.
c) removal of accumulated sediments and decaying organic matter from pond bottom and sediment sumps,
d) stabilization and restoration of eroded areas,
e) mowing and removal of grass clippings,
f) aeration, tilling, or replacement of topsoil as needed to restore percolation capacity (note: if the topsoil is tilled or replaced, vegetation must be established on the disturbed surface).

e) Recovery of Pollution Abatement Volume - Pollution abatement requirements shall be the first 1 inch (or 2.5 inches times the impervious area) of runoff for the developed site, or as per regulations of SWFWMD and SJRWMD, pollution abatement volume shall be recovered within 72 hours.

f) Quantity of Runoff from Impervious Surfaces - Runoff shall be discharged from impervious surfaces through retention areas, detention devices, filtering and cleansing devices, and/or selected DER Best Management practices (BMP, for projects which include substantial paved areas, such as shopping centers and high density development, provisions shall be made for the removal of oil, grease, and sediment from stormwater discharges.

g) Groundwater quality Monitoring - Stormwater Management Ponds - Stormwater retention ponds receiving runoff from commercial or industrial development shall have a water quality monitoring system consisting of two wells, one upgradient and one downgradient well installed at appropriate locations and depths to yield groundwater samples from the uppermost aquifer that:

- represent the quality of background water that has not been affected by leakage from the ponds; and
- represent the quality of groundwater passing the compliance boundary hydraulically downgradient from the pond.

The property owner shall have each of the wells sampled simultaneously and analyzed each six months by a laboratory certified by FDER for the following parameters:

Heavy Metals:	Lead, zinc, copper
Nutrients:	Total Nitrogen, Total Phos.
Oxygen Demanding Substances:	BOD (5 day)
Sediments:	TSS
Pathogens:	Total coliform

The property owner shall cause the laboratory results to be submitted to _____ of Polk County.

If the development includes on the site the manufacture or storage of materials considered to be hazardous substances as listed in EPA's current list, then in such event the owner may be required to provide additional wells, a more frequent sampling and reporting schedule and testing for additional parameters to the extent reasonably required in accordance with the risk presented.

h) Irrigation & Landscaping - Irrigation of landscaped areas with stormwater runoff shall be encouraged. Xeriscape is also encouraged to keep the evapotranspiration at or below pre-development levels. An attempt should be made to save existing trees and natural vegetation. Encourage existing sites to install xeriscape and irrigate with stormwater run off.

i) Site Alterations - Recharge or storage characteristics of the site should not be altered significantly. After grading, high permeability soils should not be replaced with low permeability soils in the uppermost 6 feet.

j) Plans - Preliminary plans submitted for review should include:

- the location and size of interior and exterior areas and structures to be used for, storage, use, loading/unloading, recycling, or disposal of hazardous substances;
- the locations of all underground and aboveground tasks for such uses as fuel storage, waste oil holding tanks, chemical storage, hazardous waste storage, collection of contaminated stormwater or wash water, and all similar uses; and
- the locations of exterior drains, dry wells, catch basins, retention/detention areas, sumps, drainage wells and other facilities designed to collect, store, or transport stormwater. The point of discharge for all drains and pipes shall be specified on the site plan. Sites at which hazardous substances are stored, used or generated should be designed to prevent spills and discharge to the air, surface of the ground, groundwater, lakes, streams, rivers, or wetlands.

2. Wastewater - Spray Irrigation of Re-use Water

Spray irrigation of re-use water shall be encouraged where feasible and systems shall be designed as per FDER regulations.

3. Water Conservation Measures

The use of computer operated landscape/golf course irrigation systems using rain or soil-moisture sensors to override in the event of significant rainfall and the use of xeriscape landscaping principles shall be encouraged. Limitation of lawn sprinkling from 5:00 p.m. to 9:00 a.m. Encourage implementation at existing facilities.

4. Wellfields

The development of public water supply Upper Floridian Aquifer wellfields of capacity greater than 1.8 mgd (averages 3.6 mdg maximum) should be discouraged within the potential Development Areas of the ACSC Lower Floridian Aquifer large capacity wellfields, can be considered in this area. The objective of using the lower Floridian is to mitigate drawdown impacts to the surficial aquifer system and resulting dehydration of wetlands, lakes, streams, upper Floridian potentiometric surface, and other water bodies, especially within the core.

For large wellfields, an environmental monitoring/mitigation plan shall be submitted which describes monitoring within the 1 root water table drawdown contour as indicated by a verified model, among other things, the plan/report shall include/address:

a) measures for ensuring the continued survival of wetlands during drought with continuing public supply requirements;
b) sinkhole monitoring within 0.5 mile of the wellfield;
c) groundwater level monitoring of the water table and artesian aquifers within the radius of influence;
d) rainfall monitoring;
e) reduction in water levels of legal adjacent users;
f) the possibility of inducing natural or man-made contaminants into a usable portion of any aquifer;
g) potential degradation of water quality;
h) potential damage to crops and other vegetation causing financial harm to owner;

i) monitoring levels or flows of lakes, wetlands, impoundments, streams, or other water courses within the radius of influence of the pumpage; and
j) monitoring of habitat of endangered or threatened species,
k) a detailed outline of the proposed mitigation measures in the event the wellfield pumpage creates adverse environmental impacts.
l) The permittee shall investigate complaints within one mile of the property boundaries of the wellfield site which are related to withdrawals at the wellfield.
m) Depending on the size and location of the wellfield, regional monitoring wells may be required to monitor water levels (with continuous water level measurements) in the surficial and Floridian aquifers.

5. Additional Studies
The groundwater under the Green Swamp ACSC can be more effectively managed if more data is available on groundwater levels and groundwater quality. It is recommended that additional surficial aquifer and Floridan aquifer monitoring wells be installed to monitor the level and water quality of the Floridan aquifer within the Green Swamp ACSC to assist in the identification of critical areas and areas of high recharge.

B. It is the recommendation of the Task Force that there be no exportation of water from the hydrologic Green Swamp area.

X. WETLAND PROTECTION MEASURES

A. No residential development should be allowed in wetlands.

B. Wetland mitigation should be allowed within the Area of Critical State Concern.

C. The following uses may be allowed in wetlands, provided wetland impacts are unavoidable and wetland impacts will be properly mitigated.

1. access to the site;

2. internal traffic circulation, where other alternatives do not exist, or for purposes of public safety;

3. utility transmission, distribution and collection lines;

4. pre-treated storm-water management;

5. mining that meets state and federal regulations; or

6. for the purpose of preventing all beneficial use of the property from being precluded.

D. No commercial and/or industrial land uses should be permitted in wetlands.

E. Polk County needs additional regulations to adequately protect wetlands within the Green Swamp. Additional specific recommendations are provided below and within the remainder of this document.

1. In order to provide incentives to wetland landowners to encourage longer rotation ages on standing trees, a restructuring of the property tax system in the Green Swamp should take place. This should include a provision that a landowner with forested wetlands, not only pays no property tax on the wetland portion that meets a certain stocking level, but receives tax credits equal to that rate which can be applied to other agriculture zoned land in the Green Swamp.

2. Forestry in the Green Swamp should rely on statewide silviculture Best Management Practices (BMPS) which are being produced by a special Statewide Task Force. Monitoring compliance and increased surveillance should be done with the aid of a Timber Harvesting Notification System and by the Division of Forestry personnel.

3. The County should request a contract with the Florida Department of Agriculture and Consumer Services, Division of Forestry for an additional county forester whose primary responsibilities will be within the Green Swamp and include:
a) Monitor timber harvesting operations for compliance with silvicultural B.M.P.'s.
b) Train landowners and timber harvesters on silvicultural B.M.P.'s.
c) Track and record logging occurrence data.
d) Assist landowners with silvicultural information and technical advice. This will require legislative approval. The County's cost has traditionally been $3,000.00 per year and office space with phone.

4. The County should establish a timber harvesting notification system which will require that anyone harvesting timber in wetland areas of the Green Swamp complete a two-part form and deliver one copy to Polk County officials. The form will advise the county of the person responsible, landowner, location, length of time of operation, methods (equipment and harvesting criteria), and will stress the importance of complying with silvicultural Best Management Practices. This will facilitate more complete monitoring for compliance with Silvicultural B.M.P.'s. It will also help quantify the magnitude of wetland logging that occurs in the Green Swamp. It will also allow for studying regeneration results.

5. The Green Swamp Review Panel should evaluate the appropriateness of revised Silviculture Best Management Practices by January 1993 to determine of further restrictions on logging operations are warranted. They should also evaluate the Hillsborough County Regulations on silviculture to see if they should be adopted in Polk County.

6. Polk County should endorse and issue a proclamation which recognizes that:
a) Prescribed fire is a critical land management tool.
b) Much of the vegetation in the Green Swamp is fire dependent.
c) Florida legislature passed Statute 590.026 that recognizes a landowners right to conduct prescribed burns without liability for damage or injury caused by fire or resulting smoke, unless negligence is proven.
d) Prescribed fires reduce accumulated fuels and consequently lessen the likelihood and severity of fires.
e) Complaints do occur over concern for fire and particularly smoke from prescribed fires.

7. Polk County should support the Agriculture Conservation Program and Stewardship Incentive Program which will be administered by the Florida

Department of Agriculture and Consumer Services, Division of Forestry and Agricultural Stabilization & Conservation Service. These programs provide federal cost-share funds to help landowners establish trees. Pond and bald cypress trees can be planted and the landowner can be reimbursed for approximately 65% of the cost of planting. Polk County can assist by providing help in collecting seed in the fall. This will require approximately 400 man hours in a two week period in September or October. The trees will be grown in Division of Forestry nurseries and sold at cost to landowners. The trees will be planted in wetland areas where regeneration is inadequate.

8. The County should support a series of in-depth interviews with long time residents in the Green Swamp, compile a history of past agricultural and silvicultural activities and personal recollections. Information which parents and grandparents passed down to these folks may provide an important base to future managers of the Green Swamp. For example:
a) What was vegetation type on what is now improved pasture?
b) How do today's cypress dome systems compare to earlier times?
c) What was the vegetation like along river systems?
d) What was the ratio of pine to cypress?
e) What utilitarian use was the cypress put to?
f) What were annual fluctuations of water levels?
g) What was the significance of cypress stands?
The interviewers should also solicit for old landscape photos which can be borrowed and reproduced for future reference. This material should be archived and made readily available at the Polk County Historical and Genealogical Library

9. The County should encourage, support and fund research at the university level aimed at wetland ecological management, especially silvicultural aspects.

10. The County should support an inmate and Community Service tree planting program in the Green swamp for public lands with inadequate cypress regeneration. The Florida Department of Agriculture and Consumer Services, Division of Forestry is available for technical assistance and can help with providing seedlings at cost.

11. The County should support studies conducted to consider the cumulative impacts of agriculture and mining activities on surface waters, groundwater, wetlands, and wildlife.

F. Hydric soils with no wetland vegetation, within the 100 year floodplain, should be protected from development.

XI. MINING CONCERNS

A. The Task Force is concerned about the impacts of mining in the Green Swamp for all criteria in the Commission's ten charges and particularly #6. The Task Force feels that additional studies are necessary before specific recommendations can be made to the Commission.

XII. ROAD CONCERNS

A. Extension of roads within the Green Swamp Core Area should be the County's lowest priority.

Any road construction which takes place in the Green Swamp should meet DOT standards with regard to construction and materials.

B. Crossings of rivers, and named or major tributaries should be discouraged. If considered, they should be reviewed on a site specific, case by case basis, shall be located to the greatest extent practicable with existing crossings, and should be minimized to the greatest extent practicable. New or retrofitted river or tributary crossings shall be designed:

1. to prevent adverse impact to water quality;

2. to prevent adverse impacts to the free flow of the river; and

3. to prevent the creation of major obstacles to the movement of aquatic and wetland dependent species.

Applicants for river crossings shall be required to be responsible for maintaining the river crossing from trash and debris to the greatest extent practicable.

XIII. INTERGOVERNMENTAL MECHANISMS

A. The DCA, DNR, DER, and/or the Water Management Districts and applicable agencies should make the changes proposed in this Report.

XIV. ADDITIONAL STUDIES ISSUES

A. It is recommended that the following studies be pursued:

1. It is suggested that minimum flows and levels must be established by Southwest Florida Water Management District and St. Johns River Water Management District for rivers and tributaries of the Green Swamp.
2. It is suggested that within one year DER, the Water Management Districts, with the cooperation of Polk County and the Division of Forestry, develop and implement, by rule, a permitting system for high intensity/high density agriculture operations based on best management practices or other criteria specific to the agricultural industries and specific to the Green Swamp. The specific criteria or best management standards should ensure that such operations will be in full compliance with state water quality standards. Until that time, the DER's current policy of review of such agricultural operations under a test of reasonable assurance of no adverse impact should continue. The permitting program should provide for upgrade and permitting of existing high intensity, high density agricultural operations within three years of rule implementation.
3. It is suggested that a program be developed and implemented by the Water Management Districts, Polk County, and the Division of Forestry to institute best management practices to control and reduce nonpoint source pollution within the Green Swamp.
4. It is suggested that existing water quality monitoring programs be evaluated by the Water Management Districts to determine whether to continue and/or expand these programs to include:

a) better coordination and more comprehensive monitoring efforts,
b) linkage to regulatory actions and programs,
c) borrow pit monitoring, and
d) monitoring of tributaries.

5. It is suggested that emergency action procedures be developed by Polk County to include a timely monitoring response and remediation of spills of contaminants which could potentially affect the Green Swamp.
6. It is suggested that a program be developed by the Water Management Districts and Polk County to monitor the use of ground water within the Green Swamp. Particular emphasis should be placed on the maintenance of wetland hydroperiods. The program should consider innovative means to decrease the use of groundwater such as trading effluent to industrial users to decrease their overall use. The Task Force also recommends that Polk County actively pursue EPA funding for this program.
7. It is suggested that a hydrologic study be developed to identify, prioritize and implement feasible aquatic habitat restoration projects.
8. It is suggested that the State of Florida should contract with the Water management Districts and the Regional Planning Councils to identify the numbers and locations of vacant lots and subdivided properties which do not meet the minimum requirements of Rule 10D-6, Florida Administrative Code. This should be done for the purpose of phasing out the vested right provisions for permitting of pre-1972 undersized parcels.
9. It is suggested that the Central Florida Regional Planning Council, the East Central Florida Regional Planning Council, Withlacoochee Regional Planning Council, and Tampa Bay Regional Planning Council or a Regional Land Authority, prepare a unified, comprehensive management plan and principles for guiding development for the entire Green Swamp for inclusion in their Comprehensive Regional Policy Plans.
10. It is suggested that revision of the property tax structure for landowners with forested wetlands be considered by Polk County. The revision should make it possible for them to receive compensation in return for leaving their land forested and for practicing sound silvicultural practices. Current Polk County Property Tax Rates are:

Developable land	$800	per acre
Pasture	$80 -$250	per acre
Scrub-Marsh	$30 - $50	per acre
		(includes cypress domes)
Lake Bottom	$10	per acre

11. The County should support studies conducted to consider the cumulative impacts of agriculture and mining activities on surface waters, groundwater, wetlands, and wildlife.

XV. PRIORITIES/TIMING ISSUES

A. The Task Force recommends the following as priority actions to the Polk County Board of County Commissioners:

1. Establishment of Regional Commission and Review Panel (I)
2. Establishment of an Acquisition Program and it's Funding (II)
3. Prohibition of Sludge Disposal (III E)
4. Placement of the Disclosure Statement on all Real Estate Transactions (IV C)
5. Pursuing Outstanding Florida Waters (OFW) Status for the Withlachoochee and Oklawaha Rivers Headwaters (V A)
6. Implementing the Core Concept (VI)
7. Implementing the Recommendations in the Land Use Section (VII)
8. Implementing the Floodplain Protection Measures (VIII)
9. Implementing the Groundwater and Aquifer Recharge Protection Measures (IX)
10. Pusue Interviewing Long-Time Residents (X E 8)

XVI. COMPREHENSIVE MANAGEMENT PLAN

A. A Comprehensive Management Plan should be written to consider the following issues in detail:

Sensitive areas such as wildlife habitat, wildlife corridors, recreational, scenic, and those of unique or rare ecological value should be designated and mapped.

Wildlife corridors should be defined as shown on the Core map. Land use controls and conditions should be written for wildlife corridors.

Additional regulations to protect wildlife within the Green Swamp should be adopted. These regulations are needed in addition to the existing Comprehensive plan and regulations.

A management program that provide the best protection for the wildlife resources of the Green Swamp, while avoiding negative impacts and costly mistakes, should implement the following recommendations:

1. Identify the most critical and sensitive ecological communities within the Core area and delineate a contiguous preserve consisting of large diverse habitat areas connected by effective corridors. Restoration potential should be a consideration. Areas of remaining scrub should be considered a priority and connected to other communities. This effort should include an inventory of the flora and fauna, including listed species and current and potential nesting, roosting, breeding, and foraging sites of wading birds.
2. Design a study that will evaluate the long term effectiveness of this management and protection strategy in preserving current biological diversity.
3. Apply buffers (development, including agriculture, set-backs) to all wetlands within the Core Area.
4. Develop and implement standards for this preserve that integrate agricultural, silvicultural, recreational and other human activities that may not be compatible with wildlife protection objectives.
5. Develop and implement a management scheme (e.g. prescribed burning) that will help to maintain the best landscape diversity and habitat values. This management plan should prioritize habitat that is needed for species in danger of extinction and other biota that are indigenous to the area. Secure adequate funding for trained staff and operating expenses.
6. Design and construct a system of underpasses for the roads intersecting the Core Area that will provide safe passage for wildlife.
7. Identify and utilize the best system for acquiring lands within the delineated preserve and place them into public ownership.
8. Develop and implement standards for land use adjacent to this preserve that prohibit activities that are not compatible with wildlife protection objectives.
9. Establish a moratorium on future development and other potentially detrimental land uses within the Core area until a preserve is delineated and protected.
10. Develop a landscape ordinance that requires the use of plants indigenous to communities in the Core Area and restrict the removal of understory vegetation so that developed areas will blend into the natural areas in the preserve. This should include an integrated program to address exotic and nuisance species within the Core Area.

11. Develop standards for stormwater control ponds that include the use of native emergent vegetation, littoral zones, and native vegetation along the shore so that these ponds also will serve an ecological function.
12. Develop educational programs and additional incentives that will encourage pet owners to keep their cats and dogs confined to their property.
13. Develop educational programs that will help to instill a land ethic, and an appreciation and understanding of the natural integrity of the Green Swamp.
14. Conduct studies to determine the impacts of various human activities on wildlife. This should include human recreation activities as well as impacts from agricultural and golf course chemicals and mercury.

A landscape ordinance should be adopted for the Area of Critical State Concern.

An ordinance concerning confining pets and animals should be adopted.

An ordinance concerning management of publically owned lands should be adopted.

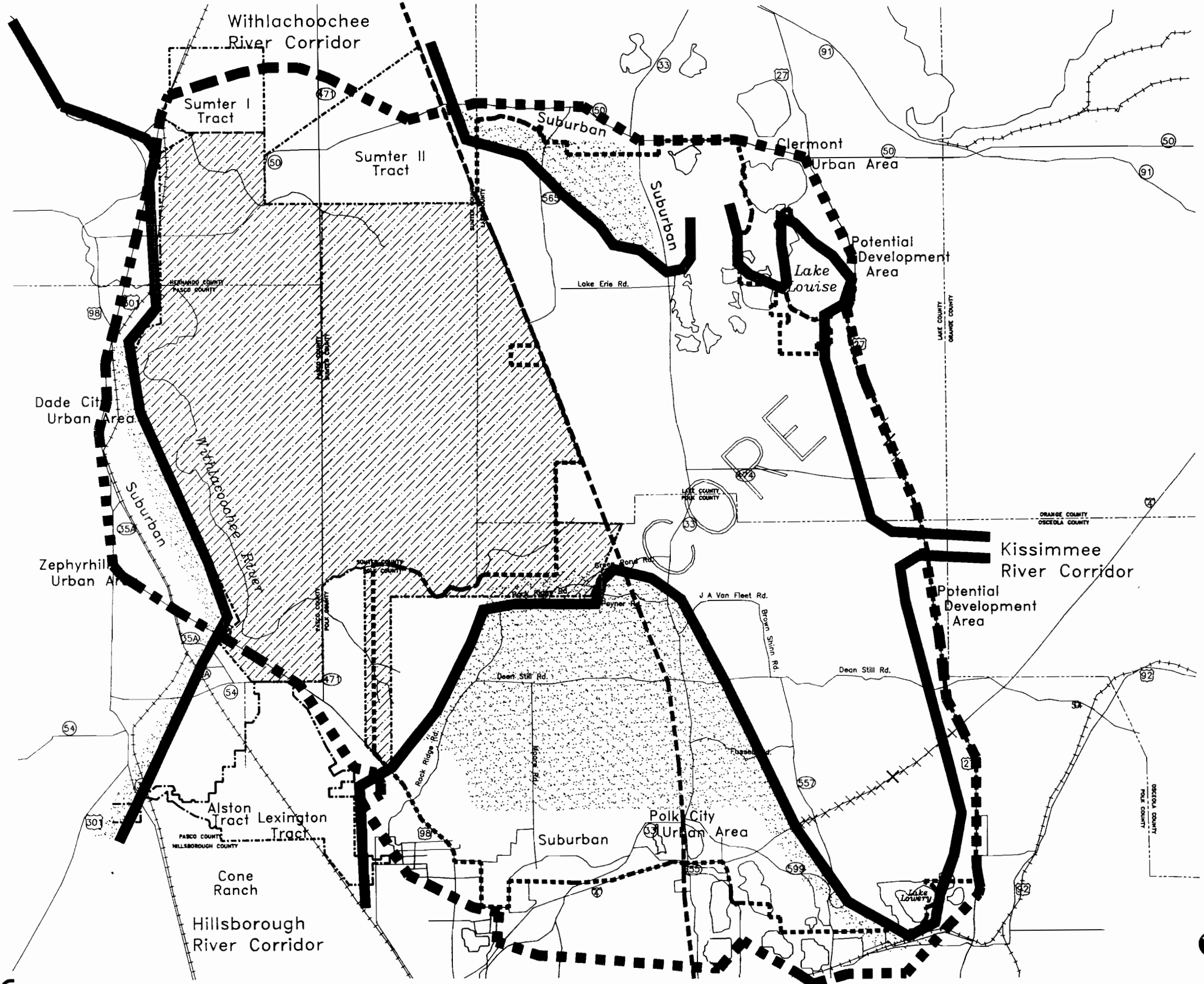
An ordinance concerning mitigation land banking should be adopted.

Rules and standards should be adopted for agricultural and forestry uses.

Recommendations concerning the management of the historical resources of the Green Swamp should be adopted.

Tax considerations are one form of compensation which should be considered as incentives for not cutting forest lands or developing land, or using good silviculture practices.

Green Swamp Core Area



Legend

- Public Owned Lands
- Core Boundary
- Area of Critical State Concern
- Hydrologic Boundary
- Culverts
- Agriculture Areas

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SCALE IN MILES
May, 1992

RESOURCE DESCRIPTION

The Green Swamp, an area of 870 square miles, as depicted on Map 1-1, Green Swamp Area, is not a contiguous typical swamp, as the name implies. However, being a mosaic of cypress swamps, hardwood forests, and marshes, with interspersed slightly elevated areas of pine flatwoods and sandhills, it is a very ecologically and hydrologically significant resource. Being a large area and being the headwaters of five major river systems (Withlacoochee and Little Withlacoochee, Oklawaha, Hillsborough, Peace and Kissimmee, in order of flow from largest to smallest), it is possibly second only to the Florida Everglades as far as its environmental and hydrologic significance. The Green Swamp a is a fairly intact open space system, existing between large population centers, provides recreational opportunities, flood water storage, natural water filtering systems and a diversity of habitats for wildlife, both plants and animals, thus contributing to the preservation of biodiversity to all of Central Florida. The vegetation of an area determines both the quality and diversity of the habitat as well as determining the animal life which will be present.

Climate

Central Florida, which includes the Green Swamp, has a warm and humid subtropical climate. Rainfall and temperature are the two main climatic elements that influence the hydrology of the Green Swamp.

According to Pride, et.al. (1966), the long-term average rainfall of the Green Swamp area is 52.7 inches. The period from June through September is the rainy season with 60 percent of annual rainfall. Rainfall during this period usually occurs as late afternoon or early evening thundershowers. The driest months are usually from November through February. Rainfall during the winter usually occurs as the result of southward moving cold fronts.

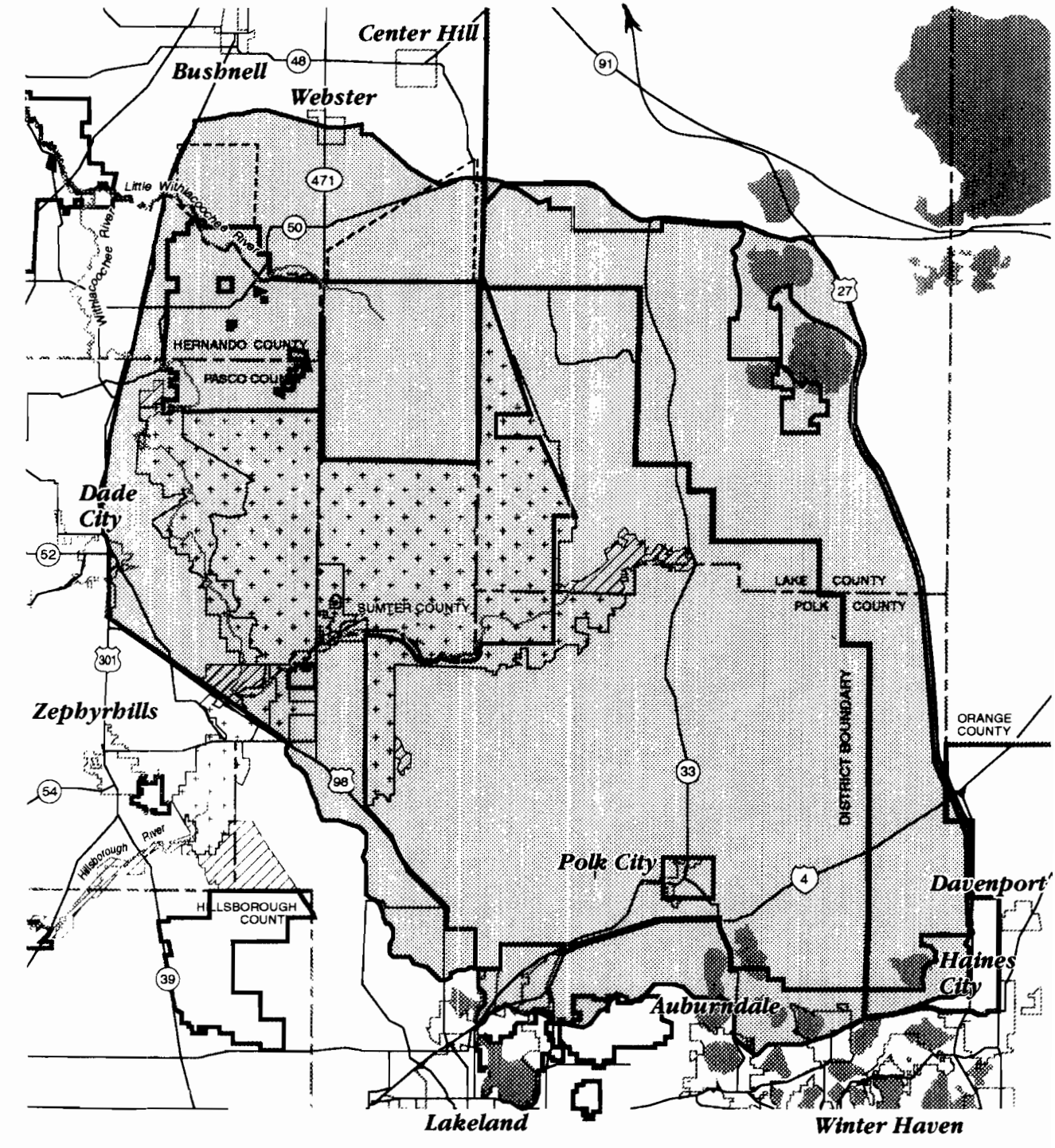
Temperatures in the Green Swamp can vary from winter lows in the high teens (degrees fahrenheit) to summer highs of over 100° F. During the summer the average temperature is 81° F with highs often above 90° F. The average winter temperature is 61° F.

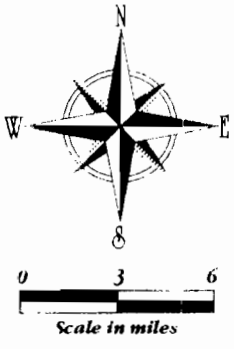
Hydrologic Cycle

The hydrologic cycle is the continuous circulation of water from the sea, through the atmosphere, to the land, and its eventual return to the atmosphere by way of evaporation from sea and land surfaces and transpiration from plants (Figure 1-1, The Hydrologic Cycle). The path is complex and, for a given particle of water, may take hundreds or thousands of years to complete the journey. A particle of water evaporated from the sea may become part of a rainfall over the Green Swamp. It can be re-evaporated as it falls, or it can be intercepted by vegetation and evaporate from a leaf surface. If the particle gets to the ground, it might evaporate from a puddle, flow as surface runoff, or infiltrate the ground. Surface runoff may flow back to the sea or get back into the cycle by various mechanisms including man's activities.

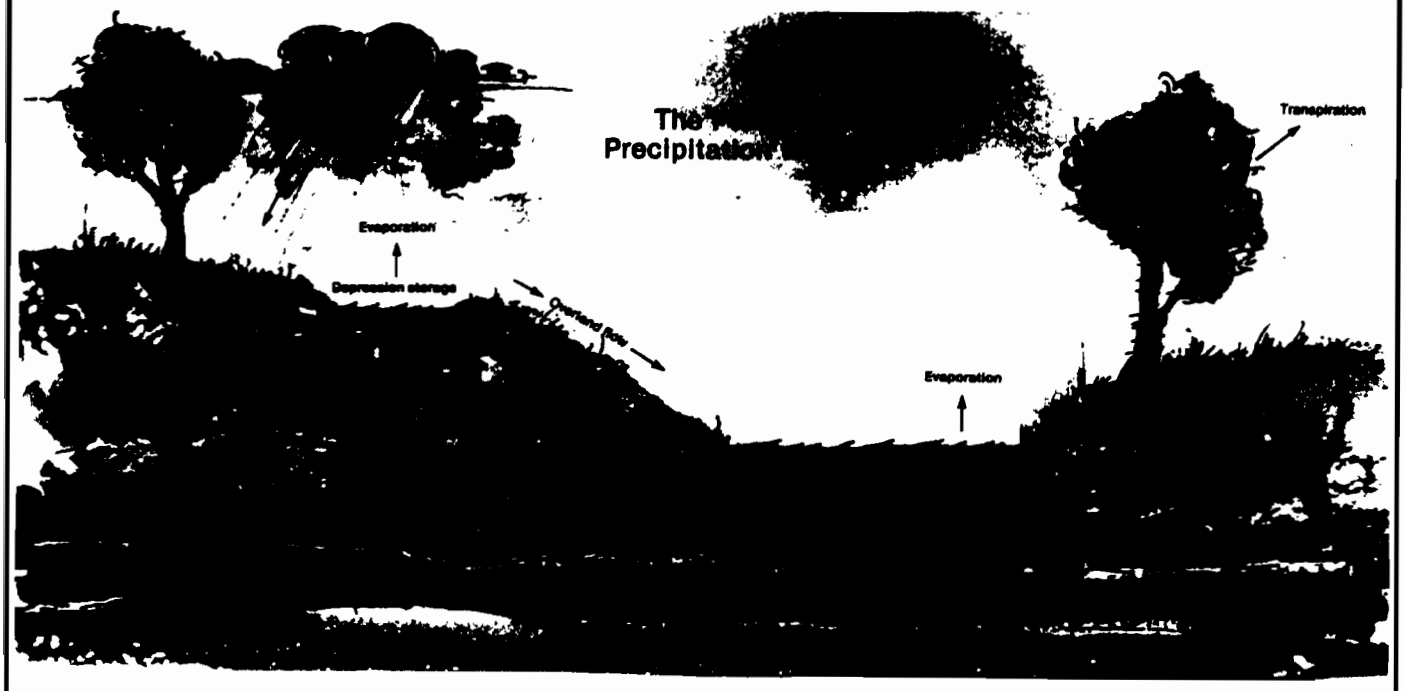
Water that infiltrates the ground may be captured in the root zone and be transpired by plants, it may form base flow to a stream, or it could percolate downward to become part of the regional ground water system. In that regional system, water moves from areas of high pressure to areas of low pressure. In other words, that particle of water that percolates downward from the Green Swamp will migrate underground from the Green Swamp toward the sea unless discharged from a spring or intercepted by by a pumping well.

Green Swamp Area





- Other Public-owned Lands
- District-owned Lands
- Area of Critical State Concern
- Proposed SOR/P2000 Acquisitions
- SOR Study Areas



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SOURCE: NATURE'S DESIGN, 1982.

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	**THE HYDROLOGIC CYCLE**
GURR & ASSOCIATES, INC. — Drafted: 1/15/92 — Revised:	PROJECT No. GSTF-001 — FIGURE 1-1

Water Budget

The theory behind evaluation of a water budget for a given basin is simple: inflow - outflow = change in storage. Inflow is all of the water entering a defined volume and its elements are precipitation and groundwater flow. Outflow is all movement of water out of the defined volume. Outflow has the following elements: evaporation, plant transpiration, stream flow, groundwater flow, and well fields supplying water to other areas. Change in storage is the increase or decrease in the amount of water contained within a defined volume.

Water budget accounting involves measurement and/or analysis of each of the elements. Thus, practical aspects of water budget evaluation are significantly more complex than theory. Furthermore, all of the elements cannot be measured. Evapotranspiration, the combined loss of water through transpiration from plants and evaporation from soil and open bodies of water, is usually calculated as a residual of inflow and other measured outflows.

In the water budget equation, change in storage is usually ignored. In the case of the Green Swamp, the volume is difficult to define. Is it the average volume of water on the surface of the ground? Does it include the upper 10 feet (or some other arbitrary number) of surficial deposits? Or, does it extend down to an impermeable basement.

Another confounding factor is that the system is not closed. In other words, a non-arbitrary boundary for a "hydrologic Green Swamp" is difficult to draw. Occurrences outside of the defined boundary will change water quantities associated with various elements of the water budget. For example, when drawdown in the potentiometric surface from some outside water use extends within the Green Swamp boundary, the result could be more infiltration of water from the surface and less surface water runoff via stream flow.

Water budget estimates by Hayes and Grubb (1979) suggest that 99 percent of water inflow to the Green Swamp is from precipitation. The following is a percentage breakdown of the fate of that rain water:

Evapotranspiration	76.9%
Groundwater Outflow	3.9%
Surface Water Outflow	
Withlacoochee River	15.2%
Oklawaha River	2.9%
Peace River	1.0%
Kissimmee River	<0.1%
Hillsborough River	<0.1%

The Green Swamp Watershed Basin of the Southwest Florida Water Management District covers 650 square miles of the 870 square mile Green Swamp. Within this area, the total annual average daily withdrawals permitted by SWFWMD amount to 82 million gallons per day. This amounts to 30 billion gallons per year which compares to the following amounts for the same given area:

Rainfall	587 billion gallons per year
Evapotranspiration	451 billion gallons per year
Surface Water Outflow	113 billion gallons per year
Ground Water Outflow	23 billion gallons per year

These quantities are based on 52 inches average annual rainfall over the 650 square mile area and are broken down according to the above percentages.

The reader should keep in mind that the majority of these permitted water withdrawals are used within the basin and generally stay within the system, although they probably cause some increased evapotranspiration. Also, some of the used water is discharged into streams (surface water outflow). However, withdrawal of groundwater induces increased aquifer recharge and a concomitant decrease in surface water outflow.

SURFACE WATERS

River Headwaters

The headwaters of five river systems lie within the Green Swamp area. Listed in order of their proportion of the area drained, these are: Withlacoochee and Little Withlacoochee River System, Oklawaha River, Hillsborough River and Kissimmee River (Map 1-2, Major Surface Water Drainage Basins). Major streams that head near the boundaries of the Green Swamp area are: Reedy, Davenport, and Horse creeks in the Kissimmee River basin; Peace Creek drainage canal and Saddle Creek in the Peace River basin; Fox Branch in the Hillsborough River basin; and Jumper Creek Canal and a major canal that head northwest of Mascotte in the Withlacoochee River basin. Of the total area of 870 square miles, 710 square miles are drained by the Withlacoochee River and its tributaries.

The surface drainage of the Green Swamp area is poor because of the flat topography and lack of well developed stream channels. Following heavy rainfall, water stands in large shallow sheets over much of the area. Map 1-3, Hydrographic Features, shows the different basins within the Green Swamp. The Withlacoochee River Basin, the principal hydrographic feature of the Green Swamp, is shaded in from its origin near Lake Lowery. Many of the other basins drain into the Withlacoochee basin.

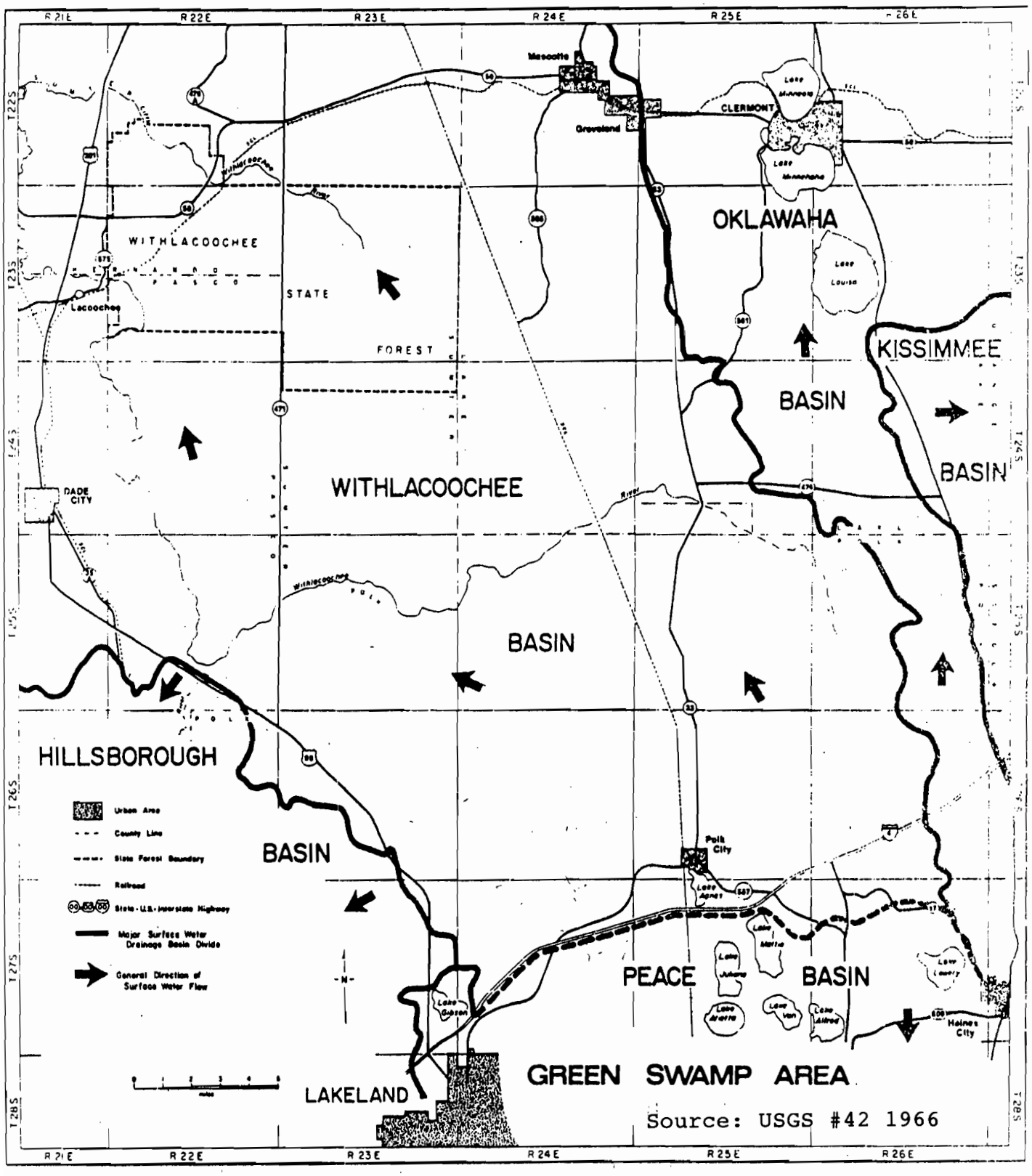
Boundaries of the elongated north-south drainage basins, in the eastern part of the Green Swamp area, are formed by low ridges. The valleys between the ridges are not deeply incised but their effectiveness as drainage channels has been altered by many miles of canals and ditches. Some parallel drainage basins are interconnected in several places by gaps or saddles through the ridges. Through these gaps water may flow at times from one stream valley into another. The amount and direction of flow depend on the relative elevation of water levels in the adjoining basins and the hydraulic conveyance of the connecting channels.

The canals and ditches, for the most part, have been dug to follow the natural drainage courses through the shallow swamps. However, in some places, probably to provide firm footing for the excavation equipment, to avoid clearing through the dense growth of cypress trees, and to drain areas, the ditches have been dug along the edges of the large swamps rather than through the interior. Also, to provide better alignment in some places, the ditches have been cut through ridges to connect the adjacent swamps. These shortcuts have bypassed the circuitous natural drainage routes and have straightened and shortened the courses of the waterways.

Surface drainage from most of the Green Swamp area is generally toward the north and west, as depicted on Map 1-4, Surface Water Drainage Features. However, the headwaters of the Peace River basin originate along the southern boundaries of the area and the flow is generally southward. Along the eastern boundary of the area, drainage is toward the east and southeast into the Kissimmee River basin. Other drainage from the Green Swamp area is toward the southwest into the Hillsborough River via a natural channel in eastern Pasco County.

The subsurface drainage of the Green Swamp area is generally poor. Ground-water levels in the interior of the area remain near the surface most of the time, consequently the aquifers are provided little opportunity to store water from heavy rainfall. Ground-water levels fluctuate through a greater range in the ridges that form the eastern, southern, and western boundaries. The wide range of fluctuation indicates better subsurface drainage and greater storage capacity along the boundaries than in the interior.

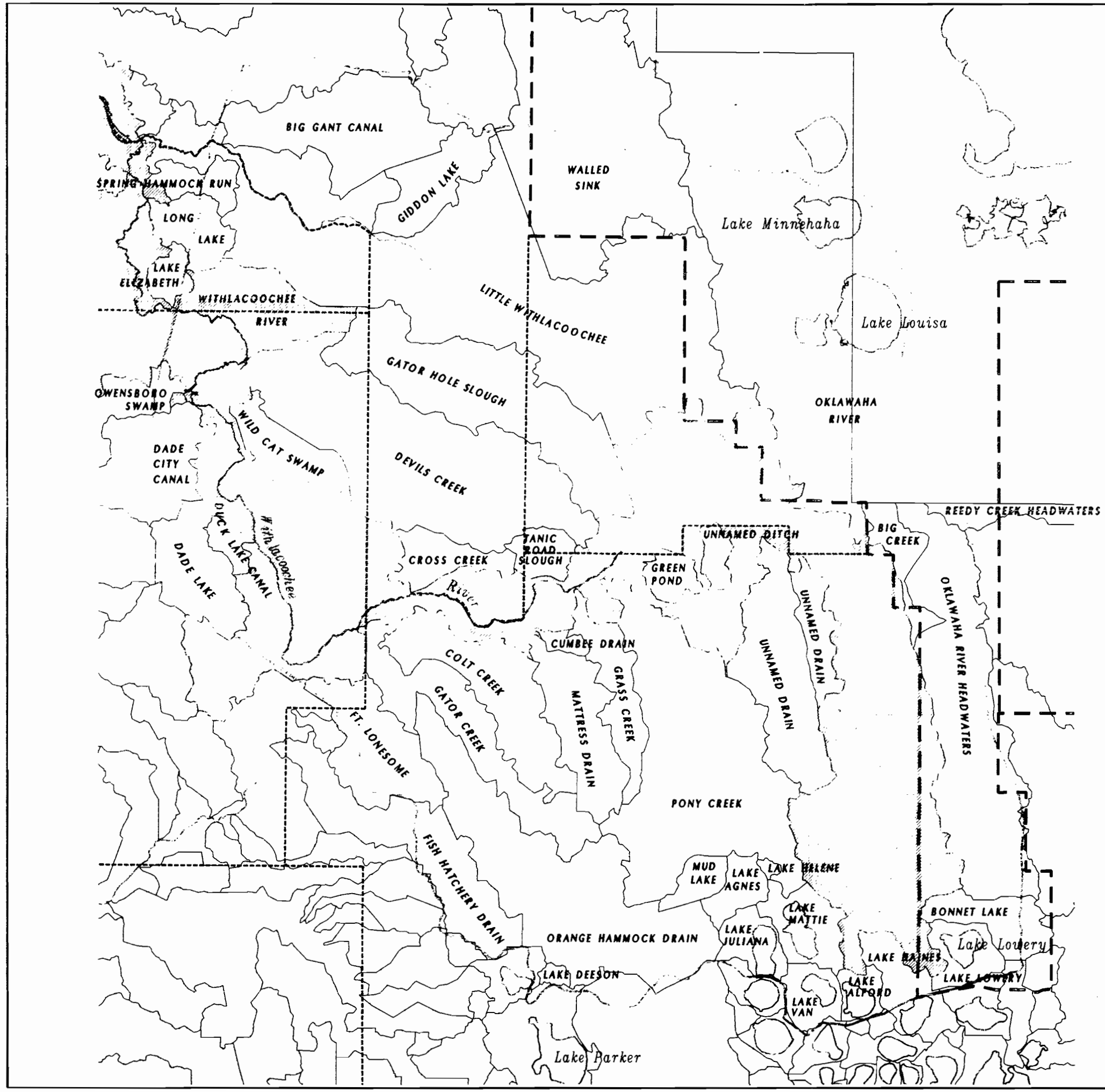
Subsurface drainage is through both the Floridan and the surficial aquifers but most is via the Floridan aquifer. Water percolates downward from the overlying surficial aquifer to the Floridan aquifer or enters the Floridan directly in areas where it may be exposed.



Major Surface Water Drainage Basins and General Direction of Surface Water Flow

MAP 1-3

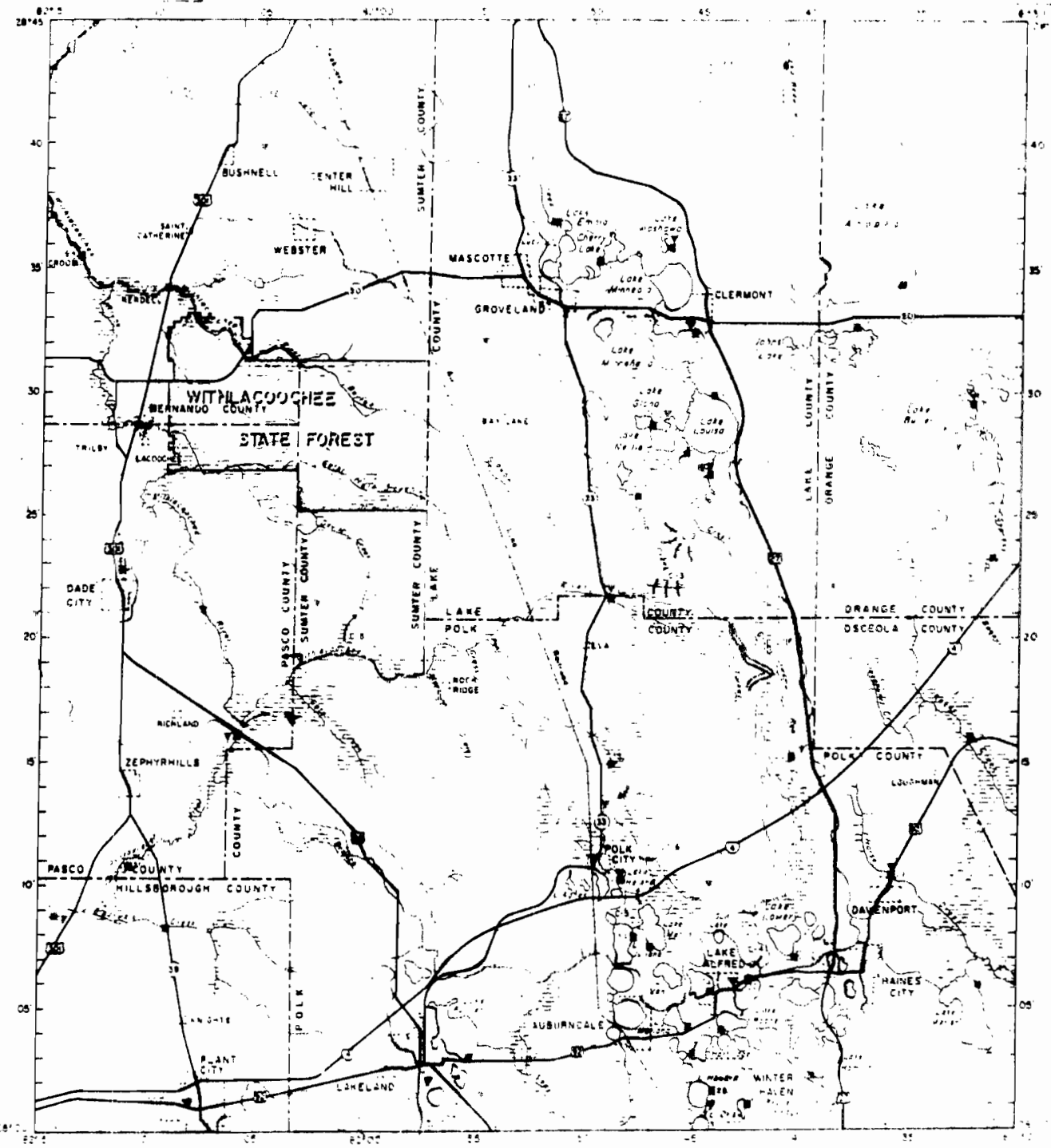
HYDROGRAPHIC FEATURES



- Hydrography
- Drainage Basin Boundary
- WMD Boundary
- Green Swamp Boundary
- County Boundary

N

Scale 1:250,000



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SOURCE: REPORT OF INVESTIGATIONS No. 42, 1966.

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	SURFACE WATER DRAINAGE FEATURES OF THE GREEN SWAMP AREA
GURR & ASSOCIATES, INC. Drafted: 1/15/92 Revised:	PROJECT No. GSTF-001 Map 1-4

Movement of ground water in the Floridan aquifer is generally outward in all directions from the southeastern part of the area. However, the areas contributing to the aquifer show that the predominant directions of ground-water movement are east and west. The ground-water divides in the aquifer shift slightly in response to demands in each contributing area.

Withlacoochee River (Map 1-5, Withlacoochee River System)

Of the five rivers that receive water from the Green Swamp, the Withlacoochee River and its tributaries drain the greatest portion. Estimates in the literature indicate that this system accounts for 79 to 82 percent of the surface water drainage from the swamp.

A group of lakes and swamps in north-central Polk County form the headwaters of the Withlacoochee. The river meanders westward from this area about 20 miles. It then turns abruptly to flow northward and eventually cross the western boundary of the Green Swamp at U.S. Highway 301. Several large tributaries enter the Withlacoochee before it turns northward. These tributaries (Pony Creek, Grass Creek, and Gator Creek) drain lakes and wetland areas of the Green Swamp. Pony Creek originates in a wetland east of Lake Helene near Polk City and flows northwestward to intercept the Withlacoochee near the county line between Polk and Lake counties. Grass Creek heads in a group of small lakes near Polk City and flows into the Withlacoochee about one mile downstream from (west of) Pony Creek. Gator Creek heads in several small swamps northeast of Lakeland and flows northwestward to empty into the Withlacoochee at the Polk-Pasco county line.

Its diverse habitat consists of both well-defined channels, as well as shallow, poorly defined channels. It flows in a southwest direction from Lake County near S.R. 33. East of S.R. 33 are some well defined areas with some very shallow channels as well as some areas with sheet-flow and heavily vegetated canopied forests.

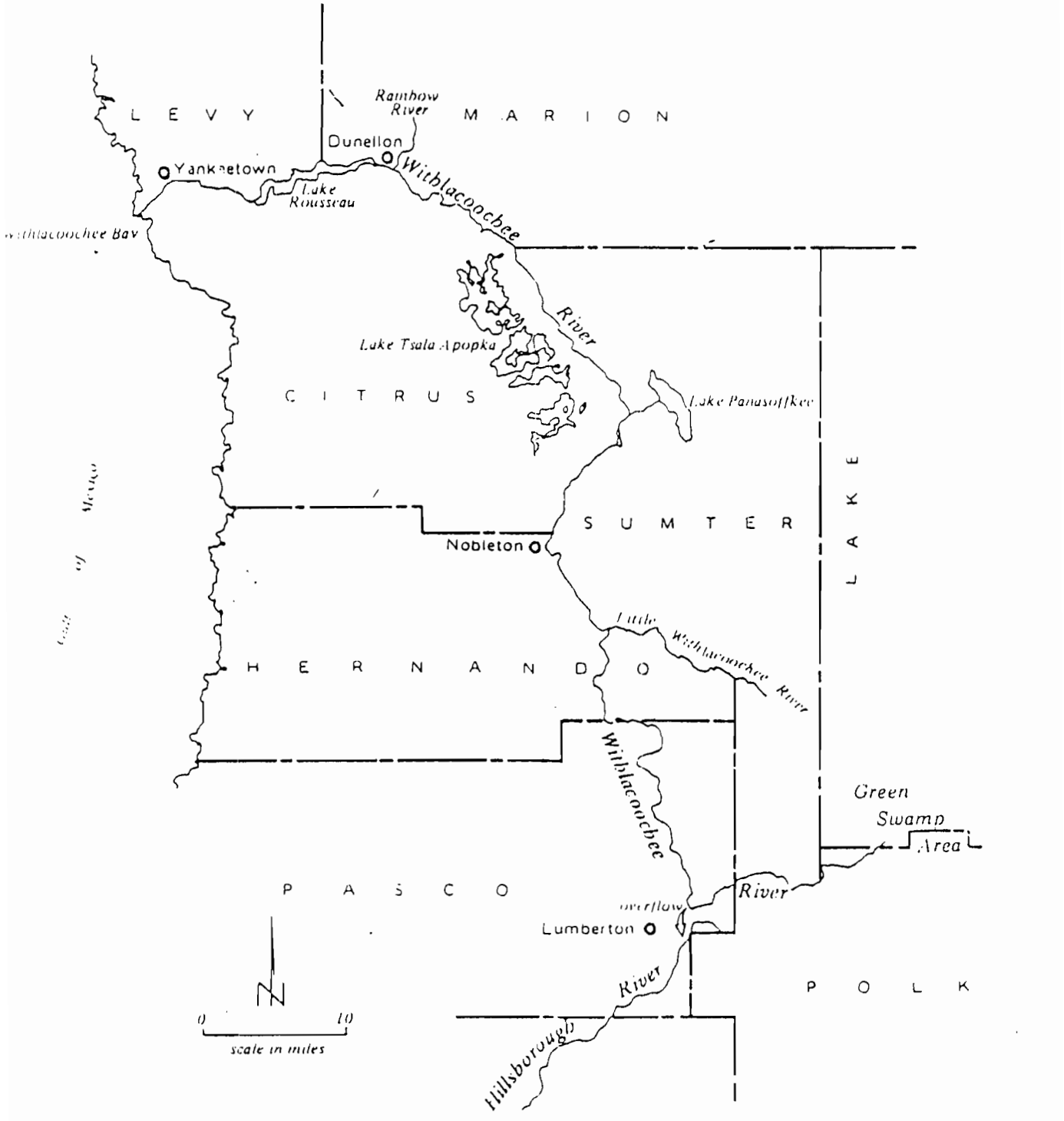
At S.R. 471, it is in a deep, well-defined channel. Downstream of S.R. 471 near U.S. 98, it makes a sharp turn to the northwest, strongly diverging from the Hillsborough drainage at an area termed "the Withlacoochee-Hillsborough Overflow", a natural high water connection between two basins. By the time it comes near Dade City, the channel is 7 to 8 feet deep with steep sides.

A diversity of substrate type exists consisting of some areas with large amounts of detritus (organic matter), areas with clean hard sand, and some with a combination.

Aquatic plants consist of red ludwigia, slender spikerush, smart weed, prairie iris, pickerelweed, water paspalum, parrot's feather, hydrocotly, bladderwort, cattail, water hyacinth, water lettuce, primrose willow, paragrass, and water primrose.

The Withlacoochee River is under the special protection category, Outstanding Florida Waters, from S.R. 33 to its mouth in the Gulf with the exception of the Inglis Reservoir (Lake Rousseau) area.

Map 1-5
The Withlacoochee River System



THE WITHLACOOCHEE RIVER SYSTEM

Little Withlacoochee River (Map 1-5, Withlacoochee River System)

The Little Withlacoochee River is the largest tributary of the Withlacoochee. Its headwaters are in several lakes and swamps east of the railroad line and near S. R. 33 in Lake County. From there it flows westerly and the northwest into the Withlacoochee State Forest where the channel is wide and shallow with a dense canopy of cypress. It is totally in its natural state within the State Forest. After leaving the State Forest, a major canal joins it; it then joins the Withlacoochee about three miles downstream of U.S 301. The entire Little Withlacoochee is also an Outstanding Florida Waters.

Oklawaha River (Map 1-6, Headwaters of the Oklawaha River)

The headwaters consist of two streams, Big and Little Creeks, issuing from overflow from Lake Lowery in Polk County. Between Lake Lowery and the Polk/Lake County line, Big Creek is called Green Swamp Run. They both flow north and enter Lake Louisa in Lake Louisa State Park. Lake Louisa is the first major lake in the South Lake County Chain of Lakes, which are lakes with excellent water quality and are in the Special Protection category, Outstanding Florida Waters. The portion of the Oklawaha basin that is in the Green Swamp is the part of the swamp under the jurisdiction of St. Johns River Water Management District (SJRWMD).

Water flows north through these lakes and forms a major tributary of the Oklawaha River called the Palatlakaha River which enters Lake Harris near Leesburg. This lake enters the Oklawaha Chain of Lakes through the Dead River.

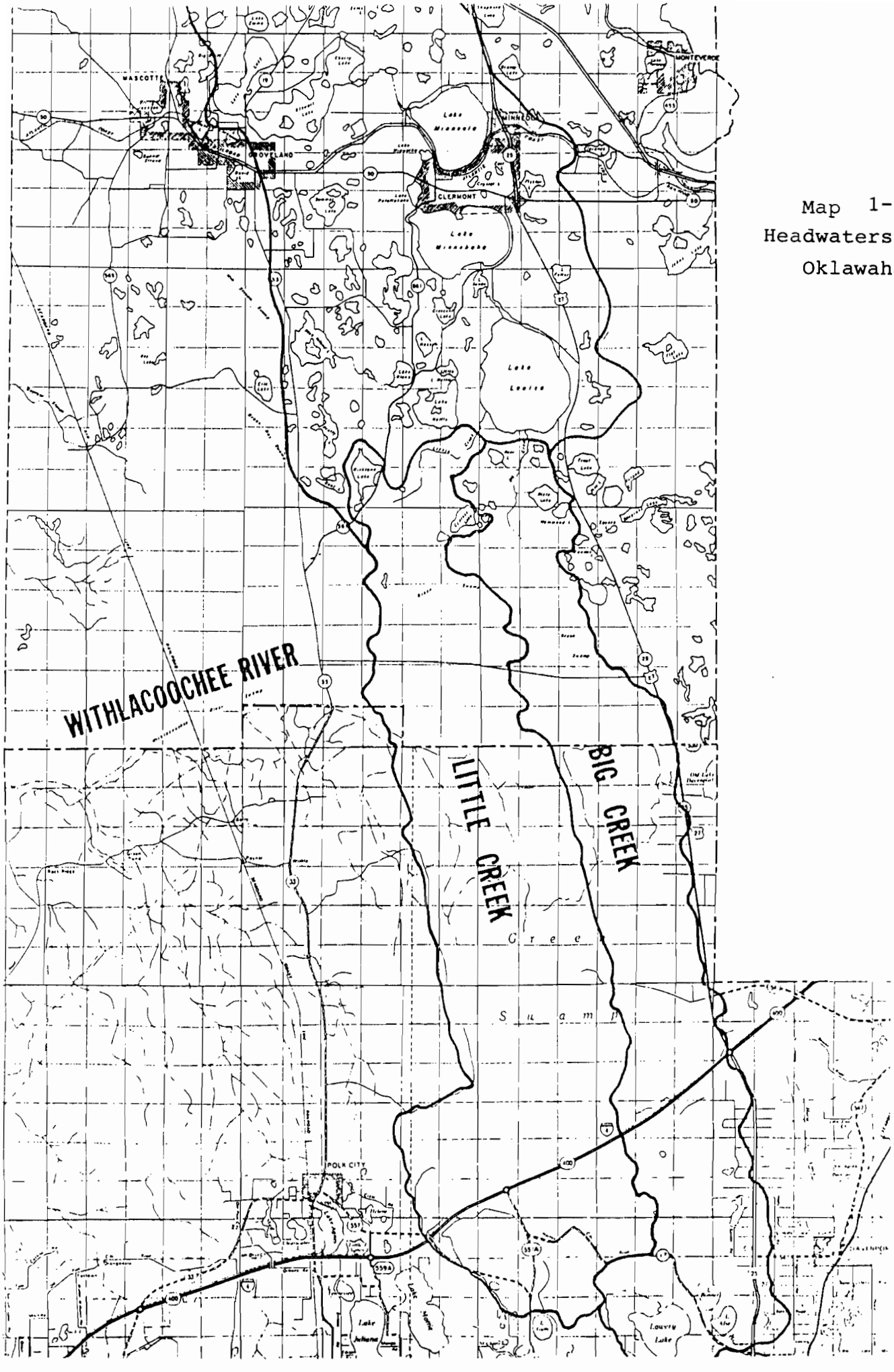
Both creeks drain through a series of wide and narrow shallow cypress swamps. They are only poorly-defined in most areas but are well-defined creeks by the time they enter Lake Louisa. Substrate type consists mainly of detritus and sand. Some of the aquatic vegetation includes primrose willow, red ludwigia, panic grasses, baby-tears, spike rush, bladderwort, frog's bit, spatterdock, salvinia, duckweed, water hyacinth, cattails, soft rush, pickerelweed, and arrowhead.

Hillsborough River (Map 1-7, Hillsborough River System)

The headwaters are in East Pasco County where the Withlacoochee overflows during major high flows out of the Green Swamp just north of U.S. 98 via the natural Withlacoochee-Hillsborough Overflow. This overflow is a sheet flow area about one mile wide consisting of cypress swamp and hardwood forest. Just upstream of Zephyrhills, it becomes a well-defined, narrow channel about 6 feet deep with steep sides. A second magnitude spring, Crystal Springs, flowing about 40 mgd enters near Zephyrhills. Downstream of Crystal Springs, the tributary Blackwater Creek enters. After crossing U.S. 301, the river enters Hillsborough River State Park where there is about a 150 foot long stretch of rapids due to limestone outcroppings.

Bottom substrate is dominated by detritus in the upstream sections and downstream, it becomes more sandy with sandy silt.
Aquatic vegetation is not well-developed except where the canopy is breached at road and railroad crossings.

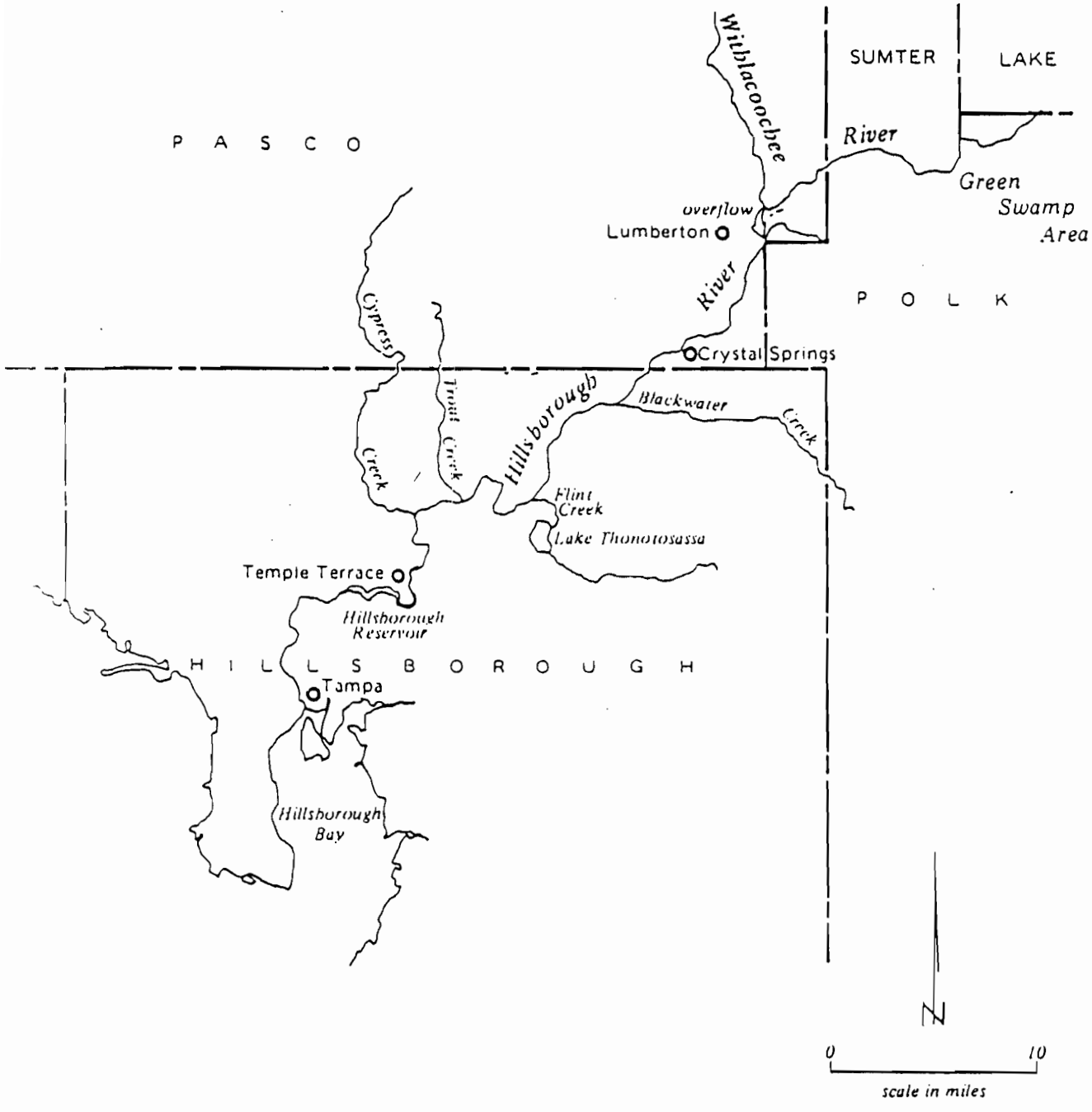
Review of the literature indicates that this river does not depend on the Green Swamp for flow. The Hillsborough River receives water from the Withlacoochee River during periods of high flow (ie. when the Withlacoochee River reaches a stage of 78.5 feet above NGVD).



Map 1-6
Headwaters of the
Oklawaha River

Map 1-7

The Hillsborough River System



THE HILLSBOROUGH
RIVER SYSTEM

Peace River

Before construction alterations, Lake Lowery and adjacent areas drained south to the Peace River, as well as north of the Oklawaha. However, now only seven square miles of the Green Swamp, including Gum Lake and its marsh outlet, and Lake Alfred, drain south into the Peace Basin.

Kissimmee River

Only a very small section of the Green Swamp drains to the Kissimmee River. The connection for the Green Swamp to the Kissimmee is Horse Creek, an intermittent (wet-weather) stream. Less than 1% of the Green Swamp flow goes east to the Kissimmee.

Past Proposals - Green Swamp Flood Control Project

The Corps of Engineers proposed the Green Swamp Flood Control Project in the early 1960's. Their plan was to construct a system of levees and dikes that would detain storm water within a 68 square mile area of the Green Swamp. The purpose was to limit the flooding that would occur as a result of a 100-year storm event.

The Southwest Florida Water Management District became involved in the project to assess potential detrimental impacts to the Green Swamp. They determined that the Green Swamp is poorly suited for a surface water reservoir because of flat terrain and the region's annual water balance. Such a reservoir would cover an excessively large area and have a shallow depth. The proposed detention area would have covered about 68 square miles. The large open-water surface area would result in increased evaporation from the region. Estimated annual water loss due to increased evaporation would have amounted to about 0.7 inch averaged over the entire Green Swamp area.

Other problems with the project were: (1) costs of project would have been much greater than the potential benefits; (2) project would have resulted in destruction of large area of wetland habitat; (3) natural filtration system for rivers would have been lost. Plans for the project were abandoned in 1985.

WATER QUANTITY

Inflow

The primary source of water to the Green Swamp is rainfall. Between 1931 and 1976 the long-term average annual rainfall for the Green Swamp was 52.10 inches.

The only known source of inflow into the Green Swamp area other than rainfall is a relatively small quantity of ground-water inflow (less than 1 per cent of rainfall) in the vicinity of Dade City. Prior to the development of groundwater in the Dade City area, ground water apparently discharged to the Withlacoochee River and associated swamps in the vicinity of the west boundary of the Green Swamp area (Pride, et. al., 1966). Discharges to the Hillsborough and Withlacoochee Rivers is still reported in some areas.

Outflow

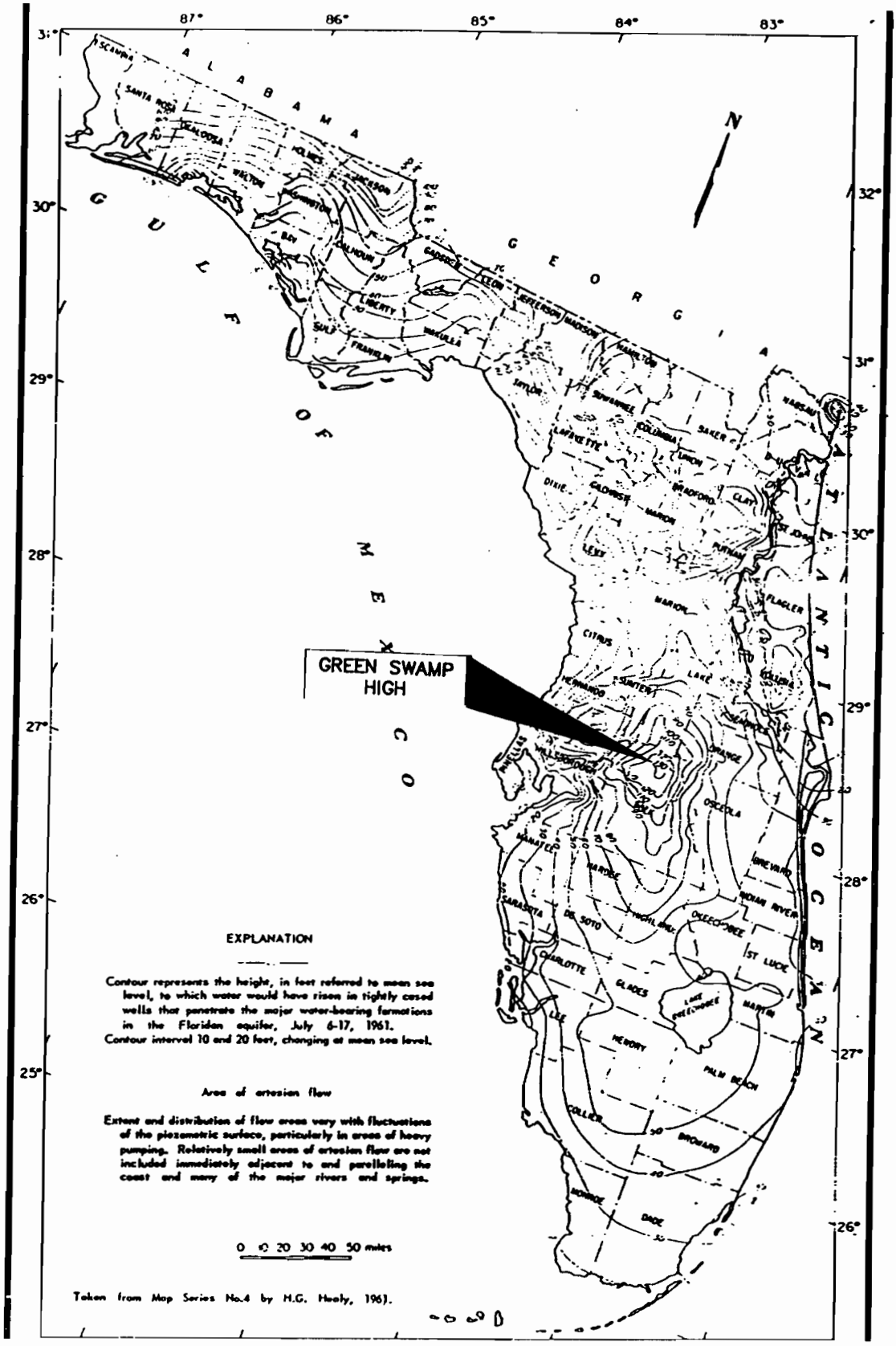
The water received from rainfall in the Green Swamp area is discharged by (1) streams which flow from the area, (2) groundwater outflow through the Floridan and near-surface surficial aquifers, or (3) evapotranspiration--that water evaporated back to the atmosphere plus that transpired by plants (Figure 1-1, Hydrologic Cycle).

The Green Swamp High

Ground water in the central part of the Florida Peninsula moves outward in all directions from an elongated piezometric high that extends approximately from central Lake County to southern Highlands county, generally referred to as the "Polk High". The top of the Polk high occurs within the southeastern part of the Green Swamp area. This phenomenon provides an important function through maintaining the freshwater/salt water interface, thus minimizing salt water intrusion into the Floridan aquifer.

Near the southeast quarter of the Green Swamp area, the principal direction of flow in the Floridan aquifer is outward from a dome on the potentiometric surface. This is the potentiometric high of the Floridan aquifer, the principle source of groundwater in central Florida (Map 1-8, Contours on the Piezometric Surface of the Floridan Aquifer)(Map 1-9, Potentiometric Map Showing Radial Flow Patterns).

The potentiometric surface of the Floridan Aquifer was in decline from May 1952 to 1962 (Map 1-10, Contours on the Potentiometric Surface, Green Swamp). Due to conservation efforts, the decline has leveled off. Figure 1-2, Monthly Mean Water Levels on Green Swamp Wells From 1958 to Present, shows the potentiometric surface as observed in six wells located near the center of the Green Swamp area (located on Map 1-11, Monitor Well Locations). Over the period from May 1977, 1985, 1988 and 1990 (Figures 1-3 through 1-6, Potentiometric Surface of Floridan Aquifer, 1977, 1985, 1988 and 1990), in general, the dry season potentiometric surface ranges from approximately 125 feet MSL in the southeastern portion of the Green Swamp area to 70 or 80 feet MSL in the western portion of the Green Swamp area.



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GREEN SWAMP TASK FORCE
POLK COUNTY, FLORIDA

GURR & ASSOCIATES, INC.

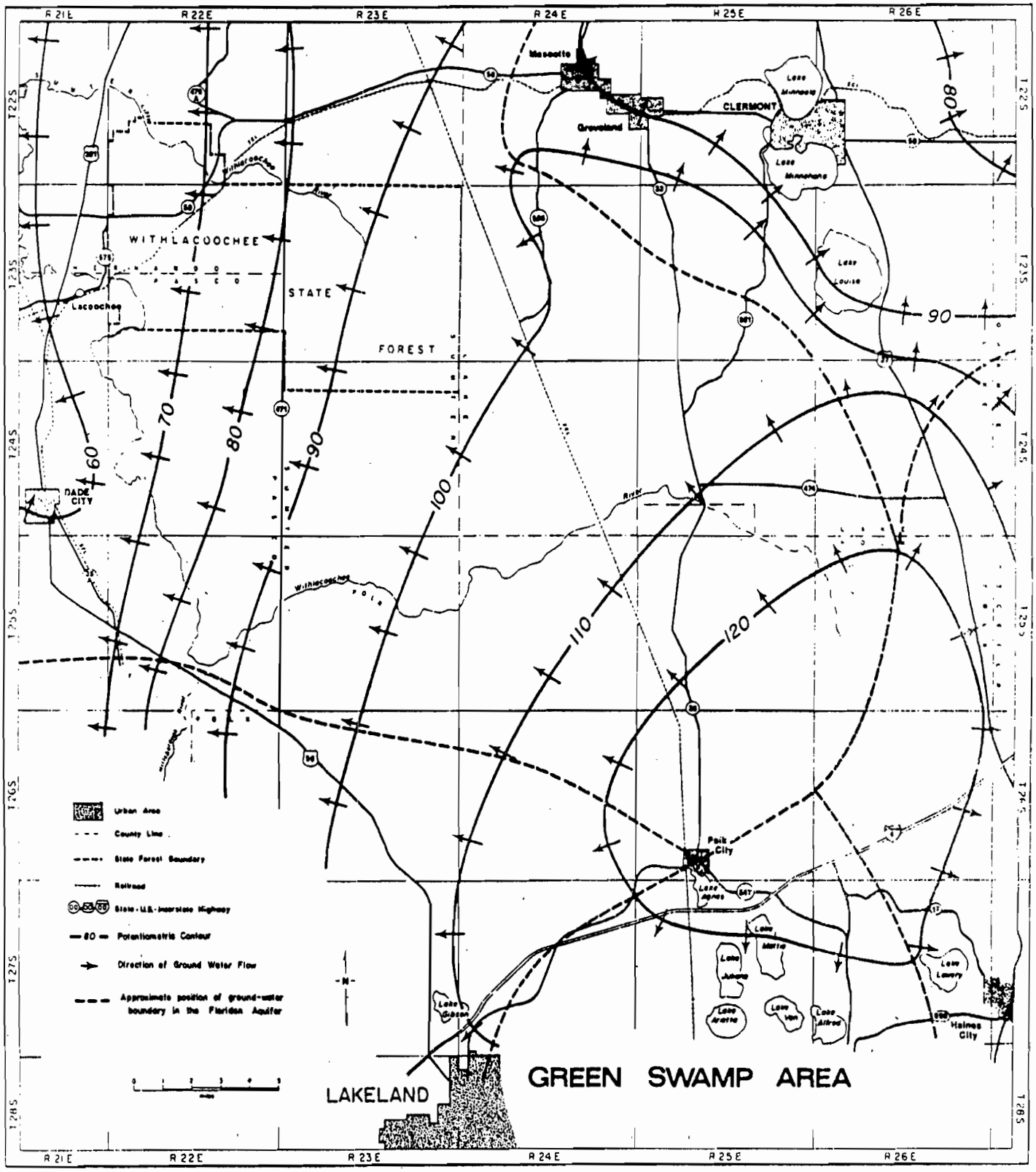
Drafted: 1/15/92
Revised:

CONTOURS ON THE PIEZOMETRIC SURFACE OF THE FLORIDAN AQUIFER

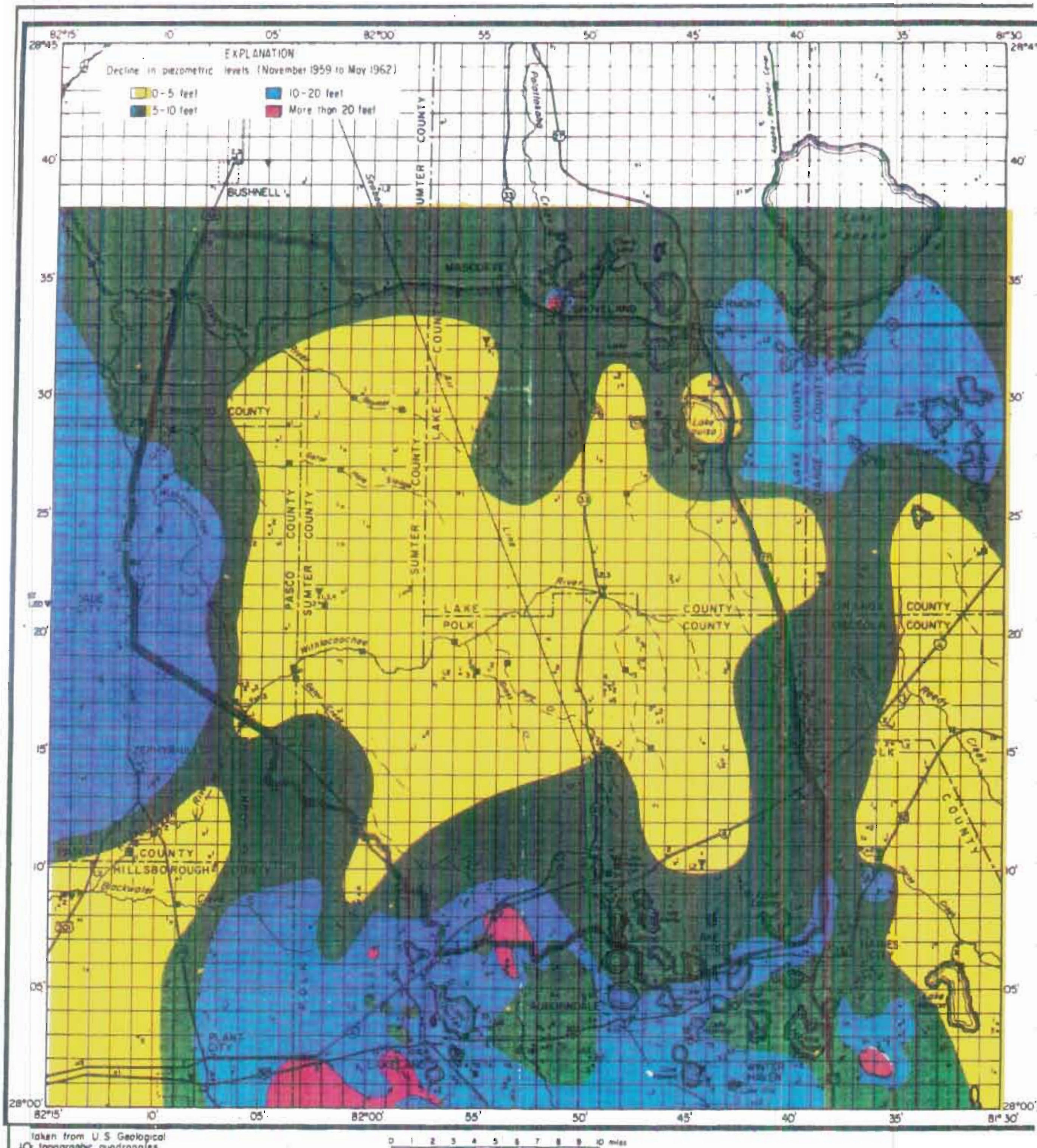
PROJECT No. GSTF-001 | MAP 1-8

MAP 1-9

Potentiometric Map Showing Radial Flow



Potentiometric Map Showing the Radial Flow Pattern of Ground Water from the Green Swamp High



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GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	**CONTOURS ON THE PIEZOMETRIC SURFACE OF THE FLORIDAN AQUIFER**
GURR & ASSOCIATES, INC. — Drafted: 1/15/92; Revised:	PROJECT No. GSTF-001 — MAP 1-8

IMPACTS

Water Supply Potential

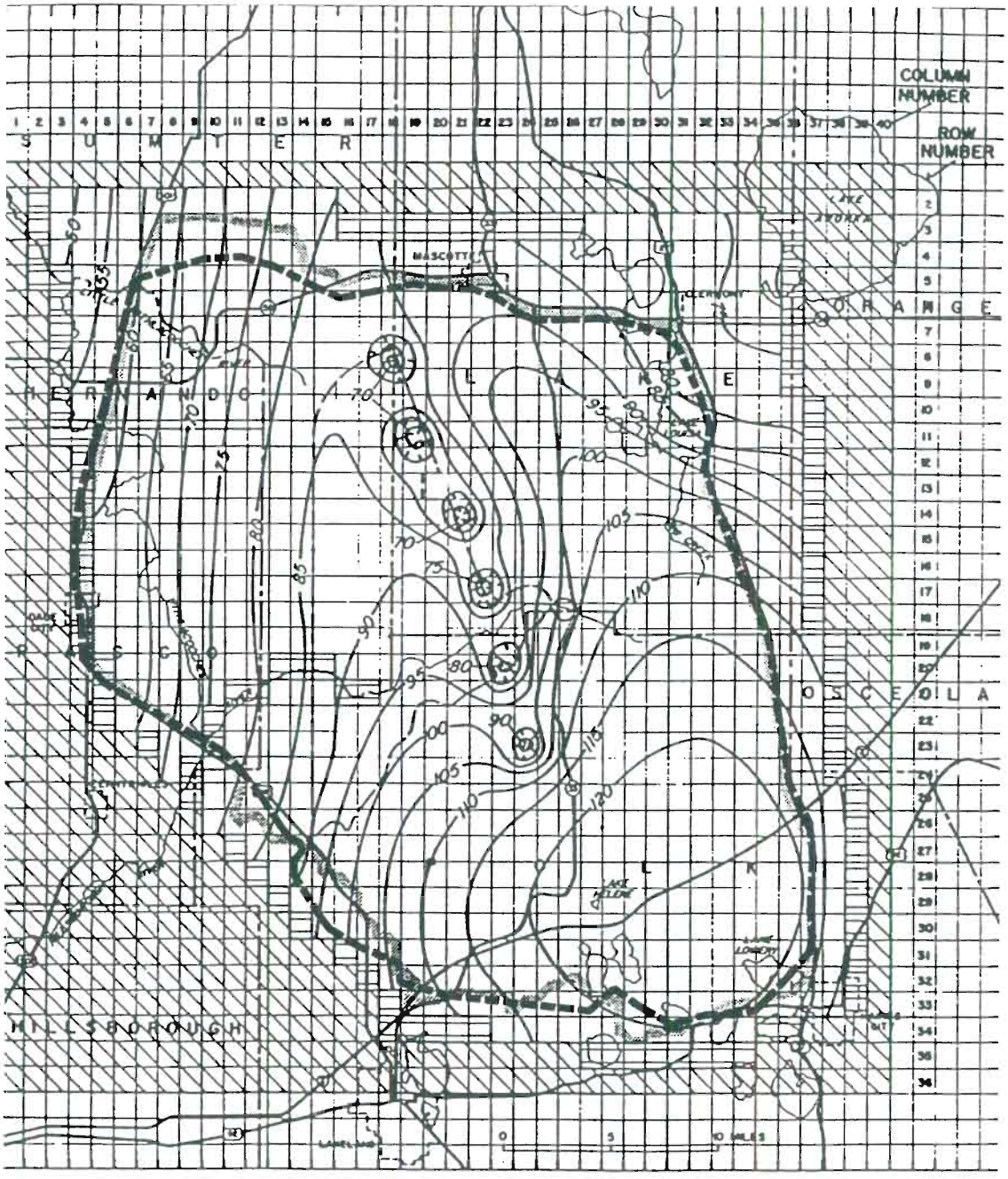
In 1979, a report discussing the long-term water supply potential for the Green Swamp area was issued by the U.S. Geological Survey, Water Resources Division. Numerous test wells were installed, pumped and monitored for the purpose of collecting data to be modeled regarding the effects of pumping.

Three different pumping models were entered for analyses: Six pumping center, twelve pumping center and 18 pumping centers located throughout the Green Swamp area (Figures 1-29 through 1-31). Six pumping centers would yield 91 million gallons of water per day, twelve pumping centers would yield 183 million gallons per day, and eighteen pumping centers would yield 274 million gallons per day. The maximum pumping amount of water using 18 pumping centers resulted in an average drawdown of 6 feet of water for the entire model area. The maximum drawdown was 38 feet in one of the pumping wells near the center of the Green Swamp. Using six pumping centers, the minimum proposed, produced an average 2 feet of water drawdown throughout the entire area, with a maximum drawdown of 32 feet at one pumping node.

Water Supply Impact on Wetlands

The Southwest Florida Water Management District (SWFWMD) conducted a hydrogeologic investigation of cypress dome wetlands in well field areas north of Tampa, Florida in 1988 and 1989. The report issued by SWFWMD stated that water impacts to cypress domes in area well fields included reduced hydroperiods (periods when standing water exists inside the upper dome), land surface subsidence, and geological impacts such as changes in vegetation and loss of use by wildlife. Based on the modeling study, it is obvious that there will be substantial drawdown in the surficial aquifer. An average drawdown of the water table of the two feet mentioned above would certainly have an adverse effect on the biota of the area. A greater drawdown, such as the 32 feet drawdown in certain locations associated with six pumping centers, would probably severely impact all vegetation within the affected area.

The potential for increasing the recharge to the Floridan Aquifer from the overlying sand aquifer in the Green swamp area was recognized by Stewart (1966) and Pride and others (1966). An increase in the downward gradient between the two aquifers, such as would be produced by pumping the Floridan Aquifer, is necessary to realize this increase in recharge. The downward movement of water from the surficial aquifer to the Floridan Aquifer was demonstrated by an aquifer test (Grubb, 1978). A drawdown of 1.00 feet was observed in the sand aquifer at a distance of about 62 feet from the pumping well which had been pumping, 1,040 gallons/minute for 420 minutes from the Floridan aquifer.



EXPLANATION

BOUNDARY OF GREEN SWAMP AREA

FLOOD DETENTION AREA PROPOSED BY SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

NO-FLOW NODE

CONSTANT-HEAD NODE

—90— SIMULATED POTENTIOMETRIC CONTOUR. CONTOUR INTERVAL 5 FEET. DATUM IS MEAN SEA LEVEL.

DRWG: GSTF1715

SOURCE: U.S. GEOLOGICAL SURVEY, WATER RESOURCES DIVISION.

GREEN SWAMP TASK FORCE
POLK COUNTY, FLORIDA

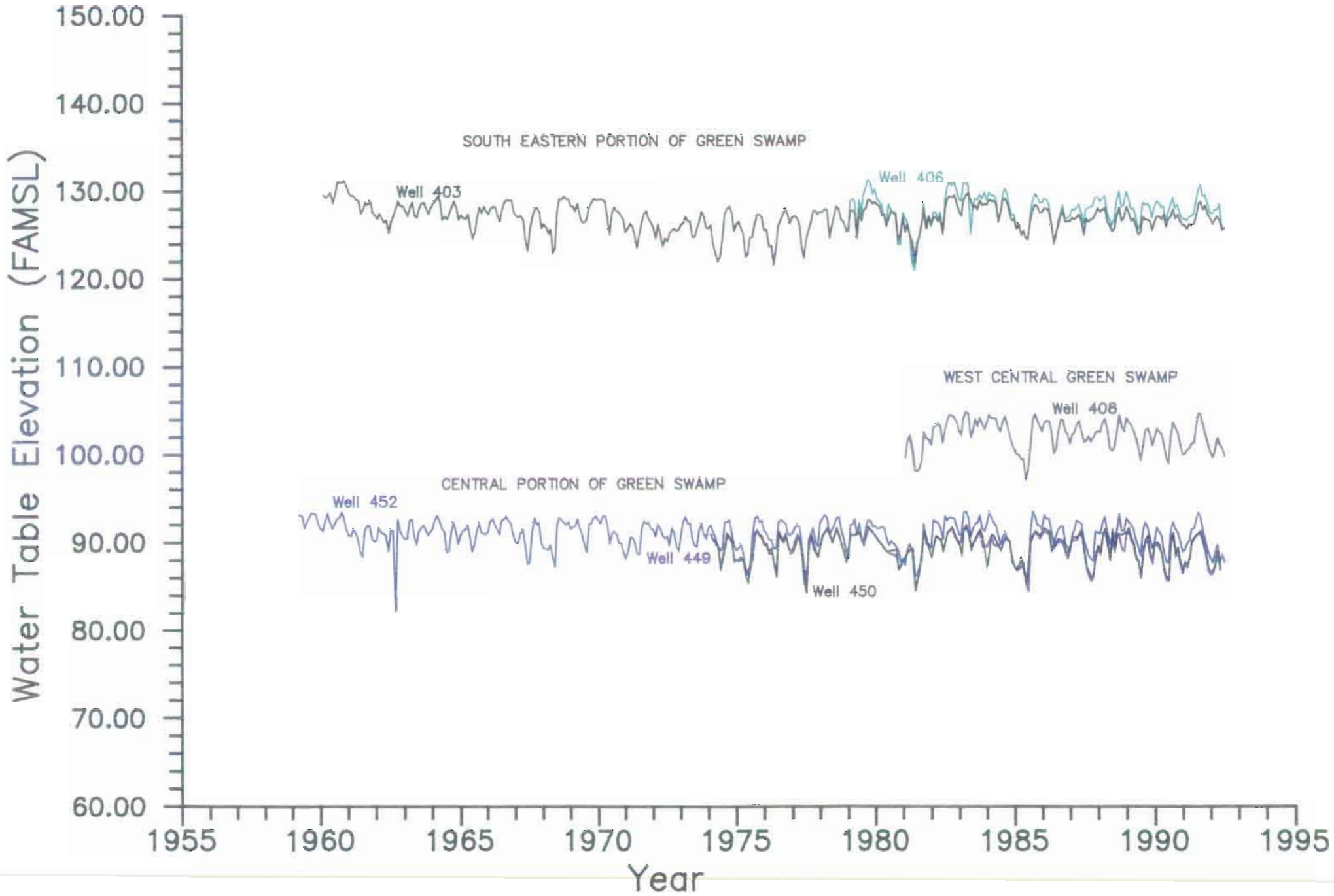
GURR & ASSOCIATES, INC.

Drafted: 1/15/92
Revised:

SIMULATED EFFECTS OF PUMPING APPROXIMATELY 91 MILLION GALLONS PER DAY ON THE POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER

PROJECT No. GSTF-001

FIGURE 1-29



NOTE

WELL 449 SHALLOW WELL

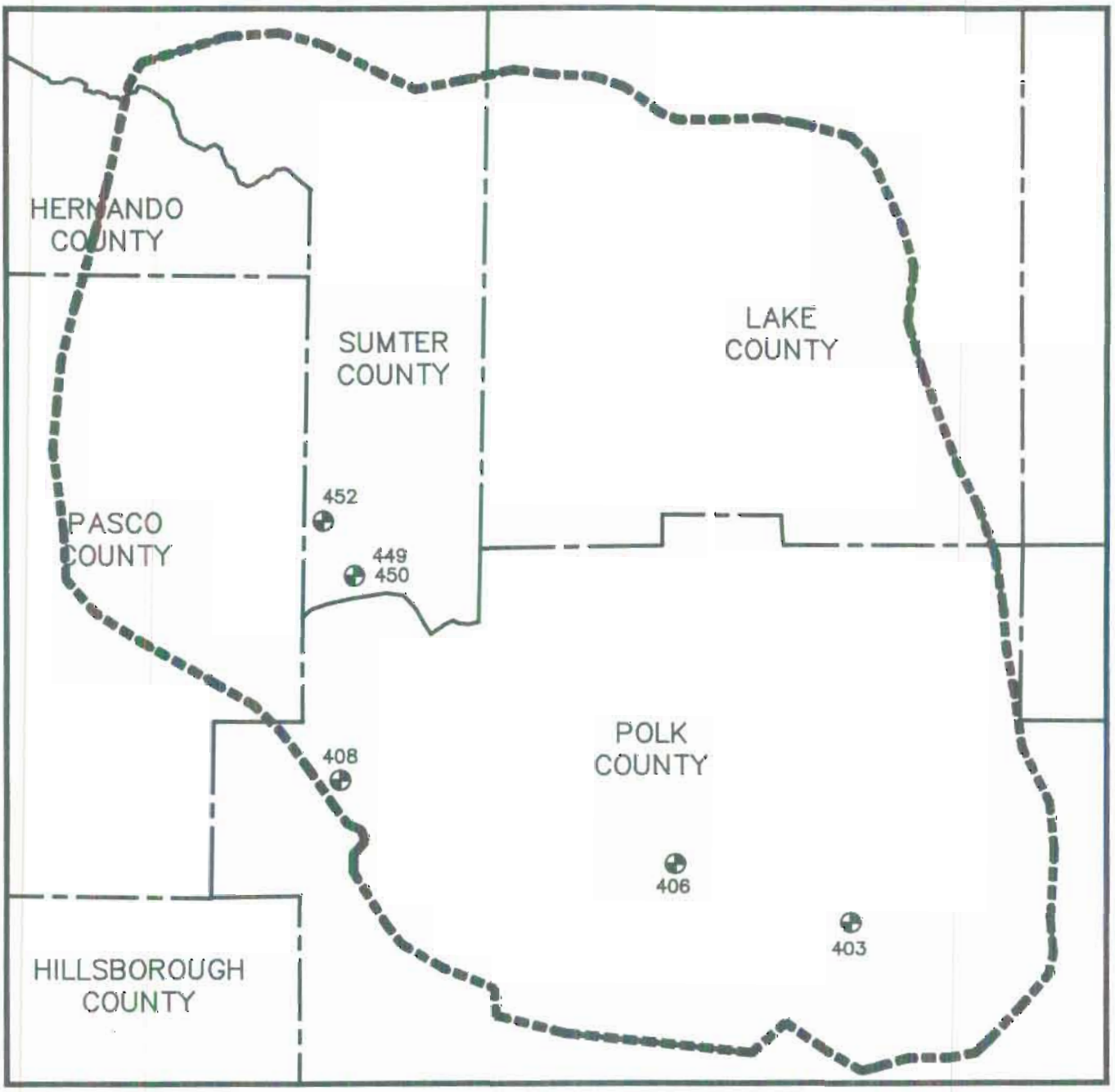
WELL 450 DEEPER WELL

SEE FIGURE 1-21 FOR LOCATION OF WELLS

SOURCE: SWFWMD WELL MONITORING RECORDS

DRWG: W450

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	MONTHLY MEAN WATER LEVELS ON GREEN SWAMP WELLS FROM 1958 TO PRESENT
GURR & ASSOCIATES, INC. Drafted: 6/24/92 Revised:	PROJECT No. GSTF-001 FIGURE 1-2



SEE FIGURE 1- FOR HYDROGRAPHS

LEGEND

MONITOR WELL LOCATION

HYDROLOGIC BOUNDARY

N

APPROXIMATE SCALE

0 3 6

MILES

SOURCE: SWFWMD

DRWG: GSTF1MWL

GREEN SWAMP TASK FORCE

POLK COUNTY, FLORIDA

GURR & ASSOCIATES, INC.

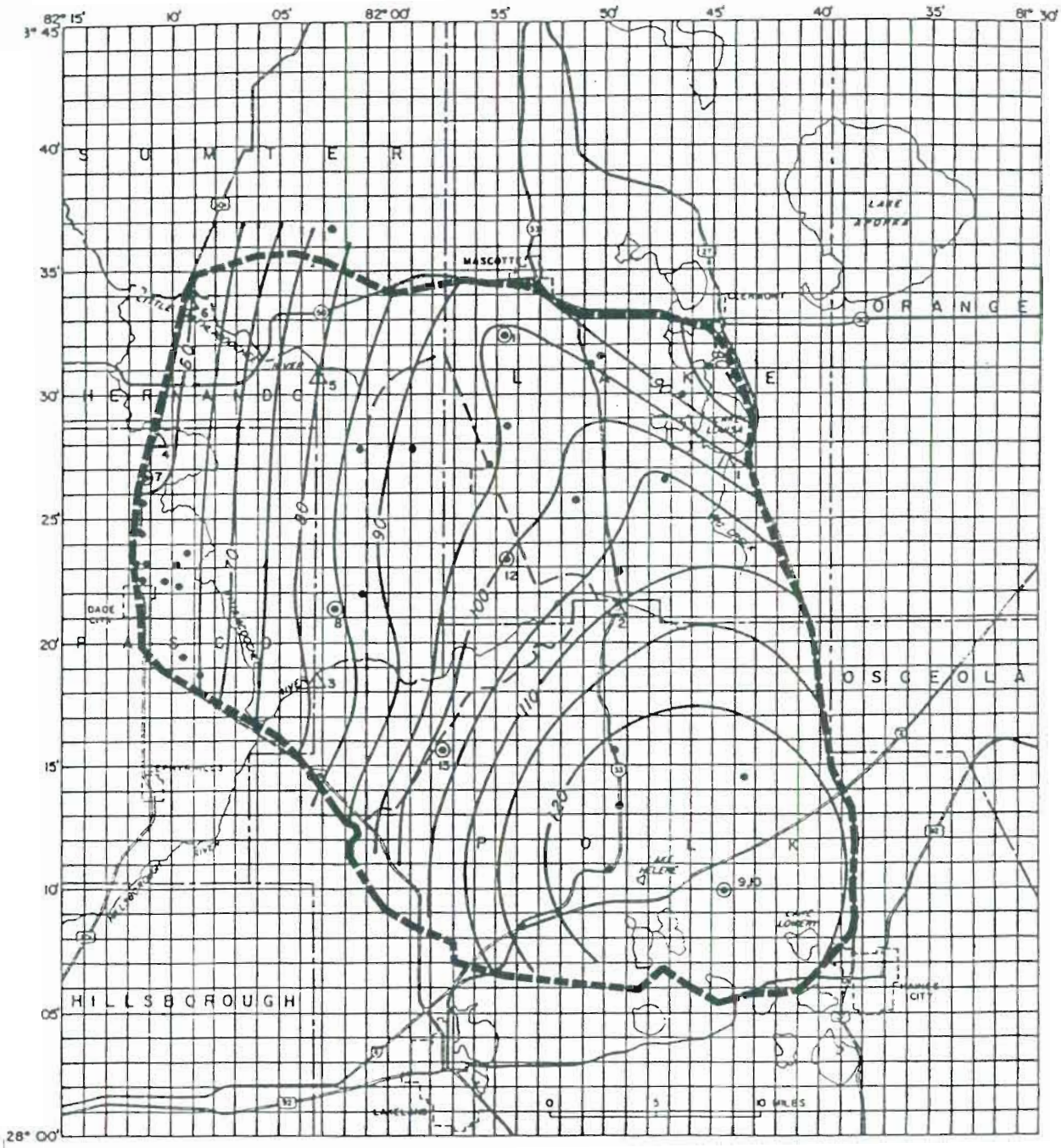
Drafted: 6/24/92

Revised:

MONITOR WELL LOCATIONS FOR HYDROGRAPH PEDIOD OF RECORD

PROJECT No. GSTF-001

MAP 1-11



EXPLANATION

- BOUNDARY OF GREEN SWAMP AREA.
- FLOOD DETENTION AREA PROPOSED BY SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
- —90— POTENTIOMETRIC CONTOUR--SHOWS ALTITUDE AT WHICH WATER LEVEL WOULD HAVE STOOD IN TIGHTLY CASED WELLS. CONTOUR INTERVAL 5 FEET. DATUM IS MEAN SEA LEVEL.
- △ STREAM GAGING STATION
- • OBSERVATION WELL
- ○ OBSERVATION WELL WITH RECORDER
- 1 HYDROLOGIC SITE INDEX NUMBER

SOURCE: U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY.

DRWG: GSTF1TB7

GREEN SWAMP TASK FORCE
POLK COUNTY, FLORIDA

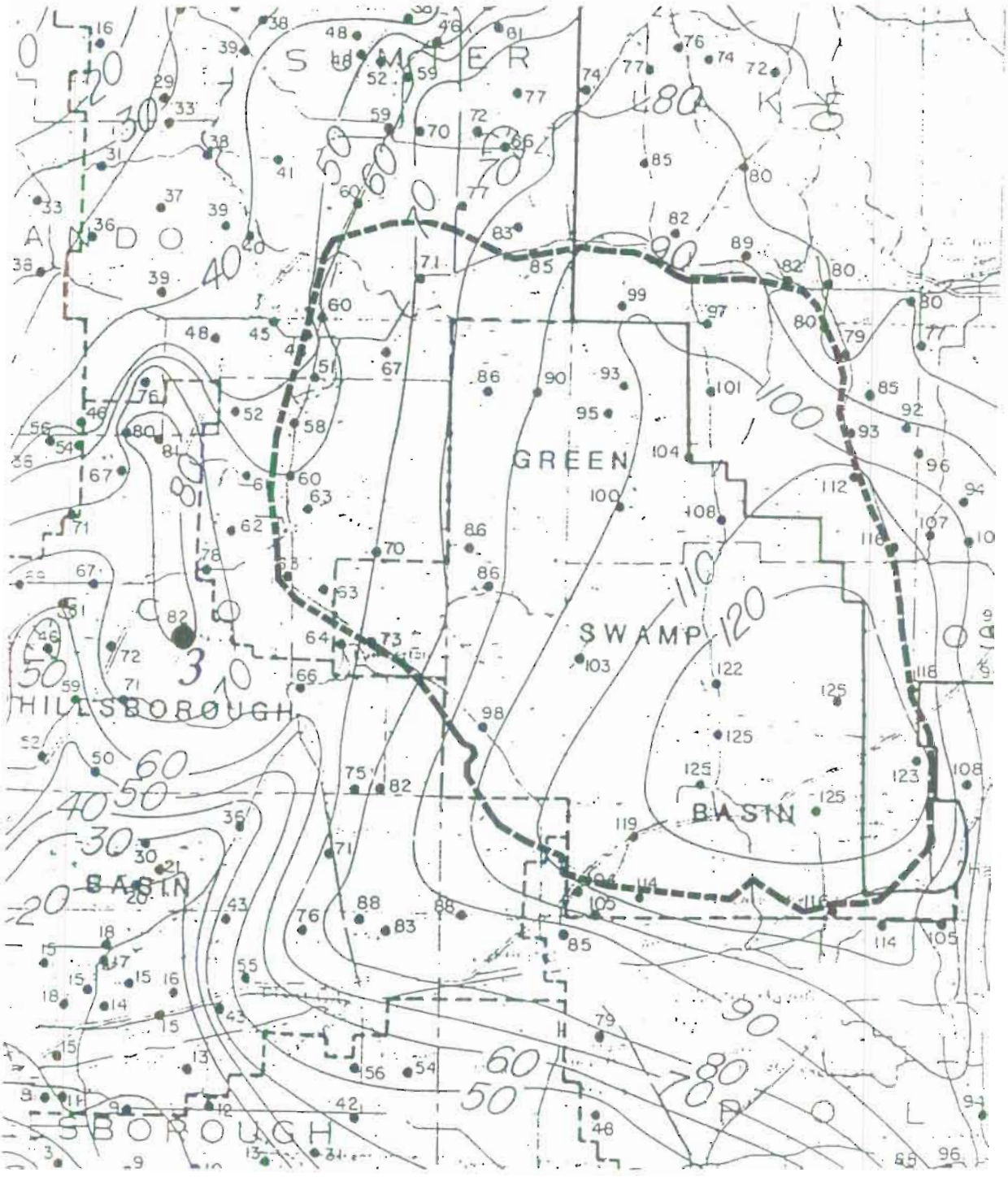
GURR & ASSOCIATES, INC.

Drafted: 1/15/92
Revised:

POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, MAY, 1977

PROJECT No. GSTF-001

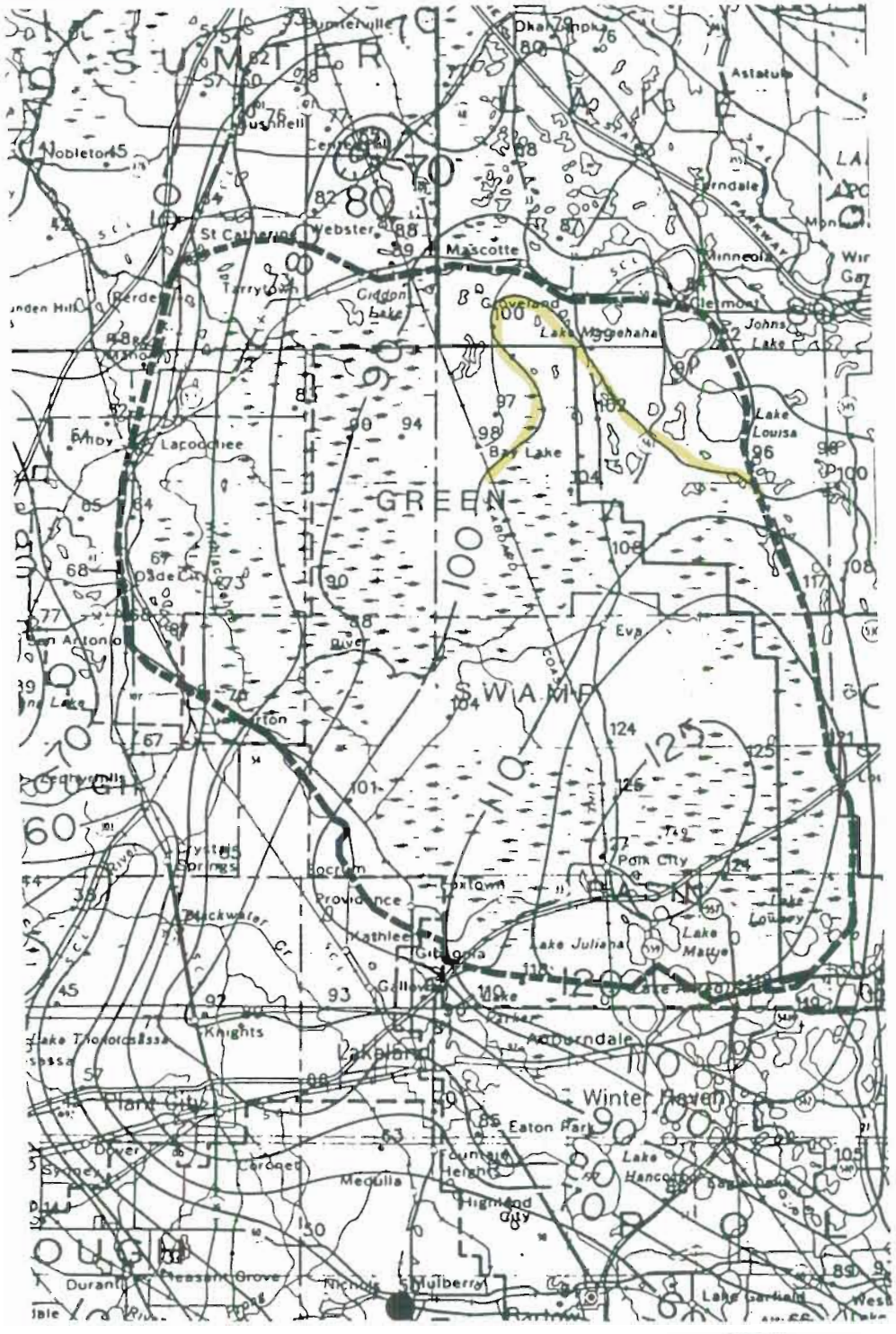
FIGURE 1-3



DRWG: GSTF1TB8

SOURCE: U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY.

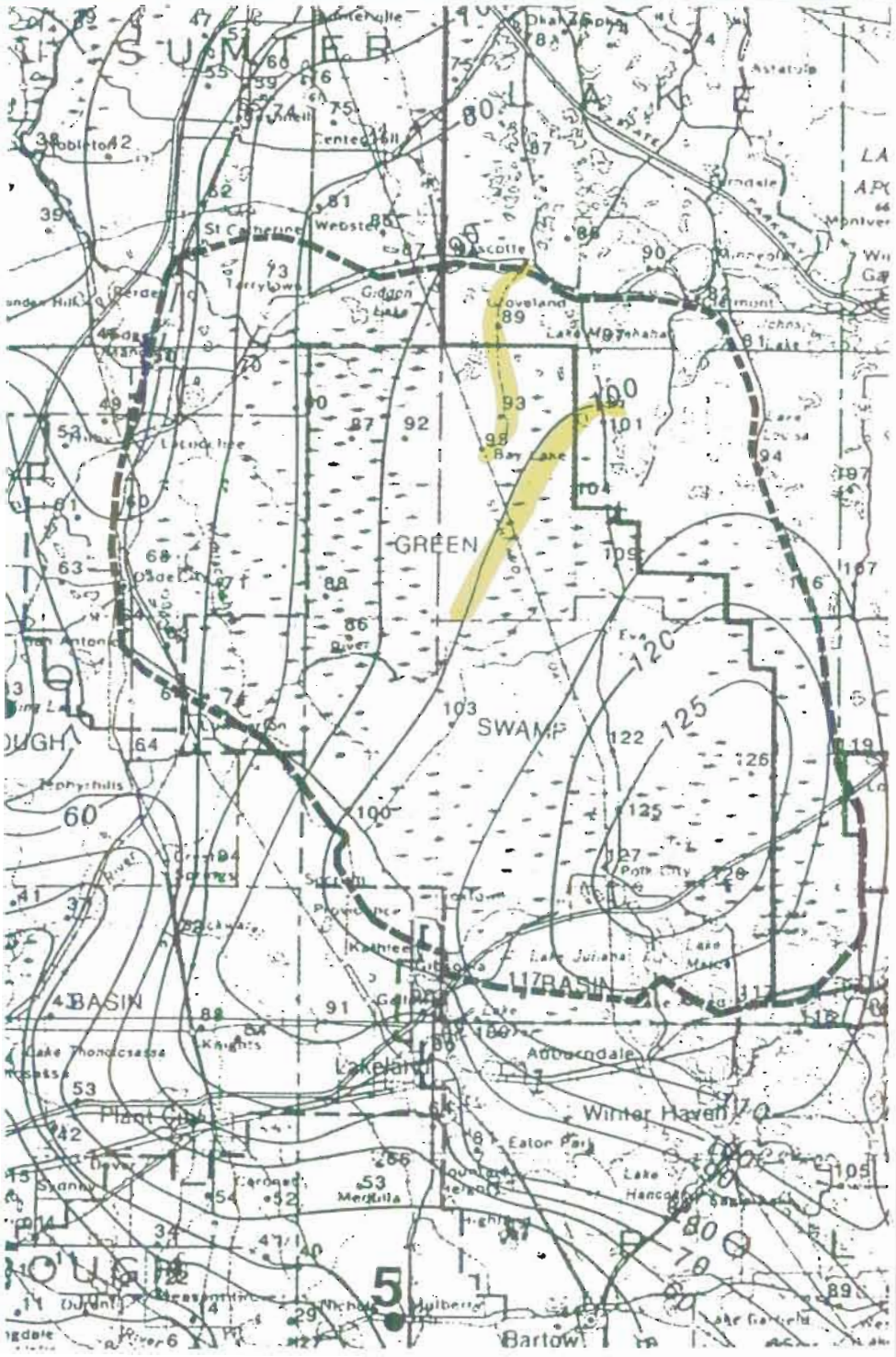
GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, MAY, 1985
GURR & ASSOCIATES, INC. Drafted: 1/15/92 Revised:	PROJECT No. GSTF-001 FIGURE 1-4



DRWG: GSTF1TB9

SOURCE: U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY.

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, MAY, 1988
GURR & ASSOCIATES, INC. — Drafted: 1/15/92 — Revised:	PROJECT No. GSTF-001 — FIGURE 1-5



SOURCE: U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY.

DRWG: GSTF1TB10

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER, MAY, 1990
GURR & ASSOCIATES, INC. — Drafted: 1/15/92 — Revised:	PROJECT No. GSTF-001 — FIGURE 1-6

Surficial Aquifer

The surficial aquifer is thickest in the eastern part of the Green Swamp where it is generally greater than 40 feet thick in a 320-square mile area. In this area a surficial aquifer thickness of 50 feet is not uncommon (Map 1-12, Depth to Top of Floridan Aquifer). The surficial aquifer is less than 10 feet thick in two areas in the western part of the Green Swamp which total about 170-square miles.

The value of the surficial aquifer relative to water supply is its large storage capacity rather than its potential for supplying water directly to pumping wells. Early in this century Matson and Sanford (1913) reported the surficial sands in Polk County were being used for water supply. However, Stewart reported typical yields of only 20 to 30 gallons/minute from the surficial aquifer in Polk County. Even the maximum known yields of some irrigation wells, in excess of 100 gallons/minute, are small compared to the 1,000 gallons/minute and greater yields typical of the Floridan aquifer (Stewart, 1966). Hydraulic conductivities of 2.7 to 24.1 feet/day were reported by Pride and others (1966) for the surficial aquifer. In the eastern portion of the Green Swamp, these deep surficial sands perform an important function by containing substantial amounts of groundwater and making it available for recharge to the Floridan aquifer.

Specific yield values of 12.5 to 27.2 per cent for three sites within the Green Swamp suggest the storage capacity for this aquifer is large. A conservative value of 10 percent is assumed for specific yield for the purposes of this report because of (1) the abundance of very fine-grained sand and clay observed in core samples from this aquifer and (2) the small number of field determinations of specific yield.

Geologic and Topographic Characteristics of the Green Swamp

The Green Swamp area is made up of linearly oriented low sand hills and solution lakes in an advanced stage of planation. Much of the surface has been reduced to the water table level. Elevations are typically between 100 feet and 150 feet above mean sea level.

Topographically, the surface of the Green Swamp area resembles a basin, or trough, opening to the north. However, geologically, the Green Swamp is part of an eroded, faulted anticline. The oldest formations are exposed along the axis of the anticline and eroded remnants of younger formations rim the flanks and present a basin-like feature (Map 1-13, Topography).

The Green Swamp is underlain by several hundred feet of limestone and dolomite that have been periodically exposed to solution-weathering and erosion. The surface is mantled with a varying thickness of clastic material (sand and clay) that was deposited in fluctuating shallow areas.

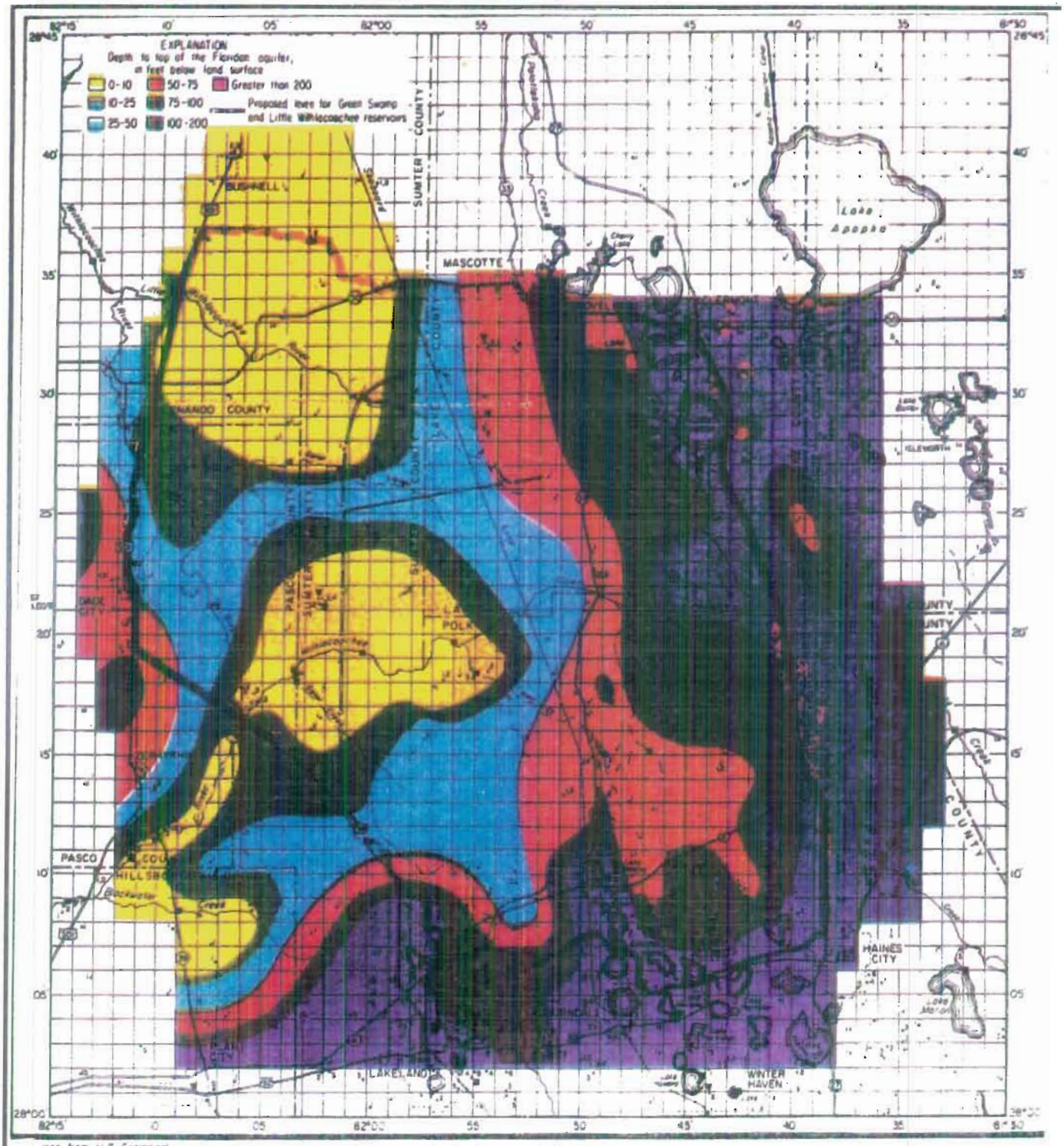
The Floridan Aquifer is the principle source of artesian groundwater in Florida. In the Green Swamp area, the aquifer is exposed at the surface in the western and northwestern parts and occurs at depths ranging from 50 to more than 200 feet below land surface in the eastern part of the area.

Soil Associations

The United States Department of Agriculture and the Soil Conservation Service publish information on the properties of the near surface soils and maps depicting the soil distribution generally by county.

When describing and mapping soils, scientists observe and measure many different soil properties including a description of the soils, location, suitability, limitations, and the management potential of the soils for a variety of uses.

The soil profile is measured and described from the land surface down into the unconsolidated material from which the soil is formed. The results of the soil survey soil association maps for the five (5) counties



DRWG: GSTF1711

SOURCE: REPORT OF INVESTIGATIONS No. 42, 1966.

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	**GREEN SWAMP AREA SHOWING DEPTHS TO THE TOP OF THE FLORIDAN AQUIFER**
GURR & ASSOCIATES, INC. — Drafted: 1/15/92 — Revised:	PROJECT No. GSTF-001 — MAP 1-12

included in the Green Swamp area have been combined into one map (Map 1-14, Soil Associations Green Swamp Area). Descriptions of these soils and the key to the soil identification numbers has been prepared (Table 1-7).

The soil surveys describe many of the soils making up the majority of the soils in the Green Swamp area as; nearly level, poorly drained sandy soils on broad lowlands interspersed with very poorly drained sandy soils and swamps in large depressions and level poorly drained soils that are subject to prolonged flooding (Table 1- 8 and Table 1-9).

The soils are also divided into four hydrologic soil groups identified as follows:

Group A - Soils having a high infiltration rate. These are deep well drained soils.

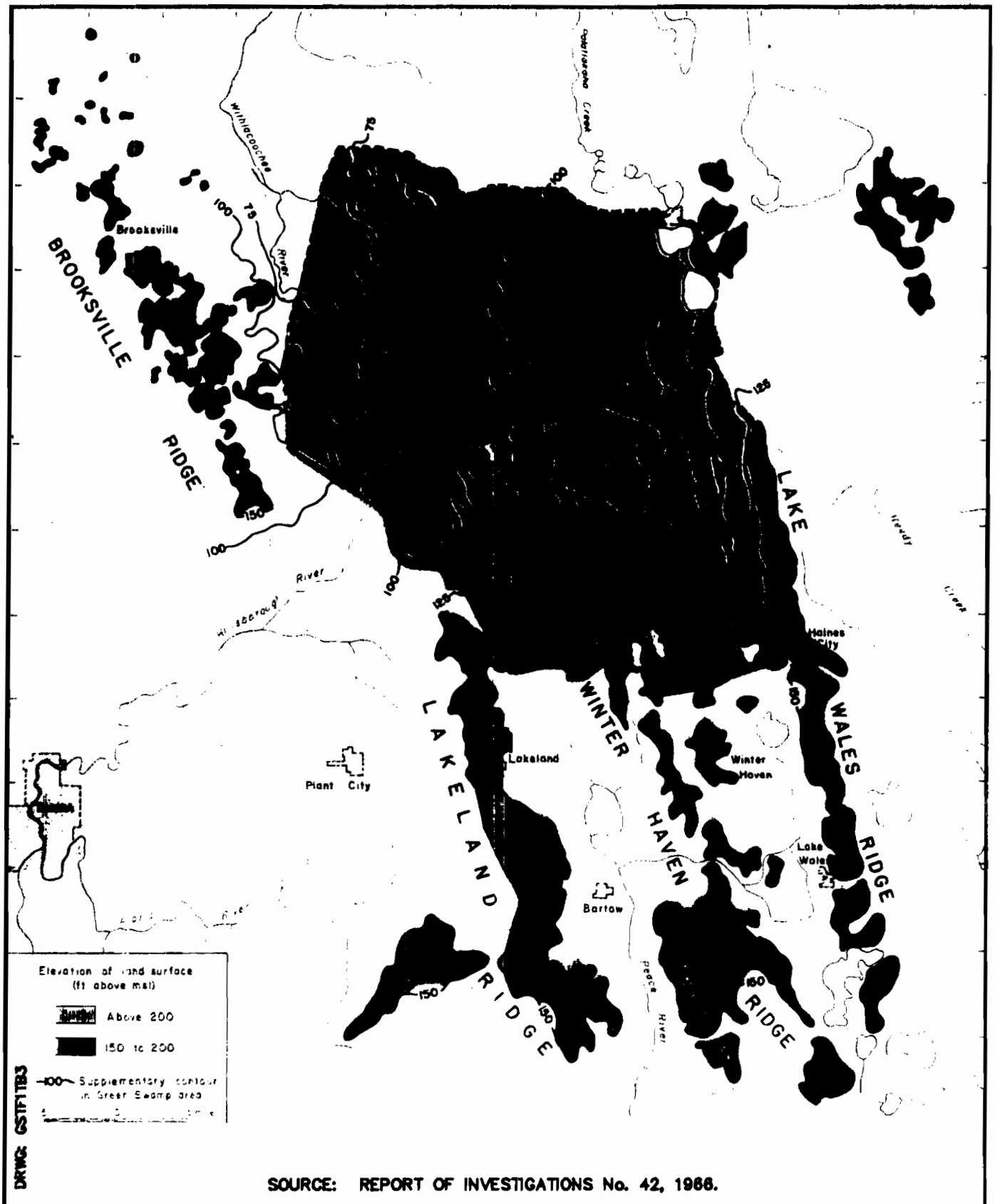
Group B - Soils having a moderate infiltration rate. These are moderately deep well drained soils with a moderately fine texture.

Group C - Soils having a slow infiltration rate. These soils generally have a layer that impedes the downward movement of water or are of a moderately fine texture.

Group D - Soils with a slow infiltration rate. These soils consist mostly of clays **or are soils with a high water table.**

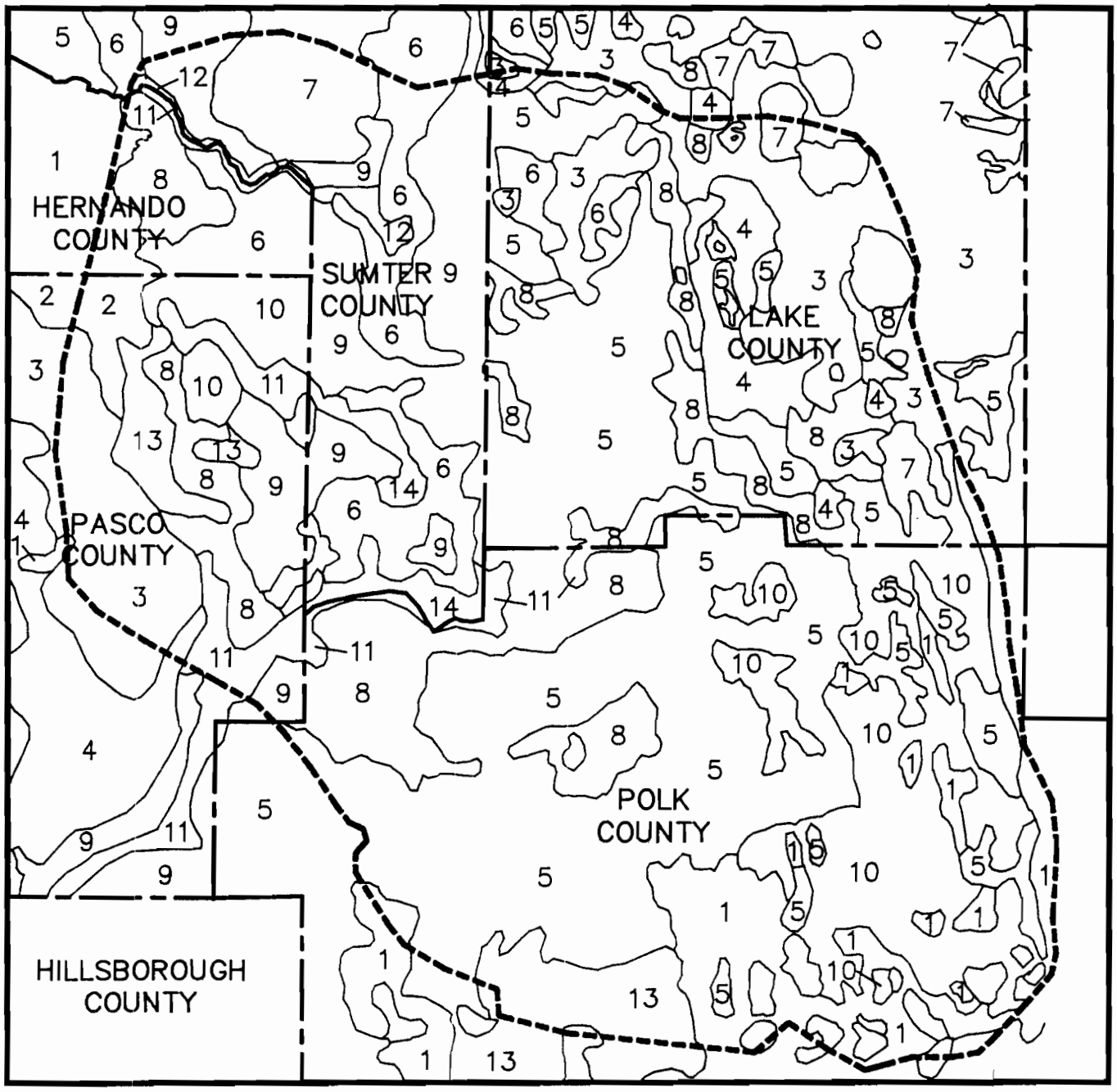
Some soils are assigned to two hydrologic soil groups. Soils with a seasonal high water table but that can be drained are assigned first to a hydrologic group that denotes the drained condition of the soil and then to a hydrologic group that denotes the un-drained condition.

Most of the low poorly drained soils in the Green Swamp Area fall into a dual hydrologic soil group identified as B/D (Table 1-8). The B/D hydrologic soils classification indicates soils which have moderate infiltration rates when the water table is low and slow infiltration rates during the season of the year when the water table is high.



SOURCE: REPORT OF INVESTIGATIONS No. 42, 1966.

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	**TOPOGRAPHY OF CENTRAL FLORIDA AND ITS RELATION TO THE GREEN SWAMP AREA**
GURR & ASSOCIATES, INC. — Drafted: 1/15/92, Revised:	PROJECT No. GSTF-001 — MAP 1-13



LEGEND

13 SOIL IDENTIFICATION NUMBER

--- HYDROLOGIC BOUNDARY

SEE LEGEND TABLE 1-

N

APPROXIMATE SCALE

0 3 6

MILES

SOURCE: USDA SOIL CONSERVATION SERVICE, SOIL SURVEYS OF THE FOLLOWING COUNTIES: POLK, LAKE SUMTER, HERNANDO, & PASCO

DRWG: GSTF1SLS

GREEN SWAMP TASK FORCE
POLK COUNTY, FLORIDA

GURR & ASSOCIATES, INC.

Drafted: 6/24/92
Revised:

SOILS ASSOCIATIONS GREEN SWAMP AREA

PROJECT No. GSTF-001

MAP 1-14

SOIL ASSOCIATION LEGEND

SUMTER COUNTY

2	Candler-Millhopper-Apopka: Nearly level to strongly sloping, excessively drained to moderately well drained, sandy soils; most are sandy throughout, and some have a loamy subsoil at a depth of more than 40 inches.
5	Sparr-Millhopper-Sumterville: Nearly level to gently sloping, somewhat poorly drained and moderately well drained, sandy soils; most have a loamy subsoil at a depth of more than 40 inches, and some have clayey subsoil at a depth of 20 to 40 inches.
6	Paisley-Ft. Green-Vero: Nearly level to gently sloping, poorly drained, sandy soils; some have a clayey or loamy subsoil, and some are sandy and dark in the upper part of the subsoil and loamy and clayey in the lower part.
7	Sparr-Seffner-Ona: Nearly level to gently sloping, somewhat poorly drained to poorly drained, sandy soils; some have a loamy subsoil at a depth of more than 40 inches, some are sandy throughout, and some have a sandy, dark subsoil within a depth of 20 inches.
9	EauGallie-Delray: Nearly level, poorly drained and very poorly drained, sandy soils; some have a sandy, dark subsoil within 30 inches of the surface; and all have a loamy subsoil at a depth of more than 40 inches.
10	Myakka-Placid-Ona: Nearly level, poorly drained and very poorly drained, sandy soils; some have a sandy, dark subsoil, and some are sandy throughout and do not have a subsoil.
12	Floridana-Basinger: Nearly level, very poorly drained and poorly drained, sandy soils; some have a loamy subsoil, and some have a sandy subsoil.
14	Nittaw-Chobee: Nearly level, very poorly drained, mucky and sandy soils that have a clayey or loamy subsoil.

LAKE COUNTY

3	Astatula-Apopka association: Nearly level to strongly sloping excessively drained and well-drained, sandy soils on broad ridges interspersed with large lakes, ponds, and wet depressions.
4	Tavares-Myakka association: Nearly level to gently sloping, moderately well drained sandy soils on low ridges interspersed with nearly level poorly drained sandy soils.
5	Myakka-Placid-Swamp association: Nearly level, poorly drained sandy soils on broad lowlands interspersed with very poorly drained sandy soils and swamps in large depressions.
6	Anclote-Iberia-Emeralde association: Nearly level, very poorly drained to poorly drained sandy and clayey soils on broad lowlands that are subject to flooding.
7	Montverde-Ocoee-Brighton association: Nearly level, very poorly drained organic soils on broad low areas that are subjectg to flooding.
8	Swamp association: Level, poorly drained soils that are subject to prolonged flooding.

HERNANDO COUNTY

1	Candler-Tavares-Paola association: Nearly level to sloping, excessively drained and moderately well drained soils that are sandy throughout, some have a thin lamalle of loamy sand and sandy loam at a depth of 48 to 80 inches.
6	EauGallie-Wabasso-Basinger association: Nearly level, poorly drained sandy soils; some have a weakly cemented layer at a depth of less than 30 inches over loamy material; others are sandy throughout.
8	Paisley-Floridana-Wabasso association: Nearly level, poorly drained sandy soils; some have a clayey subsoil within a depth of 20 inches; others are sandy to a depth of 20 to 40 inches and loamy below.
11	Floridana-Basinger association: Nearly level, poorly drained and very poorly drained soils; some are sandy to a depth 20 to 40 inches and loamy below; others are sandy throughout.

PASCO COUNTY

1	Tavares-Adamsville-Narcoossee: Nearly level to genty sloping, moderately well drained and somewhat poorly drained soils that are sandy throughout; some have a dark-colored layer within a depth of 25 inches.
2	Candler-Tavares-Paola: Nearly level to sloping, excessively drained and moderately well drained soils that are sandy throughout; some have a thin lamallae of loamy sand below a depth of 50 inches.
3	Lake-Candler: Nearly level to sloping, excessively drained soils that are sandy throughout; some have a thin lamallae of loamy fine sand below a depth of 50 inches.
4	Tavares-Sparr-Adamsville: Nearly level to sloping, moderately well drained and somewhat poorly drained soils; some are sandy throughout, and others are sandy to a depth of 40 to 80 inches and loamy below.
5	Arredondo-Sparr-Kendrick: Nearly level to sloping, well drained and somewhat poorly drained soils that are sandy to a depth of 20 to more than 40 inches and loamy below.
7	Nobleton-Blichton-Flemington Variant: Nearly level to sloping, somewhat poorly drained and poorly drained soils that are sandy to a depth of less than 40 inches and loamy or clayey below.
8	Smyrna-Sellers-Myakka: Nearly level, poorly drained and very poorly drained soils that are sandy throughout; some have a dark-colored subsoil within a depth of 30 inches, and some have a thick dark-colored surface layer.
9	Pomona-EauGallie-Sellers: Nearly level, poorly drained and very poorly drained soils, some have a subsoil that is dark colored and sandy within a depth of 30 inches and loamy below; some are sandy throughout and have a thick dark-colored surface layer.
10	Basinger-Wauchula: Nearly level to gently sloping, poorly drained soils; some are sandy throughout; some have subsoil that is dark-colored and sandy within a depth of 30 inches and loamy below.
11	Chobee: Nearly level, very poorly drained soils that have a dark-colored loamy surface layer less than 20 inches thick over calcareous materials.
13	Anclote-Tavares-Pomello: Nearly level to genty sloping, very poorly drained and moderately well drained soils that are sandy throughout; some have a thick dark-colored surface layer, and some have a dark-colored subsoil within a depth of 50 inches.

POLK COUNTY

1	Candler-Tavares-Apopka: Nearly level to moderately sloping, excessively drained, moderately well drained, and well drained, sandy soils; some are underlain by loamy or clayey material.
2	Astatula-Tavares-Basinger: Nearly level to moderately sloping, excessively drained, moderately well drained, and very poorly drained soils that are sandy throughout.
3	Archbold-Satellite: Nearly level and gently sloping, moderately well drained and somewhat poorly drained soils that are sandy throughout.
4	Zolfo-Tavares: Nearly level and gently sloping, somewhat pooorly drained and moderately well drained soils that are sandy throughout.
5	Pomona-Myakka-Smyrna: Nearly level, poorly drained, sandy soils; some are underlain by loamy material.
6	Smyrna-Myakka-Immokalee: Nearly level, poorly drained soilis that are sandy throughout.
7	Pompano-Satellite-Immokalee: Nearly level, poorly drained and somewhat poorly drained soils that are sandy throughout.
8	EauGallie-Bradenton-Floridana: Nearly level, poorly drained and very poorly drained, sandy soils that are underlain by loamy material.
9	Malabar-EauGallie-Valkaria: Nearly level, poorly drained, sandy soils; some are underlain by loamy material.
10	Samsula-Hontoon: Nearly level, very poorly drained, organic soils; some are underlain by sand.
11	Nittaw-Kaliga-Chobee: Nearly level, very poorly drained, loamy and mucky soils that are subject to flooding.
13	Arents-Hydraquents-Neilhurst: Soils that have been strip mined for phosphate or silica sand.

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FIGURE 1-8

SOIL AND WATER FEATURES

Soil Name	Hydrologic Group	Flooding			High Water Table		
		Frequency	Duration	Months	Depth	Kind	Months
Adamsville	C	None	---	---	2.0-3.5	Apparent	Jun-Nov
Anclote	D	None	---	---	+2-1.0	Apparent	Jun-Mar
Apopka	A	None	---	---	>6.0	---	---
Archbold	A	None	---	---	3.5-6.0	Apparent	Jun-Nov
Arents	B	None	---	---	2.0-3.0	Apparent	Jun-Nov
Arrendondo	A	None	---	---	>6.0	---	---
Astatula	A	None	---	---	>6.0	---	---
Basinger	B/D	None	---	---	0-1.0	Apparent	Jun-Feb
Blichton	D	None	---	---	0-1.0	Apparent	Jun-Sep
Bradenton	B/D	None	---	---	0-1.0	Apparent	Jun-Oct
Brighton	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-
Candler	A	None	---	---	>6.0	---	---
Chobee	B/D	Frequent	Very long	Jun-Feb	0-1.0	Apparent	Jun-Feb
Delray	D	None	---	---	+2-1.0	Apparent	Jun-Dec
EauGallie	B/D	None	---	---	0-1.0	Apparent	Jun-Oct
Emeralde	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-
Floridana	D	None	---	---	+2-0	Apparent	Jun-Feb
Ft. Green	D	None	---	---	0-1.0	Apparent	Jun-Jan
Hontoon	B/D	None	---	---	+2-0	Apparent	Jan-Dec
Hydraquets	D	None	---	---	+2-0	Apparent	Jun-Dec
Iberia	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-
Immokalee	B/D	None	---	---	0-1.0	Apparent	Jun-Oct
Kaliga	B/D	None	---	---	+1-0	Apparent	Jan-Dec
Kendrick	A	None	---	---	>6.0	---	---
Lake	A	None	---	---	>6.0	---	---
Malabar	B/D	None	---	---	0-1.0	Apparent	Jun-Nov
Millhopper	A	None	---	---	3.5-6.0	Perched	July-Dec
Montverde	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-
Myakka	B/D	None	---	---	0-1.0	Apparent	Jun-Oct
Narcoossee	C	None	---	---	2.0-3.5	Apparent	Jun-Nov
Neilhurst	A	None	---	---	>6.0	---	---
Nittaw	D	Frequent	Very long	Jun-Sep	0-1.0	Apparent	Jun-Nov
Nobleton	C	None	---	---	1.5-3.5	Perched	Jul-Oct
Ocoee	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-
Ona	B/D	None	---	---	0-1.0	Apparent	Jun-Nov
Paisley	D	None	---	---	0-1.0	Apparent	Jun-Nov
Paola	A	None	---	---	>6.0	---	---
Placid	D	None	---	---	+2-1.0	Apparent	Jun-Mar
Pomona	B/D	None	---	---	0-1.0	Apparent	Jun-Oct
Pomona	B/D	None	---	---	0-1.0	Apparent	Jul-Sep
Pompano	B/D	None	---	---	0-1.0	Apparent	Jun-Oct
Samsula	B/D	None	---	---	+2-0	Apparent	Jan-Dec
Satellite	C	None	---	---	1.0-3.5	Apparent	Jun-Nov
Seffner	C	None	---	---	1.5-3.5	Apparent	Jun-Nov
Sellers	B/D	None	---	---	+2-0	Apparent	Jun-Mar
Smyrna	B/D	None	---	---	0-1.0	Apparent	Jun-Oct
Sparr	C	None	---	---	1.5-3.5	Apparent	Jul-Oct
Sumterville	C	None	---	---	1.5-3.0	Perched	Jul-Oct
Swamp	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-	-NA-
Tavares	A	None	---	---	3.5-6.0	Apparent	Jun-Dec
Vero	B/D	None	---	---	0-1.0	Apparent	Jun-Oct
Wabasso	B/D	None	---	---	0-1.0	Apparent	Jun-Oct
Wauchula	B/D	None	---	---	0-1.0	Apparent	Jun-Feb
Zolfo	C	None	---	---	2.0-3.5	Apparent	Jun-Nov

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SELECT PHYSICAL PROPERTIES OF GREEN SWAMP SOILS

Soil Name	Depth	Clay	Permeability
Adamsville	0-80	2-8	6.0-20
	8-80	1-7	6.0-20
Anclote	0-18	2-8	6.0-20
	18-80	2-8	6.0-20
Apopka	0-51	<3	6.0-20
	51-80	18-37	0.6-2.0
Archbold	0-4	0-1	>20
	4-80	0-1	>20
Arents	---	---	---
Arrendondo	0-63	5-12	6.0-20
	63-87	15-25	0.6-6.0
Astatula	0-7	1-3	>20
	7-80	1-3	>20
Basinger	0-10	.5-4	<20
	10-29	1-6	<20
	19-80	1-3	<20
Blichton	0-27	2-12	6.0-20
	27-39	13-20	2.0-6.0
	39-55	20-35	0.2-0.6
	55-80	20-45	0.2-0.6
Bradenton	0-4	1-6	6.0-20
	4-12	1-6	6.0-20
	12-22	10-18	0.6-2.0
	22-80	1-18	0.6-6.0
Brighton	---	---	---
Candler	0-65	<3	<20
	65-80	3-8	6.0-20
Chobee	0-11	7-20	2.0-6.0
	11-56	20-35	<0.2
	56-80	7-20	0.2-6.0
Delray	0-16	3-13	6.0-20
	16-60	1-7	6.0-20
	60-80	13-30	0.6-6.0
EauGallie	0-17	<5	6.0-20
	17-21	1-8	0.6-6.0
	21-48	1-5	6.0-20
	48-55	13-31	0.6-6.0
	55-80	1-13	2.0-6.0
Emeralde	---	---	---
Floridana	0-15	3-10	6.0-20
	15-28	1-7	6.0-20
	28-80	15-30	<0.2
Ft. Green	0-28	1-5	6.0-20
	28-38	15-30	0.06-0.6
	38-58	20-40	0.06-0.6
	58-80	20-30	0.06-0.6
Hontoon	0-75	---	0.20-0.40
	75-80	---	---

SELECT PHYSICAL PROPERTIES OF GREEN SWAMP SOILS

Soil Name	Depth	Clay	Permeability
Hydraquets	0-80	55-90	<0.06
Iberia	---	---	---
Immokalee	0-7	1-5	6.0-20
	7-39	1-5	6.0-20
	39-58	2-7	0.6-2.0
	58-66	1-5	6.0-20
	66-80	2-7	0.6-2.0
Kaliga	0-30	1-5	6.0-20
	30-75	15-30	0.06-0.2
	75-80	1-13	6.0-20
Kendrick	0-28	1-7	6.0-20
	28-80	15-25	0.6-2.0
Lake	0-80	1-3	6.0-20
Malabar	0-22	0-4	6.0-20
	22-38	1-5	6.0-20
	38-48	1-5	6.0-20
	48-80	12-25	<0.2
Millhopper	0-7	1-5	6.0-20
	7-45	1-5	6.0-20
	45-80	15-30	0.06-2.0
Montverde	---	---	---
Myakka	0-27	<2	6.0-20
	27-38	2-8	.06-6.0
	38-80	<2	6.0-20
Narcoossee	0-3	2-6	6.0-20
	3-9	1-4	6.0-20
	9-12	2-6	2.0-6.0
	12-75	1-4	6.0-20
Neilhurst	0-80	1-2	>20
Nittaw	0-6	13-30	0.6-6.0
	6-75	35-60	0.06-0.2
	75-80	1-20	6.0-20
Nobleton	0-29	3-12	6.0-20
	29-36	22-40	0.2-2.0
	36-47	36-50	0.2-0.6
	47-80	22-40	0.2-2.0
Ocoee	---	---	---
Ona	0-9	1-7	6.0-20
	9-20	3-8	0.6-2.0
	20-80	1-4	6.0-20
Paisley	0-13	2-8	6.0-20
	13-80	45-65	0.06-0.2
Paola	0-26	<2	<20
	26-80	<3	<20
Placid	0-16	<10	6.0-20
	16-80	<10	6.0-20

SELECT PHYSICAL PROPERTIES OF GREEN SWAMP SOILS

Soil Name	Depth	Clay	Permeability
Pomona	6-22	1-6	6.0-20
	22-36	2-7	0.6-2.0
	36-52	1-6	6.0-20
	52-60	16-36	0.2-0.6
Pompano	0-80	0-5	6.0-20
Samsula	0-31	---	6.0-20
	31-80	1-14	6.0-20
Satellite	0-6	1-3	>20
	6-80	0-2	>20
Seffner	0-12	1-8	6.0-20
	12-18	1-8	6.0-20
	18-80	1-8	6.0-20
Sellers	0-9	8-12	6.0-20
	9-24	3-8	6.0-20
	24-80	2-5	6.0-20
Smyrna	0-13	1-6	6.0-20
	13-25	3-8	0.6-6.0
	25-80	1-6	6.0-20
Sparr	0-6	1-5	6.0-20
	6-57	1-5	6.0-20
	57-61	15-32	0.6-2.0
	61-69	15-38	0.6-2.0
	69-80	15-30	0.6-2.0
Sumterville	0-9	1-5	6.0-20
	9-29	1-5	6.0-20
	29-80	40-60	0.06-0.2
Swamp	---	---	---
Tavares	0-80	<3	<20
Vero	0-17	1-6	6.0-20
	17-33	1-8	6.0-20
	33-60	12-32	0.06-0.6
	60-80	7-19	0.06-0.6
Wabasso	0-21	---	6.0-20
	21-30	---	0.6-2.0
	30-38	---	6.0-20
	38-40	---	0.6-2.0
Wauchula	0-8	<2	6.0-20
	8-19	<2	6.0-20
	19-26	2-8	0.6-6.0
	26-34	<2	6.0-20
	34-80	15-30	0.6-6.0
Zolfo	0-7	1-5	6.0-20
	7-71	1-5	6.0-20

file: /wk1data/fred/soil2

Source: USDA Soil Conservation Service, Soil survey of the following counties: Polk, Lake, Sumter, Hernando, & Pasco

Upper Confining Beds

The upper confining beds of the Floridan aquifer in the Green Swamp are the Miocene clays or the residual clays in areas where the limestone is near land surface. Stringfield (1936) noted the Eocene Ocala Limestone, which is the uppermost part of the Floridan aquifer throughout most of the Green Swamp, is overlain by relatively impervious residual clays of the Miocene Hawthorn Formation in parts of northeastern Polk County, but that at least one well log revealed the occurrence of phosphatic marl on top of the Ocala Limestone. Confining beds consisting of clay and sandy clay were recognized by Pride and others and apparently were assumed to occur with the surficial aquifer throughout the Green Swamp. Several test holes were cored by Grubb (1977) in which no clay was penetrated and sand occurred on top of the uppermost limestone of the Floridan aquifer.

The thickness of the upper confining beds in the Green Swamp varies from less than 5 feet to greater than 20 feet for relatively large areas. These confining beds are generally thickest along the southern part of the Green Swamp and in two small areas in the northwest.

At the eastern boundary of the Green Swamp, the confining beds have been breached by a fault. (See Figures 1- 11, through 1- 13, Cross Sections A-A', B-B' and C-C') The relationship of this fault and the substantial storage of the surficial aquifer, at this location, may have an important impact on recharge to the Floridan aquifer. The fault also provides a direct pathway for pollutants.

Geology of the Floridan Aquifer

The Floridan aquifer is composed of middle Eocene to Oligocene limestone and dolomite and underlies the entire Green Swamp (Cooper, et al, 1953) (Figure 1-10, N-S Cross Section). Except for an area of about 24 square miles in the southwest part of the Green Swamp (Stewart, 1966) it is the uppermost limestone aquifer in the area. The base of this aquifer is not well defined in the area due to a scarcity of hydrogeologic data at depths exceeding 600 feet below land surface. Stewart (1966) and Pride and others (1966) place the base of this aquifer at the top of the Lake city Limestone or the lower part of the overlying Avon Park Limestone. This would, in general, indicate a thickness of about 1,000 feet in the Green Swamp area. A thickness of 1,500 to 2,000 feet is suggested by other workers. Knochenmus and Hughes (1976) consider the top of the lower Eocene Oldsmar Limestone as the base of this aquifer in central Florida. Klein (1971) places the base of the potable water in the Floridan aquifer at 2,000 feet below land surface for a large part of central Florida. More information is needed from deep wells drilled specifically for the purpose of studying the lower part of the Floridan aquifer to help resolve questions regarding the thickness of this aquifer and the character of its lower boundary. It is generally believed the Floridan is underlain by dense and relatively impermeable middle or lower Eocene or older rocks (Figures 1-10 through 1-13, Cross Sections N-S, A - A', B - B' and C - C').

The upper boundary of the Floridan aquifer is the overlying Miocene clay, residual clay, or post-Miocene sand. The top of this aquifer may be found at land surface or at depths greater than 200 feet below land surface. It has been observed at land surface in only a few isolated locations in Sumter, Polk and Pasco Counties near the Withlacoochee River (Rutledge and Grubb, 1978). Depths to the top of this aquifer in excess of 200 feet were reported for a few isolated areas along the Lake Wales Ridge on the eastern side of the Green Swamp (Pride and others, 1966). Generally, the aquifer is from 10 to 100 feet below land surface.

Groundwater Recharge and Discharge

The Florida Aquifer in the Green Swamp area is recharged by rainfall that percolates downward from the surface of the ground whether through the surficial aquifer and aquiclude or directly into the Floridan Aquifer in outcrop areas. Water is discharged from the aquifer by (1) outflow to areas of lower piezometric

head, (2) seepage and spring flow into the streams, (3) upward leakage to the nonartesian aquifer in areas of artesian flow, (4) evapotranspiration, or (5) pumpage. (See Recharge Maps 1-15 and 1-16)

The limestone formations which comprise the upper portions of the Floridan Aquifer are at or very near the land surface over large areas in the central and western portions of the Green Swamp (Figure 1-11). In the eastern portion of the Green Swamp the Floridan aquifer is overlain by a thick section of clastic sediments(Figures 1-11, 1-12 and 1-13).

Both recharge and discharge are reported to occur in the Green Swamp area. The changes which may occur in the rates of recharge and discharge from the aquifer in the Green Swamp are a function of the rain fall and therefore are expected to change in the wet and dry seasons of the year. For instance during the wetter months of the year (July, August, and September) the potentiometric surface of the Floridan Aquifer is at or very near the surface over much of the central portion of the Green Swamp, the land surface has a high water table or may be flooded in some areas. Discharge may occur during this period. Recharge rates are higher than during rainfall events which occur in the winter months when the potentiometric surface of the aquifer is lower and there is a thicker section of unsaturated sediments into which the rainfall can seep.

On the eastern portion of the Green Swamp and in some areas of the extreme western most sections of the Green Swamp the surfical sediments are much thicker and the recharge of rainfall can be more consistent over the entire year.

Several attempts have been made to quantify the annual recharge potential of the Green Swamp area (Maps 1-16 and 1-17). In general, both workers show similar recharge features for the area. The central and northwestern portion of the Green Swamp is characterized as an area of low to moderate recharge. This area also reports discharge to stream flow during portions of the year. The western fringes and the eastern and southern portions of the Green Swamp area are characterized as areas of high recharge. The real significance is that even though the rate of recharge may vary from low to moderate to high the large size of the Green Swamp make it a significant recharge area.

These attempts to quantify the recharge rates are general in nature and can to be more accurately defined and calibrated to the site specific soils which occur in the area (see soils section), the potentiometric level of the aquifer, and the hydrologic season of the year. This would better quantify the recharge potential of the Green Swamp area.

Hydrogeologic Properties

The transmissivity of this aquifer is highly variable within the Green Swamp. Pride and others (1966) reported aquifer test values of about 2,900 to 94,000 feet^2/day. They attributed this variability to areal and vertical variation in hydraulic conductivity of the aquifer and to unequal depths of aquifer penetration by the pumping wells. They recognized five different areal zones of constant hydraulic conductivity and made estimates of transmissivity for each area based on an assumed aquifer thickness of 1,000 feet.

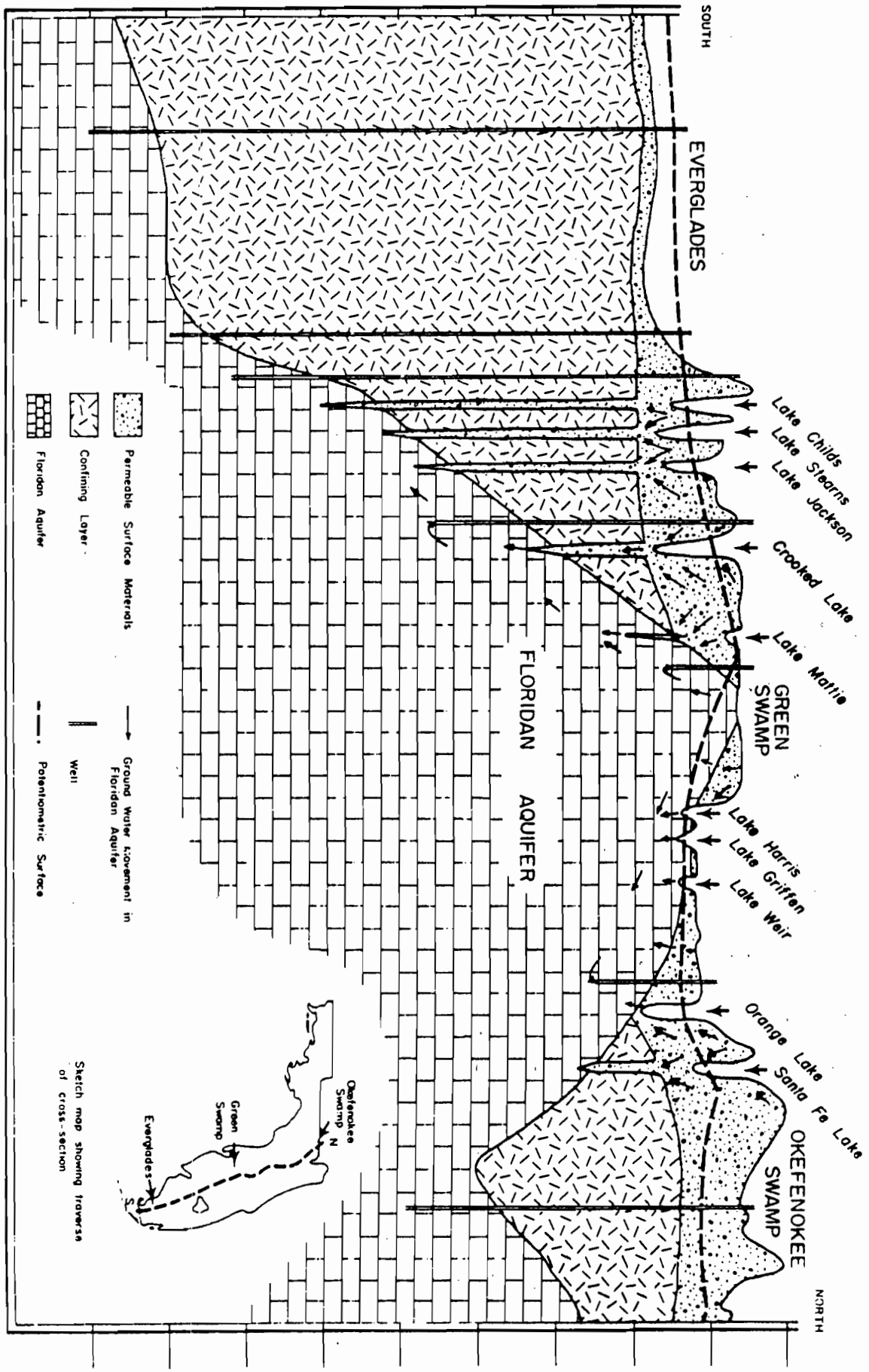
There may be a tendency to overestimate transmissivity by assuming the hydraulic conductivity computed from an aquifer test applies to the total thickness of the aquifer when only a small fraction of the total thickness was penetrated by the control wells. Grubb (1977) found that 99 percent of the flow to a 200 feet deep, 8-inch well came from the upper 30 percent of the Floridan aquifer at a south Lake County aquifer test site. The lower 70 percent of the aquifer penetrated at this site was a clayey limestone in the upper part of the Avon Park Limestone. Thus, a computed average hydraulic conductivity would give undue weight to the higher conductivity of the upper 30 percent of the open hole. The variability of the aquifer is illustrated by the following example. A 47 feet thick cavity was penetrated in a well at an aquifer test site in northwest Polk County about 9 miles south of the Lake County test site. The top of this cavity

was 165 feet below land surface in the upper part of the Avon Park Limestone. Just 60 feet away, another well penetrated a clayey limestone to a depth of 200 feet below land surface without encountering the cavity.

There is a large quantity of water stored in the Floridan aquifer because of its great thickness and a relatively high specific yield of 13 percent (average of 10 values reported by Stewart, 1966). However, with the aquifer under artesian conditions, the change in storage per unit change in head (storage coefficient) in this aquifer is much less than that in the near-surface sand aquifer. Values of the storage coefficient for the Florida aquifer are one-tenth to one-thousandth of those for the unconfined surficial aquifer (Pride et. al., 1966; Stewart, 1966; and Grubb, 1977).

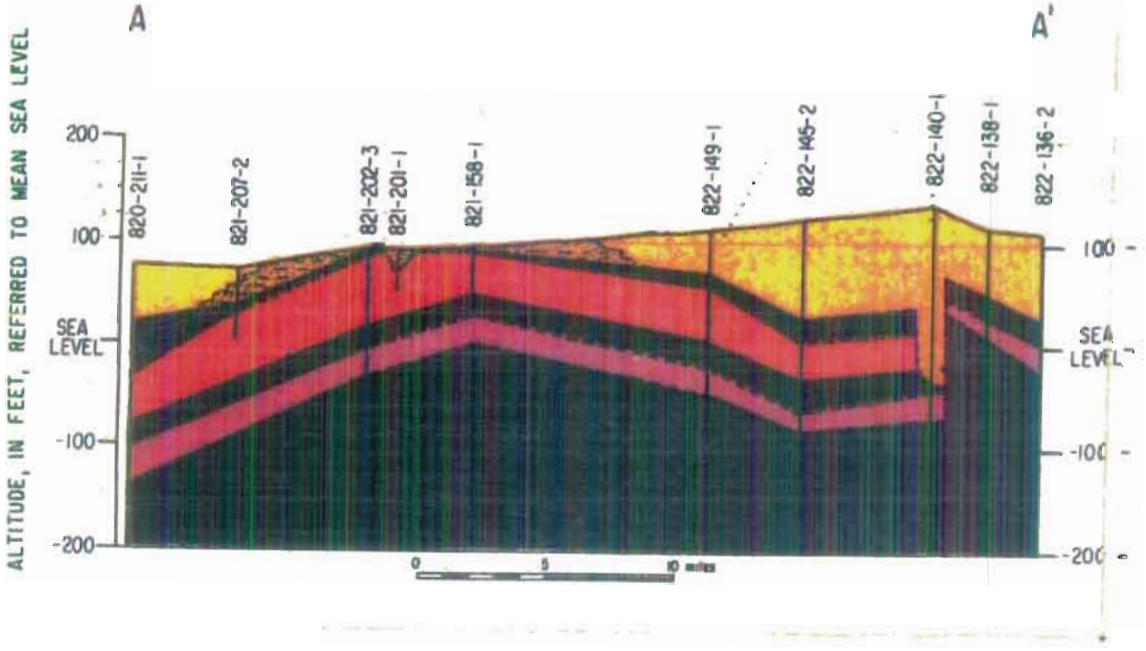
FIGURE 1-10

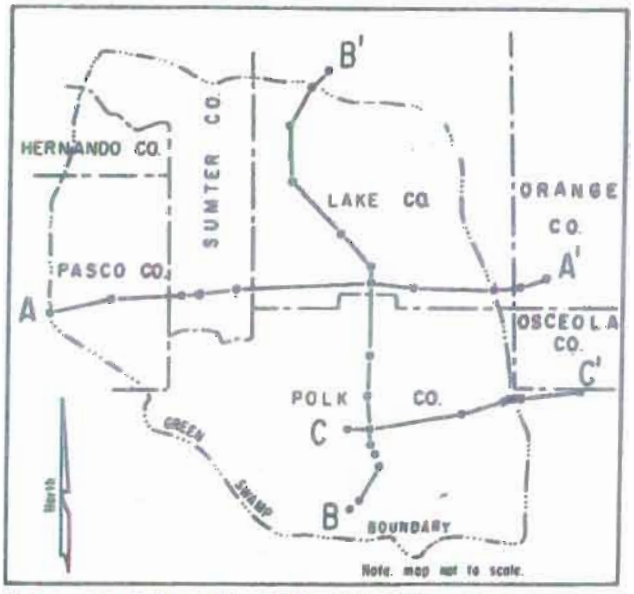
Generalized Geologic Cross Section N-S



Generalized Geologic Cross Section of the Florida Peninsula Showing the Relation of the Green Swamp Area to the Floridan Aquifer

Source: USGS





Sketch map of the Green Swamp area showing the locations of cross sections

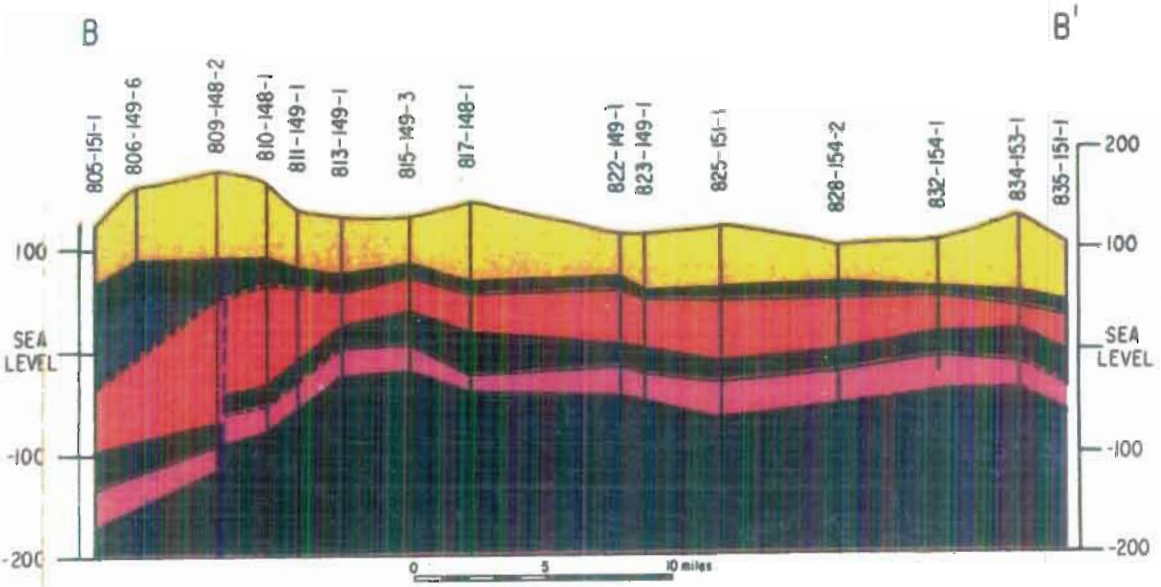
EXPLANATION

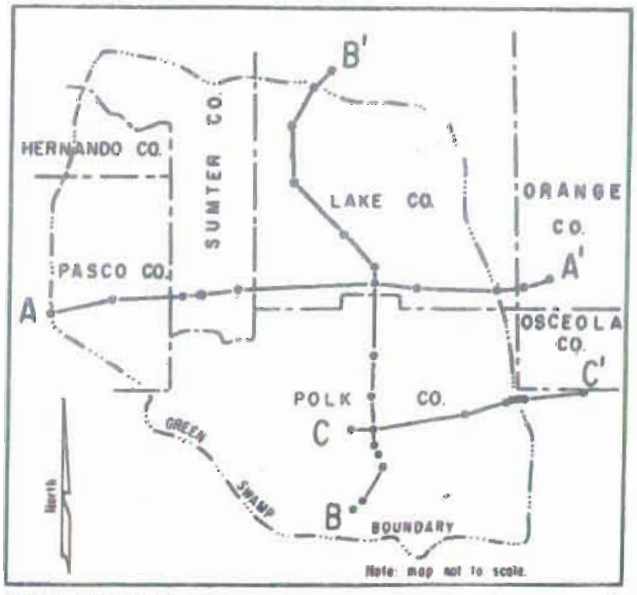
- Undifferentiated clastic deposits (clayey sand on left side graded into sandy clay on right side)
- Undifferentiated clay
- Suwannee Limestone
- Crystal River Formation
- Williston Formation
- Inglis Formation
- Avon Park Limestone
- Fault; arrows indicate direction of movement.

SOURCE: REPORT OF INVESTIGATIONS No. 42, 1966.

DRWG: GSTF1T12

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	GENERALIZED GEOLOGIC CROSS SECTIONS ALONG LINES A – A'
GURR & ASSOCIATES, INC. Drafted: 1/15/92 Revised:	PROJECT No. GSTF–001 FIGURE 11





Sketch map of the Green Swamp area showing the locations of cross sections

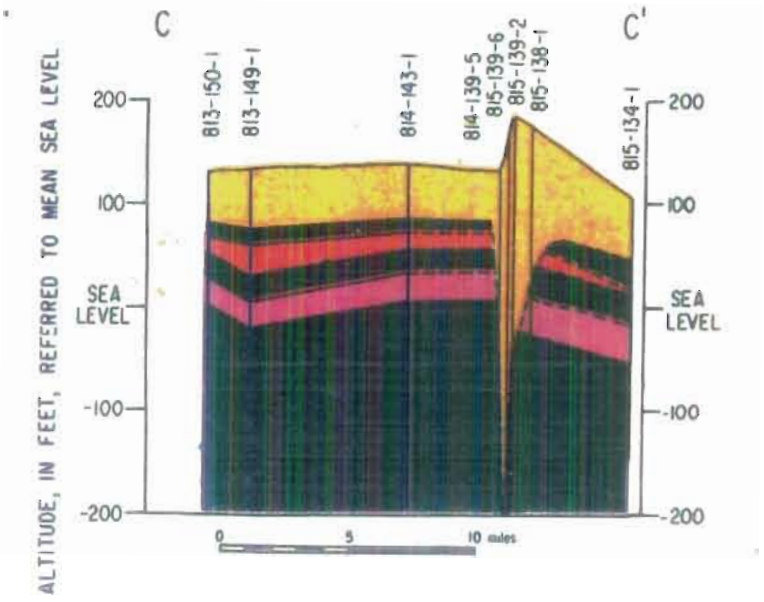
EXPLANATION

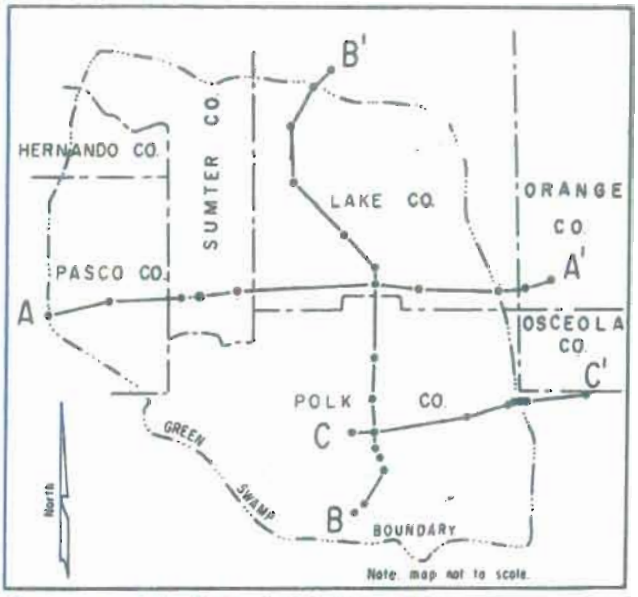
- Undifferentiated clastic deposits (clayey sand on left side graded into sandy clay on right side)
- Undifferentiated clay
- Suwannee Limestone
- Crystal River Formation
- Williston Formation
- Inglis Formation
- Avon Park Limestone
- Fault; arrows indicate direction of movement

SOURCE: REPORT OF INVESTIGATIONS No. 42, 1966.

DRWG: GSTF1113

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	GENERALIZED GEOLOGIC CROSS SECTIONS ALONG LINES B – B'
GURR & ASSOCIATES, INC. Drafted: 1/15/92 Revised:	PROJECT No. GSTF–001 FIGURE 12





Sketch map of the Green Swamp area showing the locations of cross sections

EXPLANATION

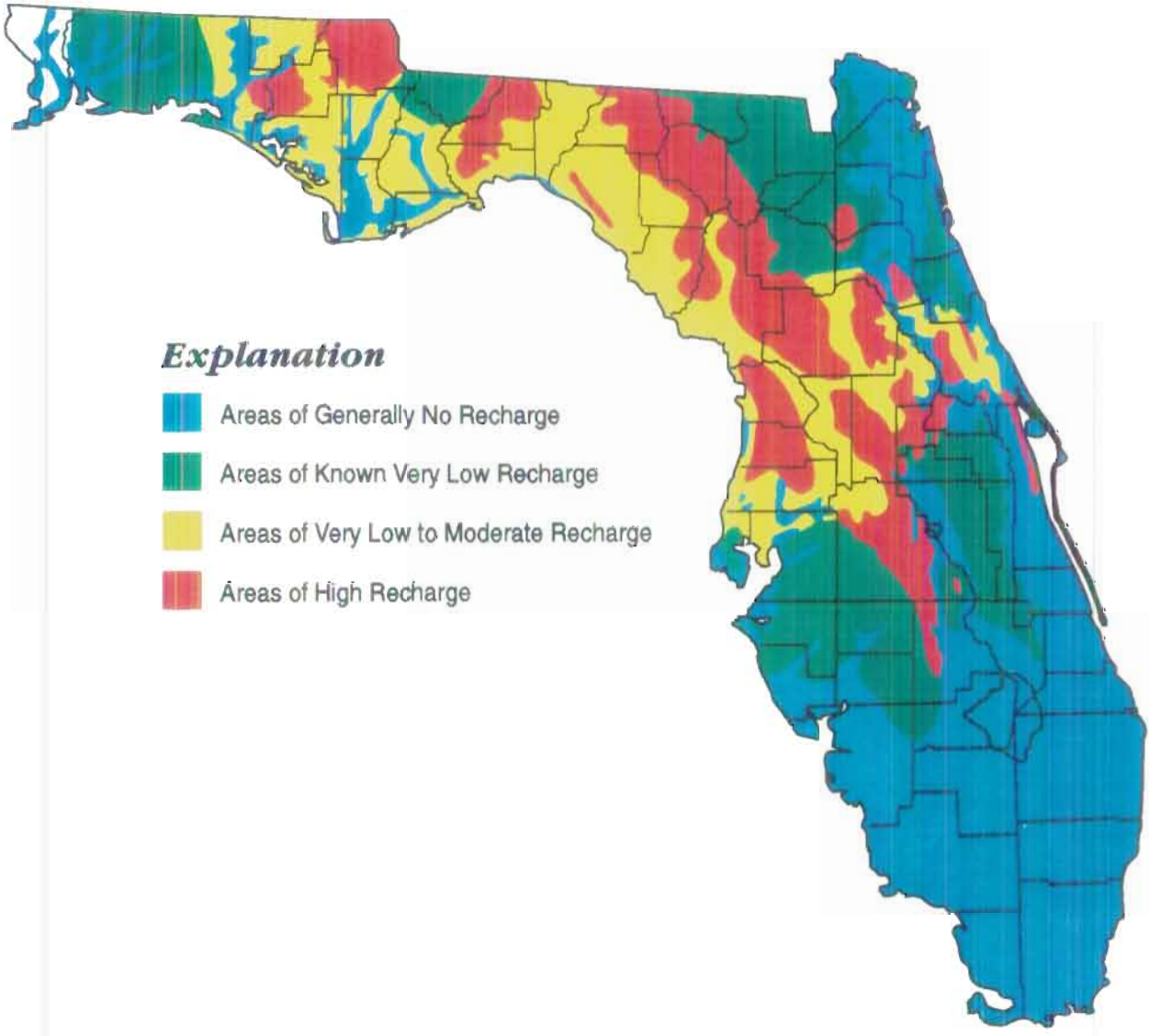
- Undifferentiated clastic deposits (clayey sand on left side graded into sandy clay on right side)
- Undifferentiated clay
- Suwannee Limestone
- Crystal River Formation
- Williston Formation
- Inglis Formation
- Avon Park Limestone
- Fault; arrows indicate direction of movement

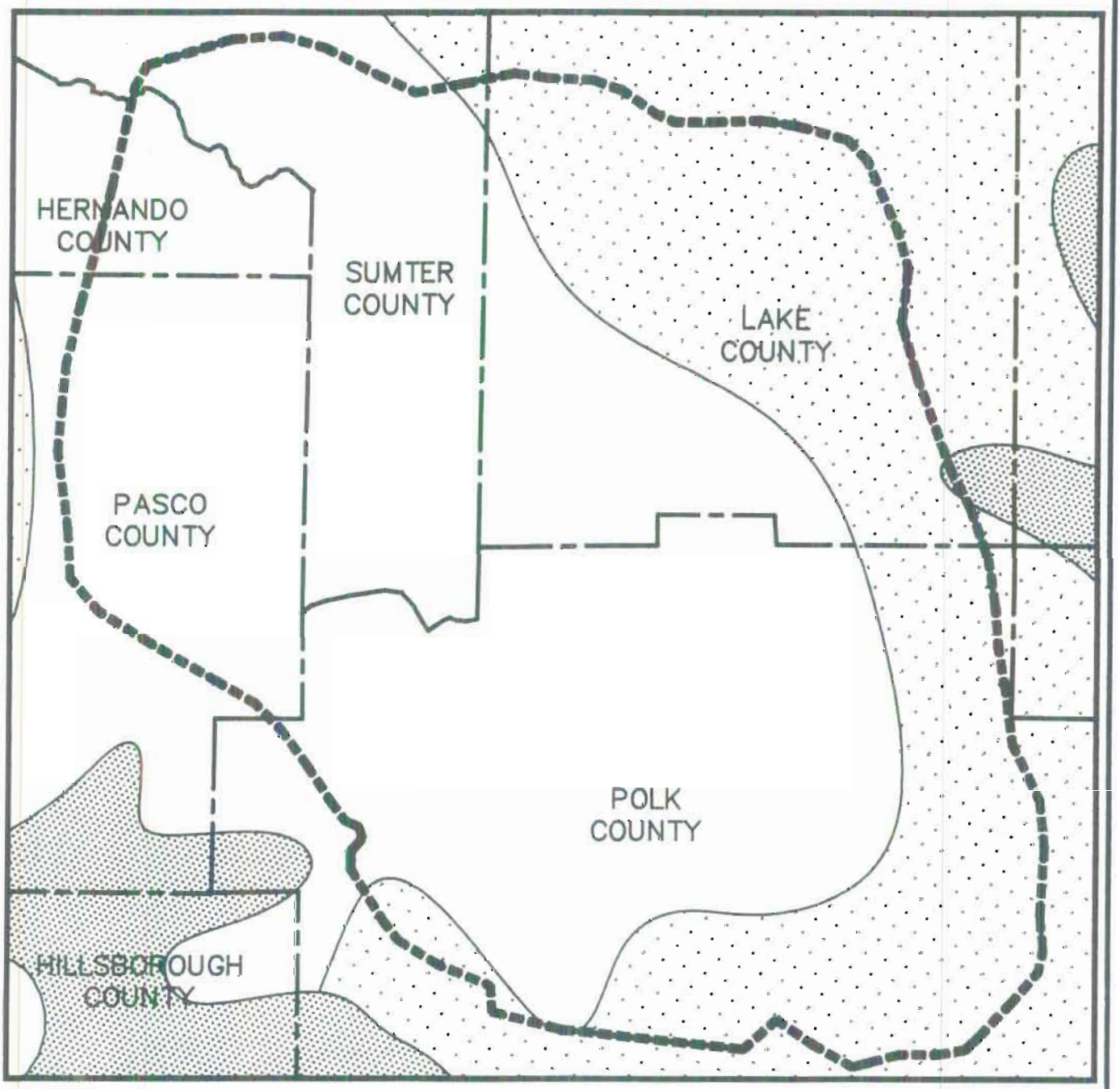
DRWG: GSTF1114

SOURCE: REPORT OF INVESTIGATIONS No. 42, 1966.

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	GENERALIZED GEOLOGIC CROSS SECTIONS ALONG LINES C – C'
GURR & ASSOCIATES, INC. Drafted: 1/15/92 Revised:	PROJECT No. GSTF–001 FIGURE 13

Areas of Natural Recharge to the Floridan Aquifer in Florida





LEGEND

- HYDROLOGIC BOUNDARY
- AREAS OF KNOWN VERY LOW RECHARGE (<2" PER YEAR)
- AREAS OF VERY LOW TO MODERATE RECHARGE (<2-10" PER YEAR)
- AREAS OF HIGH RECHARGE (10-20" PER YEAR)

N

APPROXIMATE SCALE

0 3 6

MILES

SOURCE: J.W. STEWART, FDNR, BUREAU OF GEOLOGY (No. 98-1980)

DRWG: GSTF1RG2

GREEN SWAMP TASK FORCE
POLK COUNTY, FLORIDA

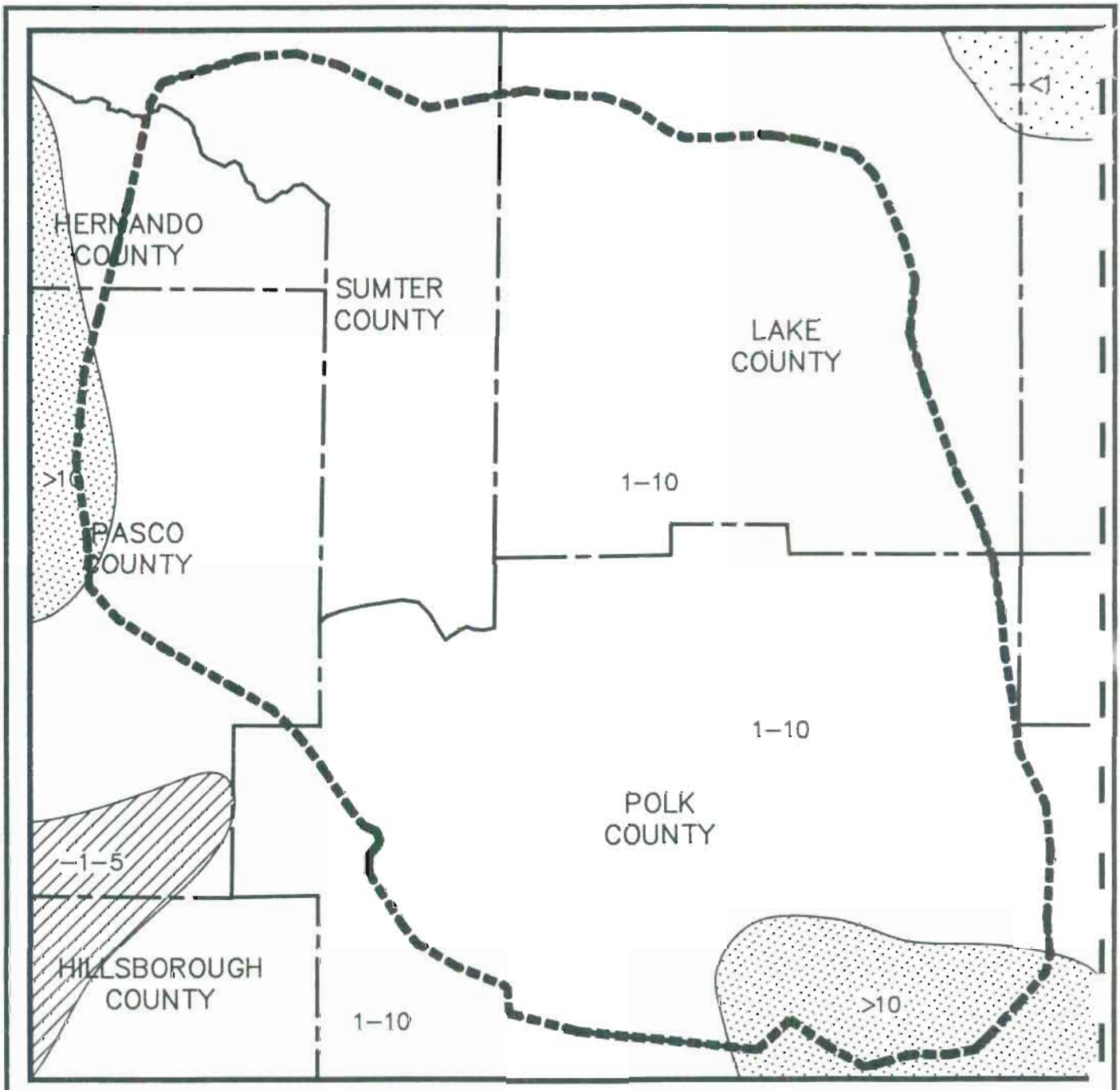
GURR & ASSOCIATES, INC.

Drafted: 6/24/92
Revised:

NATURAL RECHARGE AREAS TO THE FLORIDAN AQUIFER IN THE GREEN SWAMP

PROJECT No. GSTF-001

MAP 1-16



GREEN SWAMP TASK FORCE
POLK COUNTY, FLORIDA

AREAL VARIATION IN RECHARGE TO AND DISCHARGE FROM THE FLORIDAN AQUIFER IN THE GREEN SWAMP

GURR & ASSOCIATES, INC.

Drafted: 6/24/92
Revised:

PROJECT No. GSTF–001

MAP 1-17

WATER QUALITY

Quality of the water forming the headwaters of the six river systems issuing from the Green Swamp is, generally, very good. Color is naturally high due to humic, tannic, and other colored organic acids formed from the decomposition of vegetation. These organic acids also cause the pH to be low; in other words, acidity to be high. Mineral content, as measured by dissolved solids and specific conductance, is generally low, as is alkalinity and hardness, except where there is spring flow influence from the Floridan Aquifer.

Total nitrogen (TN) and total phosphorus (TP) are the primary nutrients that contribute to eutrophication of surface water. However, they are also nutrients required for plant growth. Excessive amounts lead to increased aquatic plant growths and nuisance conditions.

TN and TP concentrations tend to be somewhat higher in Florida swamps and marshes than they are in natural lakes and streams. For example, a number of years of data collection on an Orange County swamp and marsh showed the respective TN and TP values for each, 2.2 and 0.2 mg/L and 2.3 and 0.2 mg/L (2,8).

Dissolved oxygen (DO) tends to be quite a bit lower naturally in swamps, especially of flow is mainly from groundwater or aquifer water. Also, the large amounts of decaying vegetation, along with a lack of sunlight penetration, which is needed to drive photosynthesis, both contribute to lower DO's.

All the Green swamp rivers are examples of Florida swamp and bog streams according to Beck's Florida stream classification (1). Of the swamp and bog stream, Beck said, "They originate in swamps, sphagnum bogs, and marshes. They show a definite relationship to the sand-bottomed stream in that all chemical differences are functions of the one significant physical difference, velocity. An increase in gradient would convert them to the sand-bottomed type by increasing turbulence, which in turn would increase rearation, reduce carbon dioxide, and increase pH and alkalinity, and, finally, be removing the finer bottom sediments of organic silt and replacing them with sand. The swamp-and-bog stream is, then, a sand-bottomed stream with lowered velocity and the chemical and physical attributes that accompany this lowered velocity... The swamp-and-bog stream has the following characteristics: pH 3.8 to 6.5, alkalinity and hardness both normally well below 40 mg/L, color sometimes as high as 750 units, turbidity low, and carbon dioxide at times above 100 mg/L...the general fauna gives the impression to those in pollution abatement of being composed almost totally of species highly resistent to organic pollution, though the fishes are an exception." (1).

Figure 14, Means/Ranges of Pertinent Water Quality Parameters shows data from streams on the west side of the Green Swamp. Figure 15, Water Quality Index Criteria indicates the quality level of some parameters. Specific river water quality data is summarized in Figures 1-16 through 1-27 by river heading. The sources of these data are Lake County Pollution Control, Florida Department of Environmental Regulation, Southwest Florida water Management District, U.S. Geological Survey, and STORET (the Environmental Protection Agency's water quality data storage and retrieval system).

Withlacoochee River

Water quality is very good in this entire basin. water flowing from the Green swamp forming the headwater of this river is highly colored and acid with the pH averaging 4.8. TP and nitrate-nitrogen are low to moderate. Ammonium-nitrogen is low; organic nitrogen is moderate for swamps. As flow moves downstream from the Green Swamp, DO, conductivity, pH, calcium, magnesium and inorganic carbon tend to increase; organic carbon decreases. These trends indicate increasing influence of the Floridan aquifer inflow.

General water quality of the major Withlacoochee River tributaries follow:

A. Gator Creek (Figure 1-16):
This tributary is slightly and clear with moderate TP and nitrate-nitrogen, low ammonium-nitrogen, conductivity, calcium and magnesium and high DO.

B. Colt Creek (Figure 1-17:
This tributary to Gator Creek has water quality similar to Gator Creek but with lower DO due to more Green swamp influence.

C. Pony Creek (Figure 1-18):
Likewise, this tributary demonstrates water quality similar to that of gator Creek.

Little Withlacoochee River (Figure 1-19, Withlacoochee River Basin, South Fact Sheet)(Figure 1-20, Withlacoochee River Basin)(Figure 1-21, Withlacoochee River,South)

The water issuing from the Green Swamp forming this river is clear during low flow but tannin colored and acid during higher flow with pH averaging about 4.7. Conductivity calcium, magnesium, TN, TP, organic nitrogen, ammonium-nitrogen and inorganic carbon are all low. Nitrate-nitrogen is moderate. DO is low but typical of swamps with low flow.

Hillsborough River (Figure 1-22, Hillsborough River Fact Sheet)(Figure 1-23, Hillsborough River Basin)(Figure 1-24, Hillsborough River Water Quality Stations)(Figure 1-25, Hillsborough River Data)

The water coming from the Green Swamp and forming this river is slightly acid (but varying from acid to slightly alkaline). TN and TP are low to moderate with higher values around bridges indicating an influence from road runoff. Conductivity, nitrate-nitrogen, pH, calcium, and inorganic carbon are all somewhat high and DO is low, which indicates groundwater and Floridan Aquifer water influence. Once Crystal Springs enters the river, the water becomes clear, hard and alkaline.

Oklawaha River

The Oklawaha River starts out of the Green swamp as Little and Big (Green Swamp Run) Creeks which enter lake Louisa and then become the Palatlakaha River as a major tributary to the Oklawaha. Little and Big Creeks are highly acid (low pH), with high color and organic nitrogen, and low TP, alkalinity, hardness conductivity, and DO. Little Creek has somewhat higher TN and color with lower pH and DO than Big Creek.

In the early 1980's large fires occurred in this section of the Green swamp. Reflooding after the fires contributed to large amounts of TN flushing out into Little and Big Creeks during heavy rain events (3).

Peace River (Figure 1-26, Peace River Basin Fact Sheet)(Figure 1-27, Peace River Basin)

Very Little of the Green Swamp drains via the Peace River and very little water quality data exists for the Green swamp headwaters. The headwaters are a typical acid, highly colored blackwater drainage system of good quality. However, in a short distance from the Green swamp, many anthropogenic impacts add to a downstream degradation of this river. This basin is affected by domestic and industrial sources, urban stormwater, phosphate mining and agriculture runoff.

Kissimmee River

No water quality data could be located for the Kissimmee River portion of the Green Swamp.

FIGURE 1-14

Means/Ranges of Pertinent Water Quality Parameters[1]

Parameter	Withlacoochee[2]	(N)[3]	Little Withlacoochee[4]	(N)	Big Creek[2]	(N)	Oklawaha Little Creek[2]	(N)	Hillsborough[4]	(N)
Dissolved Oxygen	3.4	(131)	1.8	(10)	5.0	(15)	2.9	(15)	2.2	(10)
Total Nitrogen	2.18	(42)	1.24	(10)	1.31	(16)	1.61	(15)	1.47	(10)
Nitrate-Nitrogen	0.01	(54)	0.13	(10)	0.02	(16)	0.01	(16)	0.27	(10)
Total Phosphorus	0.10	(128)	0.04	(10)	0.03	(16)	0.03	(16)	0.18	(10)
Color (Units)	298	(74)	15->100		65-240[5]		150-300[5]		80-150[5]	
pH (Units)	4.8	(166)	4.7	(10)	5.0	(15)	4.5	(15)	6.5	(9)
Conductivity*	81	(191)	62	(10)	98	(15)	110	(16)	166	(10)

*umhos/cm

1. All values are in mg/L unless noted differently.
2. Data from STORET, the federal data storage system.
3. Number of measurements.
4. Data from SWFWMD.
5. Data from USGS.

Florida Stream Water Quality Index Criteria (Percentile Distribution of STORET Data)

		GOOD			FAIR				POOR	
		Best Quality			Median Quality				Worst Quality	
Parameter*	Unit	10%	20%	30%	40%	50%	60%	70%	80%	90%
OXYGEN DEMAND										
BOD	mg/l	0.80	1.10	1.10	1.30	1.50	1.90	2.30	3.30	5.10
NUTRIENTS										
TN	mg/l	0.55	0.75	0.90	1.00	1.20	1.40	1.60	2.00	2.70
TP	mg/l	0.02	0.03	0.05	0.07	0.09	0.16	0.24	0.46	0.89
METALS										
CD	ug/l	2	4	8	12	17	20	--	--	40
CU	ug/l	12.5	25	50	75	100	125	--	--	250
PB	ug/l	50	100	150	200	250	300	--	--	1000

Parameters*

BOD = Biological Oxygen Demand
TN = Total Nitrogen
TP = Total Phosphorus
CD = Cadmium
PB = Lead

Sources: Hand et al. 1986, Hand et al. 1988

FIGURE 1-16

Data for Selected Chemical Parameters for Gator Creek @ Proposed Levee - April, 1983 through January, 1984

Parameter		
Temperature (°C)	21.6 ± 5.1	(4)
Specific Conductance (umho/cm @ 25°C)	86 ± 27	(4)
Dissolved Oxygen	6.1 ± 1.3	(4)
pH (units)	5.8 ± 0.4	(4)
Suspended Solids	3.22 ± 2.72	(4)
Calcium	9.43 ± 5.59	(4)
Magnesium	1.59 ± 0.44	(4)
Ammonia - Nitrogen (as N)	0.03 ± 0.04	(4)
Nitrogen - Organic (as N)	1.34 ± 0.10	(4)
Nitrate - Nitrogen (as N)	0.23 ± 0.13	(4)
Phosphate, Ortho (as P)	0.028	(1)
Phosphate, Total (as P)	0.157 ± 0.059	(4)
Carbon, Inorganic	4.8 ± 2.9	(4)
Carbon, Organic	36.0 ± 5.6	(4)

All values are in mg/l unless otherwise noted; values are expressed as the mean ± the standard deviation of the mean; numbers in parentheses indicate the number of water samples tested.

Data from records of the Southwest Florida Water Management District, Brooksville, Florida.

FIGURE 1-17

Data for Selected Chemical Parameters for Colt Creek @ Proposed Levee - April, 1983 through January, 1984

Parameter		
Temperature (°C)	21.5 ± 5.7	(4)
Specific Conductance (umho/cm @ 25°C)	150 ± 43	(4)
Dissolved Oxygen	1.2 ± 0.4	(4)
pH (units)	6.2 ± 0.4	(4)
Suspended Solids	2.43 ± 1.26	(4)
Calcium	24.69 ± 5.48	(4)
Magnesium	2.16 ± 0.65	(4)
Ammonia - Nitrogen (as N)	0.03 ± 0.01	(4)
Nitrogen - Organic (as N)	1.22 ± 0.12	(4)
Nitrate - Nitrogen (as N)	0.33 ± 0.13	(4)
Phosphate, Ortho (as P)	0.000	(1)
Phosphate, Total (as P)	0.132 ± 0.127	(4)
Carbon, Inorganic	2.1 ± 2.8	(4)
Carbon, Organic	27.0 ± 12.7	(4)

All values are in mg/l unless otherwise noted; values are expressed as the mean ± the standard deviation of the mean; numbers in parentheses indicate the number of water samples tested.

Data from records of the Southwest Florida Water Management District, Brooksville, Florida.

FIGURE 1-18

Data for Selected Chemical Parameters for Pony Creek @ Rock Ridge Road - April, 1983 through January, 1984

Parameter		
Temperature (°C)	19.8 ± 4.3	(5)
Specific Conductance (umho/cm @ 25°C)	82 ± 3	(5)
Dissolved Oxygen	7.0 ± 1.6	(5)
pH (units)	5.3 ± 0.6	(5)
Suspended Solids	3.08 ± 1.91	(5)
Calcium	3.71 ± 1.89	(5)
Magnesium	1.81 ± 0.59	(5)
Ammonia - Nitrogen (as N)	0.03 ± 0.01	(5)
Nitrogen - Organic (as N)	1.26 ± 0.18	(5)
Nitrate - Nitrogen (as N)	0.06 ± 0.07	(5)
Phosphate, Ortho (as P)	0.092 ± 0.030	(2)
Phosphate, Total (as P)	0.173 ± 0.072	(5)
Carbon, Inorganic	1.7 ± 2.6	(5)
Carbon, Organic	39.0 ± 3.9	(5)

All values are in mg/l unless otherwise noted; values are expressed as the mean ± the standard deviation of the mean; numbers in parentheses indicate the number of water samples tested.

Data from records of the Southwest Florida Water Management District, Brooksville, Florida.

FIGURE 1-19

WITHLACOOCHEE RIVER BASIN, SOUTH

Basic Facts

Drainage Area: 2,090 square miles
Major Land Uses: agriculture, forest, wetlands
Population Density: low (Dade City, Inverness, Wildwood, Dunellon)
Major Pollution Sources: septic tank leachate, runoff
Best Water Quality Areas: Rainbow River, Jumper Creek
Worst Water Quality Areas: Dade City Canal
Water Quality Trends: stable quality at 14 sites
OFW Waterbodies:
- most of Withlacoochee River
- Withlacoochee riverine and lake system
- Rainbow River

SWIM Waterbodies:
- Rainbow River (Blue Run)
- Lake Panasoffkee

Reference Reports:
- Rainbow River SWIM Plan, SWFWMD, 1989
- Florida Rivers Assessment (Draft), DNR/FREAC/NPS, 1989
- Florida Nonpoint Source Assessment, DER (Tallahassee), 1988

Basin Water Quality Experts:
- Kraig McLane, Citrus County Planning, 904/746-4223
- Guy Hadley, Jim Hulbert, DER (Orlando), 407/894-7555

In the News

- The Withlacoochee River was designated an OFW.
- A compromise plan to turn the Cross Florida Barge Canal into a 40,000 acre "greenway corridor" for recreation and conservation apparently was worked out on Capitol Hill in May, 1990.

FIGURE 1-20

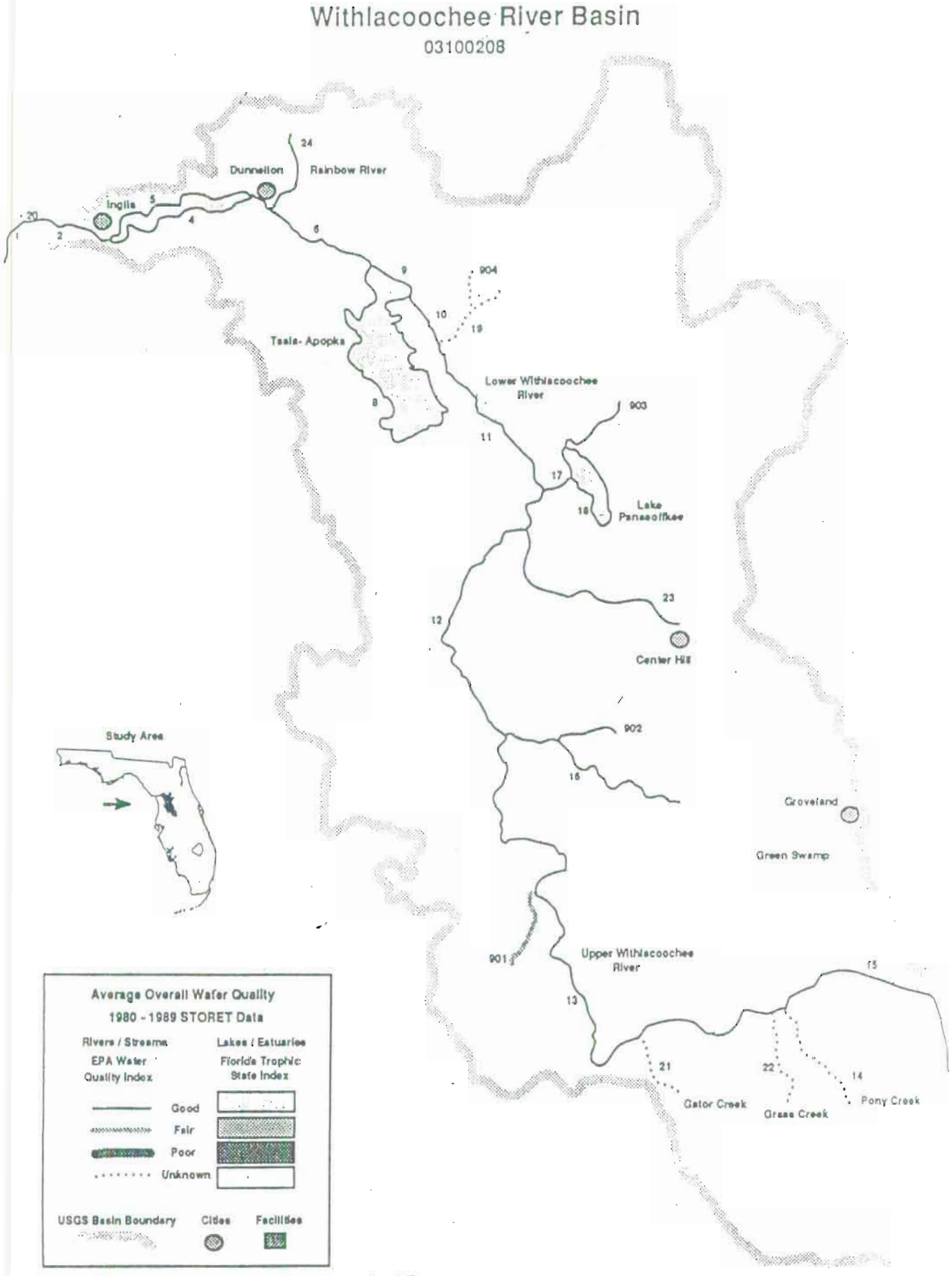
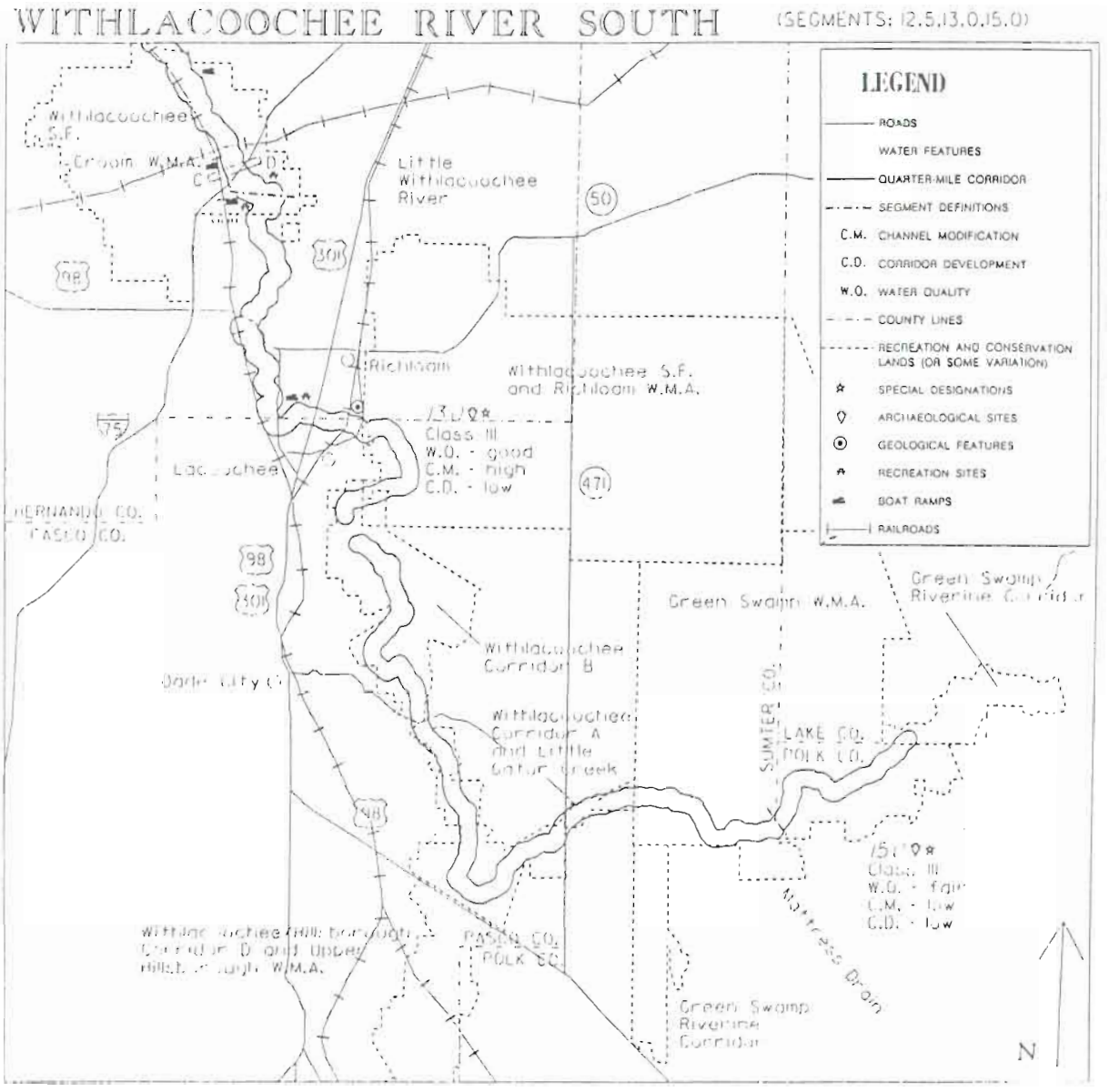

Withlacoochee River Basin
03100208
Dunnellon
Rainbow River
Inglis
Tsala- Apopka
Lower Withlacoochee River
Lake Panasoffkee
Center Hill
Study Area
Groveland
Green Swamp
Upper Withlacoochee River
Gator Creek
Grass Creek
Pony Creek
Average Overall Water Quality
1980 - 1989 STORET Data
Rivers / Streams
EPA Water Quality Index
Lakes / Estuaries
Florida Trophic State Index
Good
Fair
Poor
Unknown
USGS Basin Boundary
Cities
Facilities

FIGURE 1-21



OTHER RESOURCE VALUES

Reach	River Miles	Corridor Development	Channel Modification	Recreation Sites	Biological Comm.	Botanical Species	Exotic Species	Fish Species	Exotic Fish	Wildlife Species	Exotic Wildlife	Spec. Wildlife Areas	Archaeologic Sites	Historic Structures
0.00		-	-	0	0	2	Y	0	Y	27	Y	Y	0	0
12.50	5.1	LOW	HIGH	6	0	3	N	0	N	9	N	Y	5	2
13.00	17.8	LOW	HIGH	2	0	1	N	0	N	15	N	Y	33	0
15.00	5.7	LOW	LOW	0	0	3	N	0	N	81	N	Y	5	0

FIGURE 1-22

HILLSBOROUGH RIVER BASIN

Basic Facts

Drainage Area: 650 square miles
Major Land Uses: agriculture, rangeland, urban development
Population Density: moderate, except in southern basin (Tampa, Plant City, Zephyrhills)
Major Pollution Sources: several WWTPs and industrial sources
Best Water Quality Areas: middle Hillsborough River
Worst Water Quality Areas: Lake Thonotosassa
Water Quality Trends: stable quality at 8 sites, Lake Thonotosassa improving
OFW Waterbodies: none
SWIM Waterbodies: Lake Thonotosassa
Reference Reports:
Florida Rivers Assessment (Draft), DNR/FREAC/NPS, 1989
Florida Nonpoint Source Assessment, DER (Tallahassee), 1988
Lake Thonotosassa SWIM Plan, SWFWMD
Basin Water Quality Experts:
Sid Flannery, SWFWMD, 904/796-7211
Peter Clark, TBRPC, 813/577-5151
Doug Farrell, DER (Tampa), 813/623-5561

In the News

- Tampa has applied to the SWFWMD to increase the consumptive use of the river.
- Health advisories recommending limited consumption of largemouth bass due to mercury content have been issued for the Hillsborough River drainage system.

FIGURE 1-23

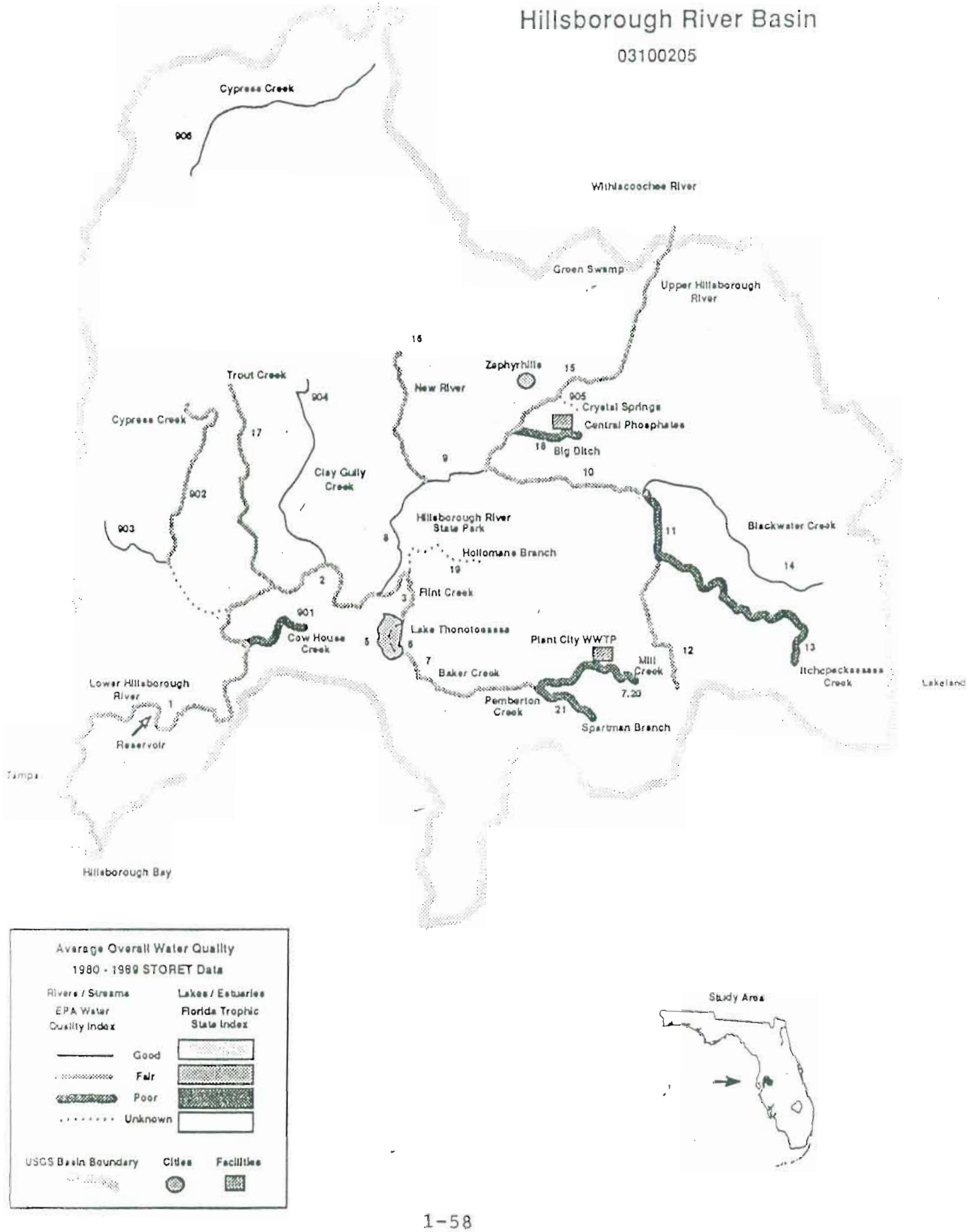
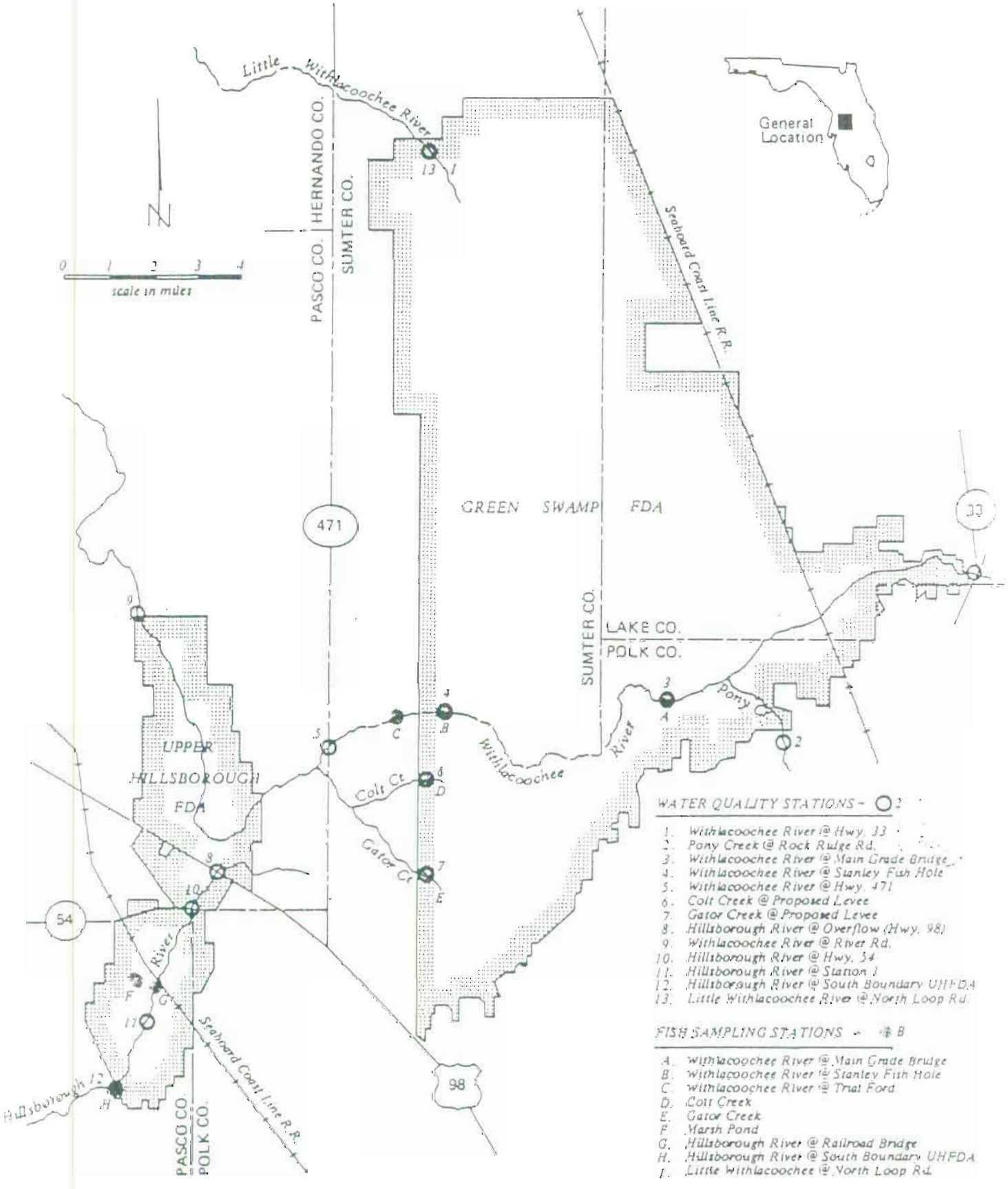
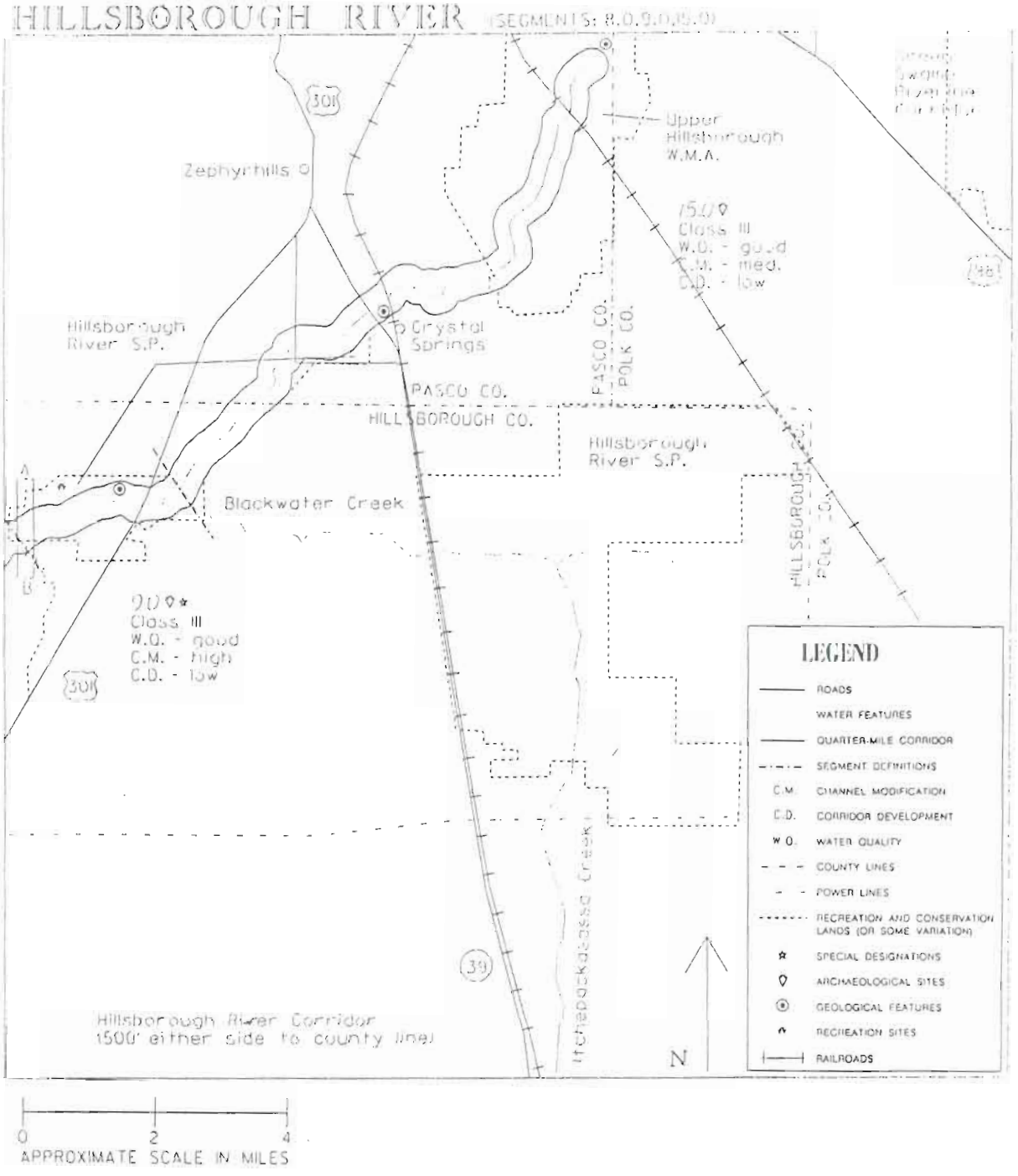

Hillsborough River Basin
03100205
Cypress Creek
906
Withlacoochee River
Green Swamp
Upper Hillsborough River
16
Zephyrhills
15
New River
905
Crystal Springs
Central Phosphates
18
Big Ditch
Trout Creek
904
Cypress Creek
17
Clay Gully Creek
9
10
902
903
Hillsborough River State Park
8
Hollomans Branch
19
11
Blackwater Creek
14
2
4
Flint Creek
3
901
Cow House Creek
5
Lake Thonotosassa
6
7
Baker Creek
Plant City WWTP
12
13
Mill Creek
7.20
Itchepackesassa Creek
Lakeland
Lower Hillsborough River
1
Pemberton Creek
21
Spartman Branch
Reservoir
Tampa
Hillsborough Bay
Average Overall Water Quality
1980 - 1989 STORET Data
Rivers / Streams
EPA Water Quality Index
Lakes / Estuaries
Florida Trophic State Index
Good
Fair
Poor
Unknown
USGS Basin Boundary
Cities
Facilities
Study Area

FIGURE 1-24



Location of water quality stations and fish sampling stations within or immediately outside the Green Swamp and Upper Hillsborough FDAs.

FIGURE 1-25



OTHER RESOURCE VALUES

Reach	River Miles	Corridor Development	Channel Modification	Recreation Sites	Biological Comm.	Botanical Species	Exotic Species	Fish Species	Exotic Fish	Wildlife Species	Exotic Wildlife	Spec. Wildlife Areas	Archaeologic Sites	Historic Structures
0.00		-	-	0	0	13	Y	0	Y	33	Y	N	0	0
8.00	5.6	LOW	LOW	2	0	3	N	0	N	8	N	Y	1	2
9.00	3.2	LOW	HIGH	1	0	3	N	0	N	5	N	Y	1	0
15.00	10.7	LOW	MED	0	0	3	N	0	Y	2	N	N	20	0

FIGURE 1-26

PEACE RIVER BASIN

Basic Facts

Drainage Area: 2,300 square miles
Major Land Uses: agriculture, mining, rangeland
Population Density: moderate (Winter Haven, Bartow, Lakeland, Port Charlotte
Major Pollution Sources: mining and fertilizer production, agriculture, WWTP
Best Water Quality Areas: Peace River tributaries in southeast part of basin
Worst Water Quality Areas: Lake Hancock and tributaries, Lake Parker
Water Quality Trends: stable quality at 14 sites, improvement at several Peace River tributaries
OFW Waterbodies: none
SWIM Waterbodies:
Banana Lake
Winter Haven Chain of Lakes
Reference Reports:
Myakka and Peace River BAS, DER (Punta Gorda), 1984
Polk County Lakes Water Quality Report, Polk County, 1988
Myrtle Slough BAS, DER (Punta Gorda), 1986
Florida Rivers Assessment (Draft), DNR/FREAC/NPS, 1989
Basin Water Quality Experts:
Russell Forrest, Michele Medani, Polk County, 813-533-2151
Sid Flannery, SWFWMD, 904/796-7211
Ford Walton, DER (Punta Gorda), 813/639-4967
Doug Farrell, DER (Tampa), 813/623-5561
Steve Palmer, DER (Tallahassee), 904/488-0780

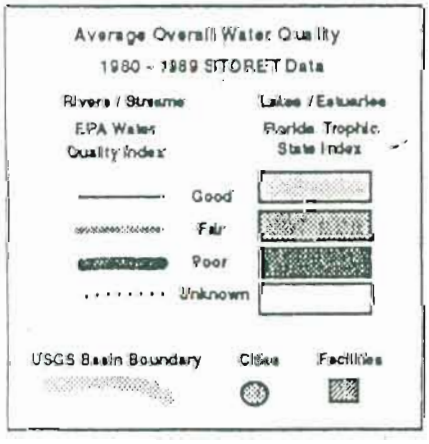
In the News

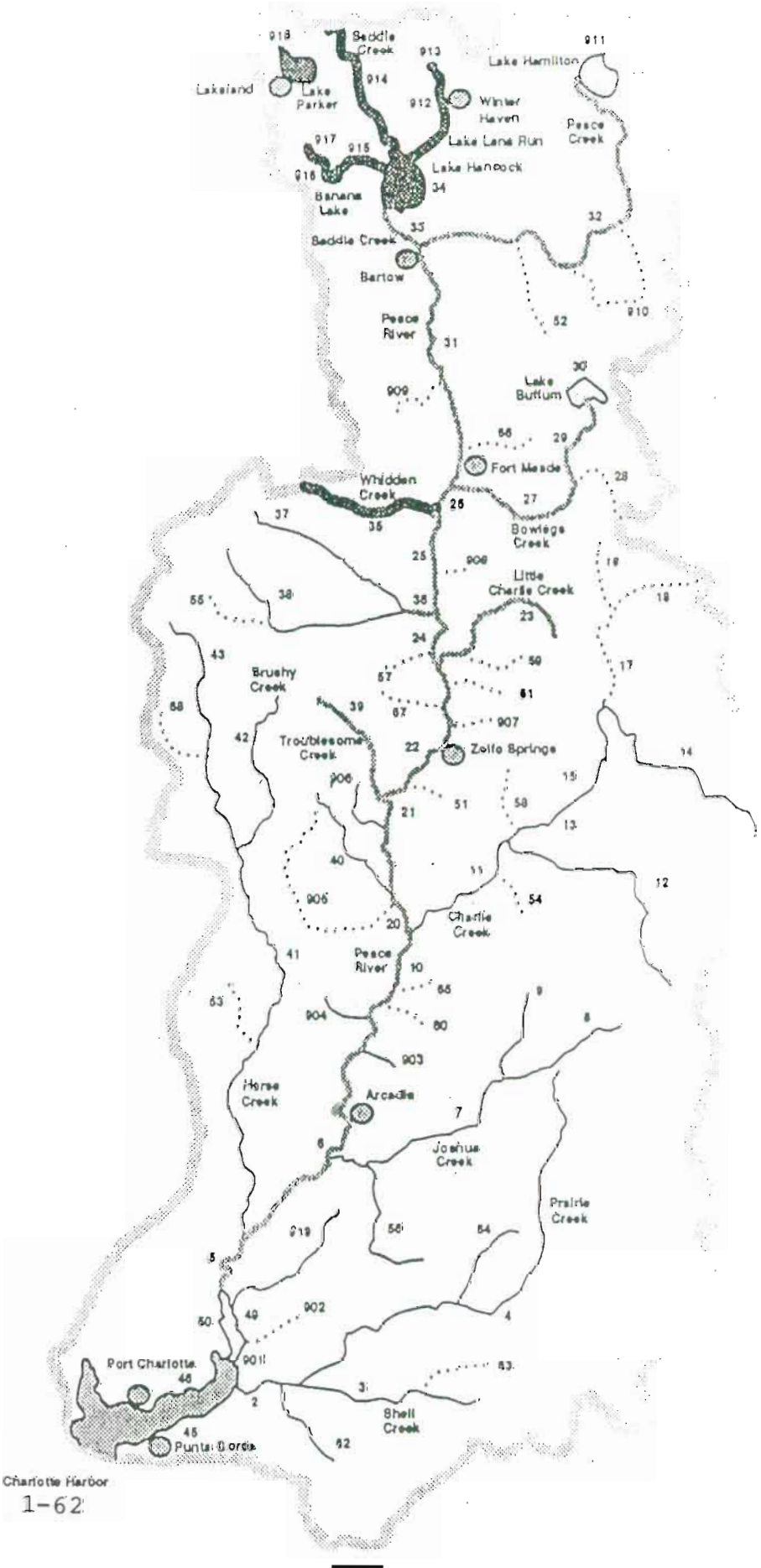
- Consolidated Minerals, Inc. has proposed a 17,000 acre mining and processing complex in DeSoto County that would straddle Horse Creek, one of the last remaining good quality tributaries to the Peace River.
- Banana Lake restoration plans - SWIM hired a contractor to dredge muck from the lake, another contractor sued and obtained an injunction. It is still pending.

FIGURE 1-27

Peace River Basin

03100101





Anthropogenic Impacts

Most attention on sources of pollutants in waterways in general has focused on point sources. Point sources include site specific discharges from sewage treatment plants, agricultural drainage canals and ditches, industrial waste discharge points, and channelized runoff from impervious surfaces. The amount of contamination coming from a point source is relatively easy to determine, as samples can be taken directly from the area of discharge, and monitored at known distances from source. Most studies of water quality use a point source as a point of reference for comparisons of nutrient loadings further down stream. (e.g. Alt et al. 1974).

As suggested by the name, non-point sources have no single defined site of discharge. Rather the origin of non-point pollutants may be over large areas, such as agricultural fields, construction sites, parking lots, or other surfaces. These pollutants may eventually be concentrated via channelized runoff or drainage ditches prior to discharge into a stream or river, or may enter a waterway through diffuse means.

Izzo (1975 uses the EPA definition of non-point source pollution: A pollutant which enters a water body from diffuse origins on the watershed and does not result from discernible, confined, or discrete conveyances." Major agricultural non-point sources of contamination for the southeast United States include soil erosion and sedimentation, and seepage of agricultural wastes and man-made chemicals into waterways. These can be conveyed to water surfaces by direct runoff, by infiltration to subsurface water, or by wind (Izzo 1975).

A number of human influences exist within and adjacent to the Green Swamp which could and possibly do, have some effect on the Green Swamp water quality. Unfortunately, the limited water quality database was not totally adequate to document those effects.

Sand mine spills and discharges can affect the receiving streams with sediment loads and water of high pH and conductivity and lower color. Usually, effects of spills are more localized near the mines themselves.

Agricultural activities, including sod farms and cattle ranches, can affect water quality by increasing TN and TP, along with the high organic and bacteria leads. A thorough bacteriological study of the Green swamp would be useful to determine if these problems exist.

The disposal of sludge within the Green swamp is another potential problem; however, the sparse data did not document a problem.

Forestry operations, such as clearcutting and logging, can cause sedimentation, erosion, and nutrient increases. Again, this potential exists but is not documented

The use of septic tanks in the high water table area of the Green swamp is a definite potential water quality problem and should be avoided. A bacteriological monitoring program could isolate this problem.

Outstanding Florida Waters (OFW) Program

The Outstanding Florida Waters (OFW) program is authorized under Section 403.061(27), Florida Statutes. The program grants the Florida Department of Environmental Regulation the authority to establish rules which provide for a special category of water bodies within the state which are worthy of special protection because of their natural attributes.

In general, DER cannot issue permits for direct pollutant discharges to OFW's which would lower ambient water quality or for indirect discharges which would significantly degrade the OFW. Permits for new dredging and filling must clearly be in the public interest.

To determine the public interest, the DER must determine:

1. Whether the project will adversely affect the public health, safety, or welfare or property of others;

2. Whether the project will adversely affect the conservation of fish and wildlife, including endangered or threatened species, or their habitats;

3. Whether the project will adversely affect navigation or the flow of water or cause harmful erosion or shoaling;

4. Whether the project will adversely affect the fishing or recreational values of marine productivity in the vicinity of the project;

5. Whether the project will be of a temporary or permanent nature;

6. Whether the project will adversely affect or enhance significant historical and archaeological resources; and

7. The current condition and relative value of functions being performed by areas affected by the proposed activity.

Only activities that require a DER permit, are affected by an OFW designation. Facilities permitted by a water management district, pursuant to stormwater management authority delegated by DER fall within this classification.

Activities that are not regulated by DER, including fishing, boating, diving, and river setback ordinances, are not affected by an OFW designation.

Facilities for agricultural lands are exempt from the OFW program provided that they are managed as part of an approved Conservation Plan which is implemented according to its terms (Section 17-25.03(1)(e), Florida Administrative Code).

Facilities for silviculture that are constructed and operated in accordance with Silviculture Best Management Practices are also exempt. The specific exemptions may vary somewhat among the water management districts.

Waters within the OFW designation include:

- National Parks
- National Wildlife Refuges
- National Seashores
- National Preserves
- National Marine Sanctuaries and Estuarine Research Reserves
- National Forests (certain waters)
- State Parks and Recreation Areas
- State Preserves and Reserves
- State Ornamental Gardens and Botanical Sites
- Environmentally Endangered Lands Program
- Conservation and Recreational Lands Program
- Save Our Coast Program Acquisitions
- State Aquatic Preserves
- Scenic and Wild Rivers (both National and State)
- "Special Waters"

As well as providing a review of the water body, and special permitting attention, this program focuses public attention on a resource that the citizens of the area may be unaware of.

Most of the Withlacoochee River and its riverine and lake systems, as well as portions of the Oklawaha River have OFW status.

Water Quality - Groundwater

There are at least 44 monitor wells located in the hydrologic Green Swamp. The monitor wells are used to sample 21 different parameters. Some of the monitor wells are used to sample only one parameter; however, some of the monitor wells are used to sample up to 19 parameters. The period of record varies for different parameters and for different monitor wells. Historical groundwater quality data dates to 1956 with varying sampling frequencies.

Groundwater quality data is available for the surficial and Upper Floridan aquifers. Very little groundwater quality data is available for the intermediate aquifer (where present) in the hydrologic Green Swamp area. In this area the intermediate aquifer is very thin and discontinuous making groundwater quality data difficult to obtain. Few monitor wells are constructed such that the samples may be obtained exclusively from the intermediate aquifer.

Groundwater quality in the surficial aquifer is generally good. Concentrations of dissolved ions are usually very low, well below Drinking Water Standards. However, in some locations nitrate concentrations can be higher in the surficial aquifer than in either the intermediate or Upper Floridan aquifers (SWFWMD, 1991). The higher concentrations of nitrates may be attributed to the following: septic tanks, livestock, sludge disposal, and the use of nitrate fertilizers for agriculture.

Groundwater quality in the Upper Floridan aquifer is also good. However, concentrations of calcium, bicarbonate, and hardness are higher in the hydrologic Green Swamp area than in surrounding areas (SWFWMD, 1991). The Upper Floridan aquifer is either unconfined or semi-confined in the hydrologic Green Swamp area. Therefore, the hydrologic Green Swamp is considered to be a recharge area for the Upper Floridan aquifer. Although the hydrologic Green Swamp is a recharge area, the hydraulic conductivity of the Upper Floridan aquifer in this area is relatively low. The low hydraulic conductivity is one of the contributing factors for the existence of the Green Swamp Potentiometric High. Therefore, residence time of the groundwater in the vicinity of the hydrologic Green Swamp is relatively long. The long residence time enables the groundwater to stay in contact with the mineralized matrix of the Upper Floridan aquifer, allowing the concentration of dissolved ions to increase.

WETLANDS

Wetlands are an integral part of the Green Swamp and it's associated river systems. Benefits from wetlands include flood and storm damage protection for private property and crops both within the swamp and downstream, erosion control, water supply and groundwater recharge, filtration and assimilation of nutrients and pollutants, harvest of natural products, wildlife habitat and recreational opportunities.

Legally defining wetlands is difficult because, biologically, wetlands grow and retreat with each year's wet season and with longer term drought trends. The transitional interface between wetlands and uplands is a constant vegetation battle. In wet years or periods plants typical of wetlands dominate the interface; in drier years or periods of drought plants typical of surrounding uplands invade. This is a natural, biological process.

The U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers define wetlands as: "Those areas that are inundated or saturated by surface or groundwater as a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."

The U.S.Fish and Wildlife Service definitions: " Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes [plants that are adapted for growth under wet conditions]; 2) the substrate is predominantly undrained hydric soil [the type that develops under wet conditions]; and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year."

The Florida Department of Environmental Regulation defines a wetland as: "Wetlands are areas which are inundated or saturated by surface or groundwater with the frequency and duration sufficient to support and under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil condition."

As indicated above, wetlands are influenced by hydrology, which over the long term influences the underlying soil type. The Soil Association Map (Map 1-14) in Chapter 1 and it's associated Figures 1-7 thru 1-9 indicate the extent of the hydric soils of this area. The majority of the Green Swamp is underlain with hydric soils and within the 100 year floodplain. Federal Emergency Management Agency (FEMA) maps of the 100 year floodplain, in the Green Swamp, are general in nature. They lack specific data that would allow elevations to be set. Site specific studies, done within the Green Swamp, indicate that the 100 year floodplain may be underestimated.

The hydrology of the Green Swamp's wetlands is underlain by the Floridan Aquifer with a more direct connection in the surficial aquifer. As shown earlier in this chapter the thickness of the surficial aquifer varies from east to west in the Green Swamp. The eastern portion being thicker than the west.

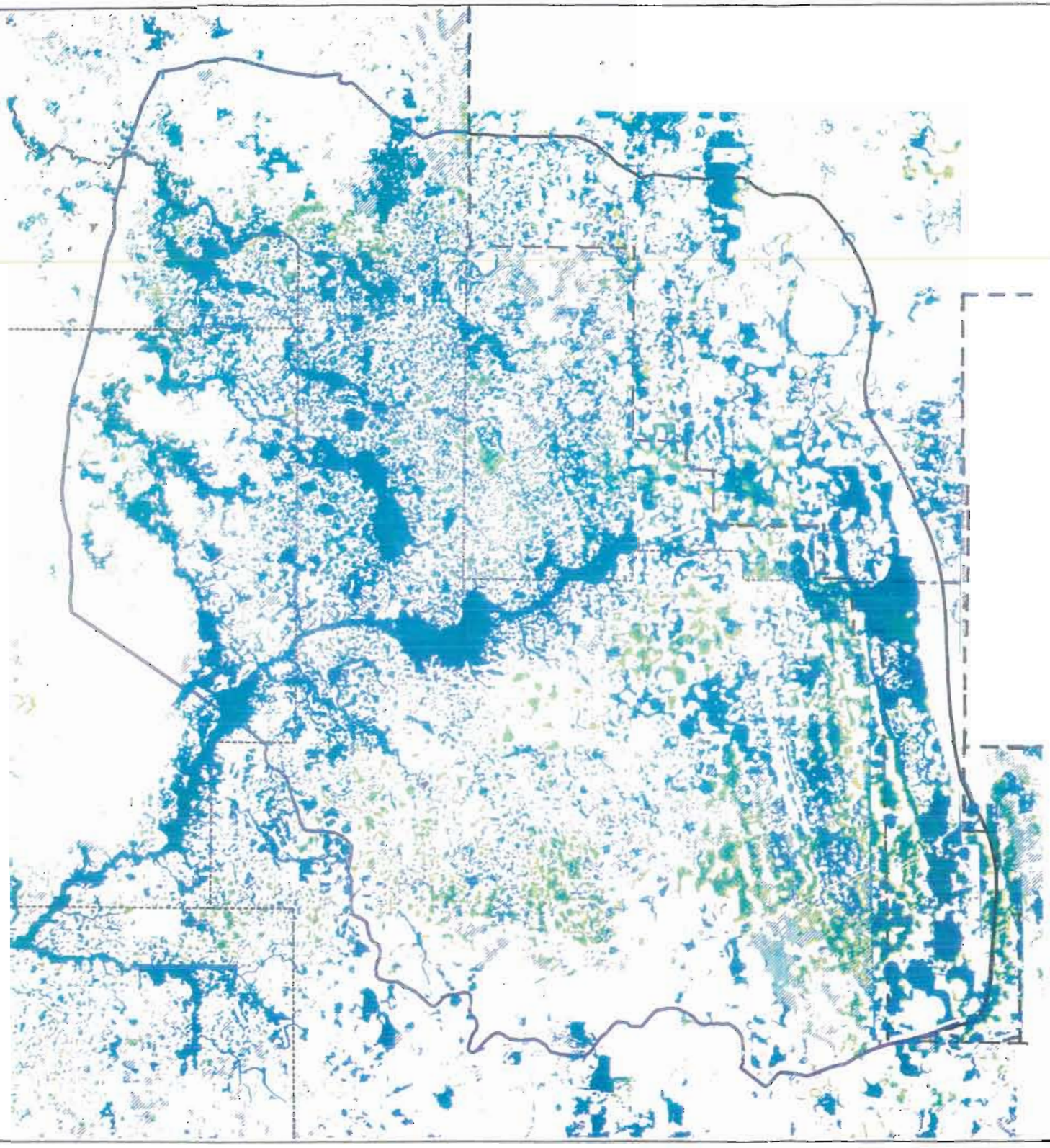
The natural hydroperiod, or natural depth and duration of flooding, is vital to the health of wetland systems. Human activities that are needed to make uplands more suitable for activities such as agriculture, forestry, and development can alter wetland hydroperiods within the surficial aquifer. Human activities that withdraw water from the Floridan Aquifer can also alter the natural hydroperiod of wetlands through the direct relationship between the Floridan Aquifer and the surficial aquifer.

Permitting of wetlands and groundwater use is discussed in Chapter Four of this report. This chapter also includes a discussion on the effectiveness of the current regulations.

According to the FG&FFC's Landsat Imagery Program wetlands within the Green Swamp are classified as freshwater marsh and wet prairie wetlands, cypress swamp, hardwood swamp, bay swamp and shrub swamp. Complete descriptions of these classifications are included in the Appendice.

The single, most extensive body of wetlands within the Green Swamp occurs in conjunction with the Withlacoochee River and it's tributaries. Water in these floodplains may stand between one to three feet deep during the wet season or following major storm events.

WETLANDS

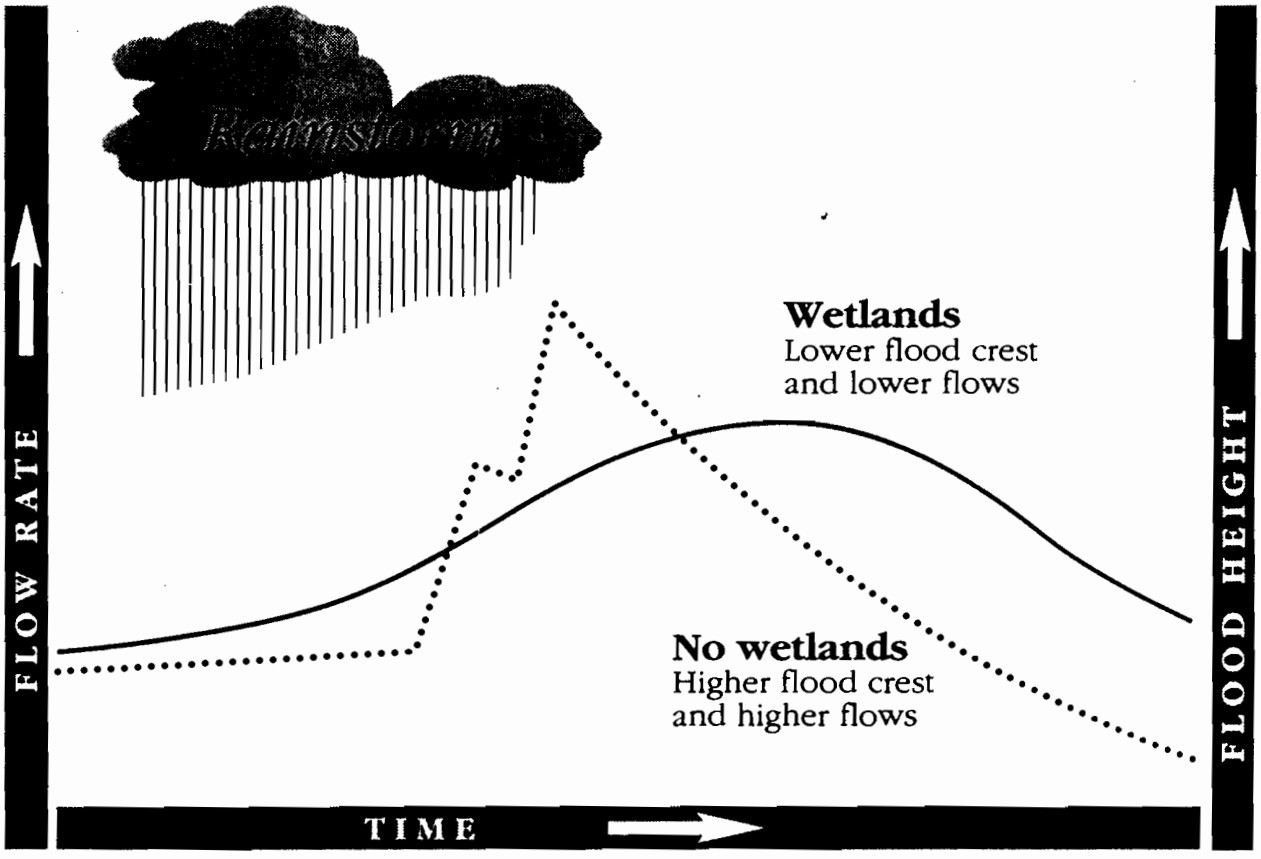


- Wetland Hardwood Forest
- Wetland Coniferous Forest
- Wetland Forested Mixed
- Vegetated Non-Forested
- Non-Vegetated
- WMD Boundary
- Green Swamp Boundary
- County Boundary

N

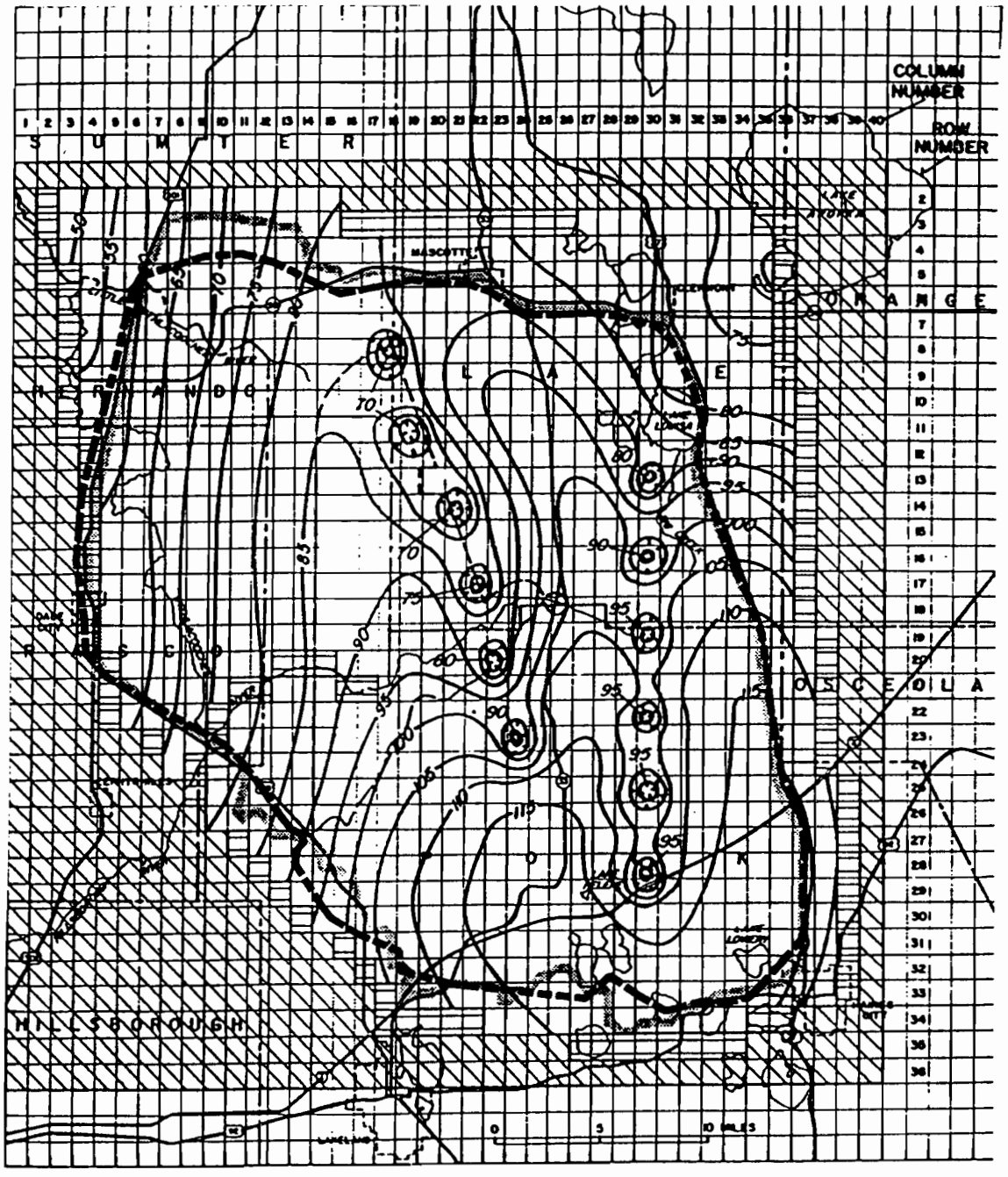
Scale 1:200,000

FIGURE 1-28 Flood Comparison Figure



Wetlands store flood waters, slowly releasing them downstream. This reservoir function helps even out stormwater flows, protecting downstream property from flood damage.

Source: Wetlands Protection
EPA/APA Sept. 1991



EXPLANATION

BOUNDARY OF GREEN SWAMP AREA

FLOOD DETENTION AREA PROPOSED BY SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

NO-FLOW NODE

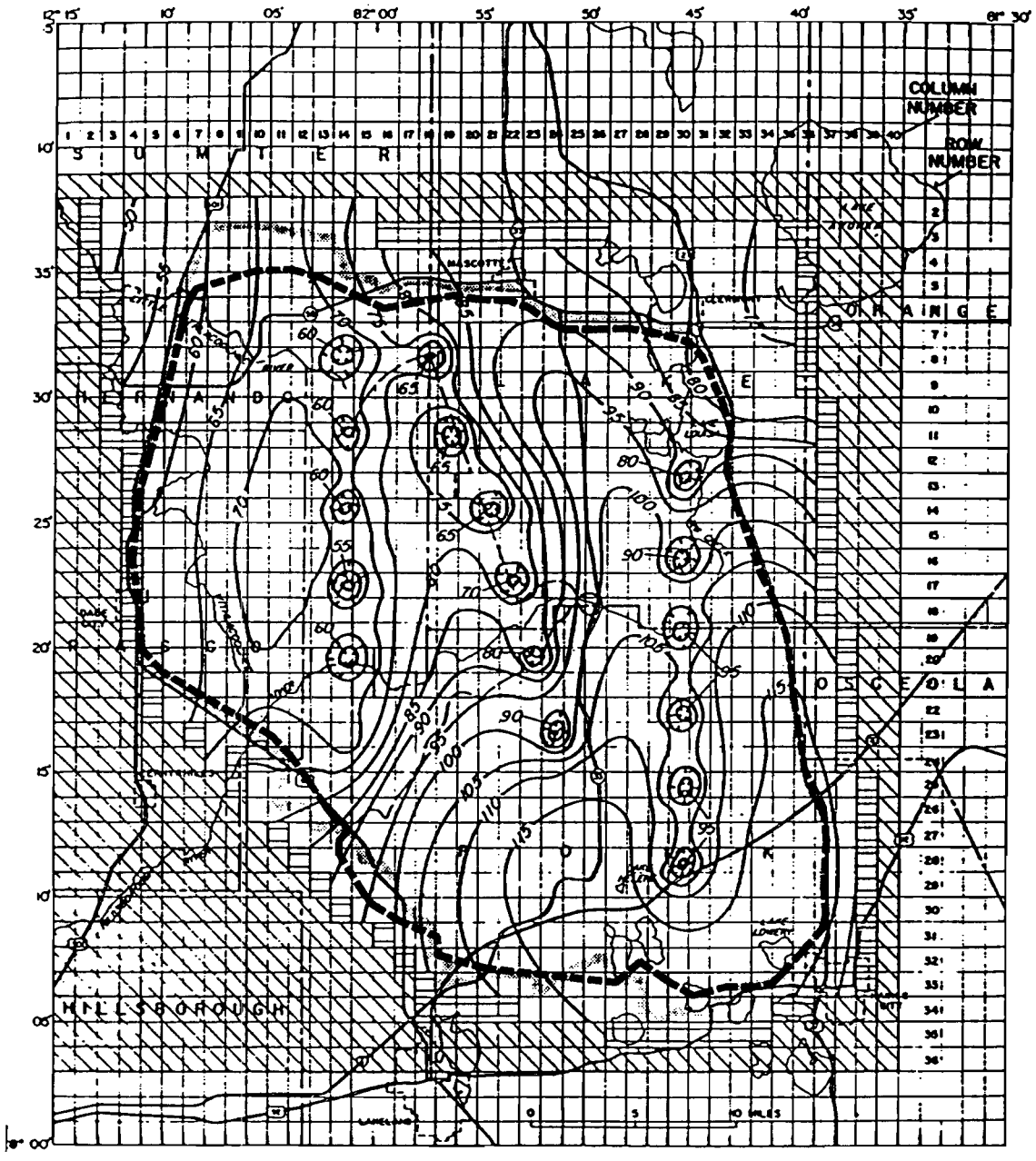
CONSTANT-HEAD NODE

—90— SIMULATED POTENTIOMETRIC CONTOUR. CONTOUR INTERVAL 5 FEET DATUM IS MEAN SEA LEVEL.

DRWG: GSTF1T16

SOURCE: U.S. GEOLOGICAL SURVEY, WATER RESOURCES DIVISION.

GREEN SWAMP TASK FORCE POLK COUNTY, FLORIDA	**SIMULATED EFFECTS OF PUMPING APPROXIMATELY 183 MILLION GALLONS PER DAY ON THE POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER**
GURR & ASSOCIATES, INC. — Drafted: 1/15/92 — Revised:	PROJECT No. GSTF-001 — FIGURE 1-30



EXPLANATION

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DRWG: GSTF1T17

SOURCE: U.S. GEOLOGICAL SURVEY, WATER RESOURCES DIVISION.

GREEN SWAMP TASK FORCE
POLK COUNTY, FLORIDA

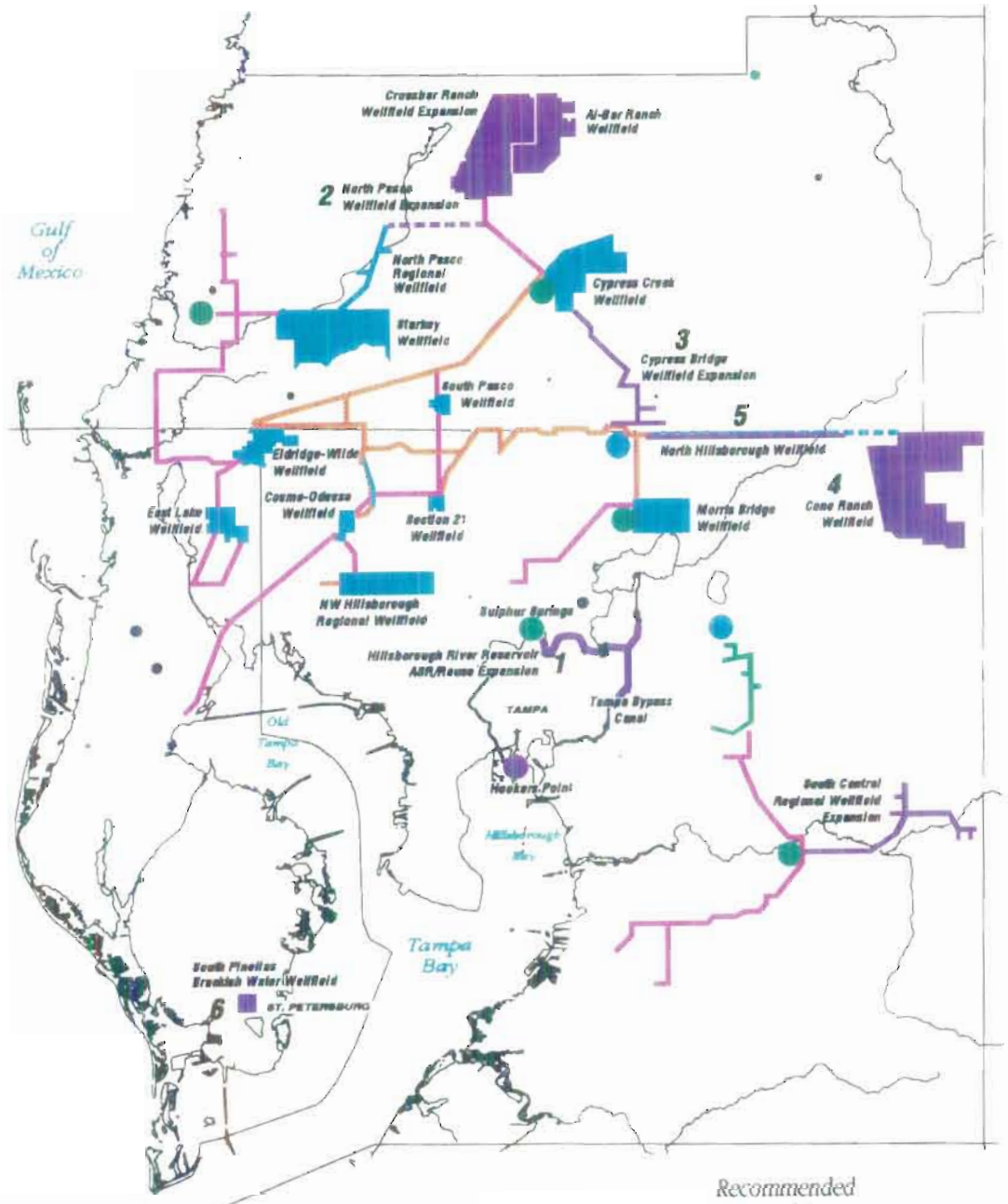
GURR & ASSOCIATES, INC.

Drafted: 1/15/92
Revised:

SIMULATED EFFECTS OF PUMPING APPROXIMATELY 274 MILLION GALLONS PER DAY ON THE POTENTIOMETRIC SURFACE OF THE FLORIDAN AQUIFER

PROJECT No. GSTF-001 | FIGURE 1-31

Potential Future Regional Sources



Potential Regional Sources

Existing Public Supply WUP > 500,000 gpd

- > 10 mgd
- 4-10 mgd
- 2-4 mgd
- < 2 mgd

Existing Distribution Pipeline

Proposed Public Supply Source

Proposed Distribution Pipeline

Pending Pipeline

Water Treatment Plant

Proposed Water Treatment Plant

Recommended Regional Sources

1. Hillsborough River Reservoir ASR/Reuse Expansion
2. North Pasco Wellfield Expansion
3. Cypress Bridge Wellfield Expansion
4. Cone Ranch Wellfield
5. North Hillsborough Wellfield
6. Southern Pinellas Brackish Water Wellfield

Potential for Contamination

Confining layers are relatively impermeable materials which impede vertical migration of water, thus reducing the chances of contaminants from one area reaching another area. The lack of confining layers between the aquifers in the Green Swamp presents an unstable condition for the maintenance of present groundwater quality while further populating of the area continues. If guidelines are not made restricting the amount, density and type of industry allowed in the Green Swamp area, the groundwater quality will probably be compromised. Any industrial spill or leakage will migrate into the Florida Aquifer, the source of drinking water for much of the population of central Florida. Furthermore, as there is no municipal or county sewage service available to homeowners in the Green Swamp area, each household must have a septic tank and drain field. This presents increasing possibilities for contamination of the aquifer system by nutrients, viruses and bacteria.

Impact of Septic System Treatment of On-site Wastewater

The most common method of wastewater treatment in the Green Swamp are septic tanks. Septic tanks are used for on-site treatment of wastewater. Essentially, a septic system contains a septic tank to receive waste water and a drain field to discharge effluent from the septic tank.

The septic tank is a large underground tank which receives wastewater from the home. Residential wastewater typically contains discharge from the kitchen, laundry and bathrooms. The wastewater enters the septic tank where solids settle out, grease is skimmed off and anaerobic bacteria begin to decompose organic materials in the wastewater. Clarified effluent is discharged through the opposite end of the septic tank and enters the percolation, or drain field. In the drain field the effluent slowly percolates through unsaturated soils where aerobic bacteria further purify the effluent.

The two major contributors to organic loading of a residential septic system are the toilets and the garbage disposal. These two sources generate the vast majority of organic material to be digested by the septic system, and contributors to residual sludge.

A septic system, properly designed, installed and maintained can be an economical and efficient method of disposing of wastewater from lower density residential development. Septic systems must be constructed on appropriate, well drained soils. The drain field must be of sufficient size to discharge the quantity of effluent discharged by the household. Finally all septic tanks must have accumulated sludge removed on a regular basis. The sludge must be safely disposed of. If accumulated sludge is not removed, it gradually fills much of the tank. Effluent entering the tank is then discharged directly to the drain field without treatment, clarification or settling of solids. Although the system may appear to be functioning appropriately for some time, inadequately treated effluent is being discharged and contaminants may be impacting the underlying aquifer. Eventually, when the drain field becomes so clogged that the effluent backs up into the home, the homeowner recognizes the failure and attempts to correct the problem.

Unfortunately, much of the problem may actually remain undetected underground, and gradually moves down gradient within the water table, potentially contaminating wells or connecting surface waters. The literature is clear that septic systems fail long before clogged toilets force corrective action.

In the Journal of Environmental Health, Richard J. Perluris, Ph.D., concluded that the second largest source of groundwater contamination is discharge from septic tanks and cesspools. This discharge source ranks highest in total volume of wastewater discharged through soil to groundwater, (more than 1 trillion gallons per year) and is the most frequently reported cause of groundwater contamination. Craun reports that overflow of septage or sewage, primarily from septic tanks or cesspools, is responsible for 41% of disease outbreaks and 66% of the illnesses caused by contaminated groundwater. Bacteria found

in wastewater include Salmonella, Shigella, enteropathic Escherichia coli, Vibrio, and Mycobacterium. Associated diseases are typhoid and paratyphoid fever, gastroenteritis, cholera, tuberculosis, dysentery and diarrhea. Bacterial migration of more than 30 meters (100 feet) is common.

There are over 100 different types of infections caused by viruses present in human feces. Associated diseases include gastroenteritis, meningitis, poliomyelitis, conjunctivitis, hepatitis, diarrhea and upper respiratory illness. Viruses appear even more mobile than bacteria, with documented viral migration distances of up to 400m (1300 feet).

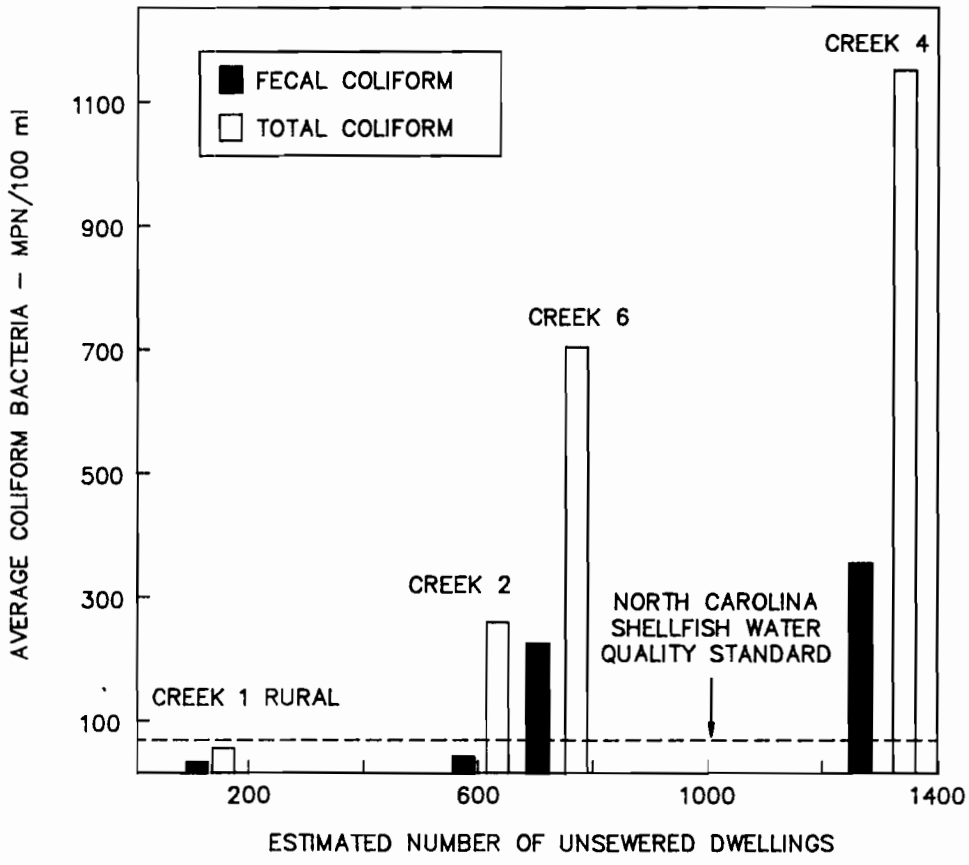
Phosphorous and nitrogen released from septic tanks can contribute to eutrophication if introduced into surface waters. Phosphate ions, however, readily undergo biological utilization, chemisorption and precipitation reactions in soil solutions, and their concentration normally decreases with distance from the source more rapidly than does the concentration of the less reactive nitrate ion. Nitrate concentration also is of concern because of its association with methemoglobinemia in humans and livestock and because of its possible association with carcinogenesis, mutagenesis, and teratogenesis.

Alfred M. Duda, of the North Carolina Division of Environmental Management, wrote in the Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, "A significant positive correlation existed between dry weather and wet weather levels of fecal coliform bacteria in waters draining coastal residential areas and increased densities of septic tank drain fields in the watersheds (Figures 1-32 and 1-33). Due to the high bacterial densities recorded during dry weather and to the seepage of effluent into drainage ditches observed during the investigation, much of the contamination was attributed to septic tank drain fields installed in soils with severe limitations rather than simply surface runoff".

A study of the effects of on-site sewage disposal on nutrient relations of groundwaters and nearshore waters of the Florida Keys indicated that "on-site sewage disposal results in extremely elevated nutrient concentrations groundwaters". The highest nutrient concentrations were associated with groundwaters adjacent to on-site sewage disposal and the effluent of the aerobic treatment units, where concentrations as high as 2.5 millimoles for ammonium, 2.3 millimoles for nitrate, and 120 millimoles for soluble reactive phosphate occurred. Annual mean concentrations of ammonium and nitrate in residential groundwaters were approximately 350 fold higher than in the control groundwaters, whereas concentrations of soluble reactive phosphate were approximately 60 fold higher. (Lapointe, Harbor Branch Oceanographic Institution, Inc., 1987). The correlation of septic system failures and resultant environmental contamination with high groundwater levels is well documented.

Within the Green Swamp residential development typically occurs upon flatwoods soils which have a seasonal high water table at or near the surface for much of the year. Due to previous agricultural drainage practices to improve pasture characteristics, many of these areas exhibit artificially improved dry weather drainage characteristics. However, given typical rainy season conditions, these soils quickly exhibit their naturally saturated characteristics.

Florida permitting criteria, as implemented in Polk County by the Florida Department of Health and Rehabilitative Services, allow construction of mounded septic system drain fields in these areas. A substantial amount of fill is brought in with the intention of providing sufficient separation between the drain field and ground water levels. Consequently, the sight of mobile homes, elevated 5 to eight feet on blocks, to provide sufficient fall to the on-site septic system are common. Unfortunately this system can become saturated, even if sufficient separation is provided, due to capillary action within the soils elevating the water table up into the mound.



DRWG: GSTF1T18

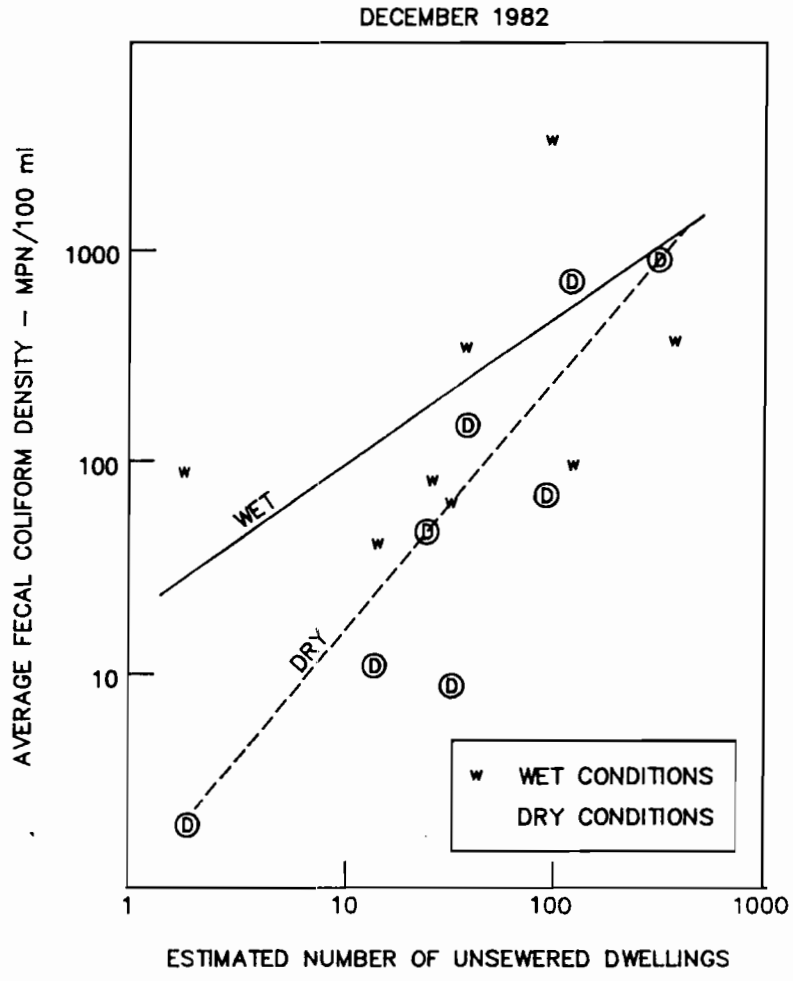
GREEN SWAMP TASK FORCE
POLK COUNTY, FLORIDA

GURR & ASSOCIATES, INC.

Drafted: 1/15/92
Revised:

COMPARISON OF AVERAGE FECAL DENSITIES WITH NUMBERS OF UNSEWERED DWELLINGS IN EIGHT TRIBUTARY WATERSHEDS

PROJECT No. GSTF-001 | FIGURE 1-2



DRWG: GSTF1T19

GREEN SWAMP TASK FORCE
POLK COUNTY, FLORIDA

GURR & ASSOCIATES, INC.

Drafted: 1/15/92
Revised:

COMPARISON OF AVERAGE VALUES OF FECAL AND TOTAL COLIFORM BACTERIA WITH NUMBERS OF UNSEWERED DWELLINGS IN FOUR TIDAL WATERSHEDS

PROJECT No. GSTF-001 | FIGURE 1-33

It must be emphasized, mounded septic systems are being installed in the western portion of the Green Swamp where the aquifer is within five to ten feet of the surface and no confining layer may be present. At times the configuration of the "upland" portions of a sold lot are situated in such a way that a variance is sought to allow a septic system to be constructed within a wetland or within the required setbacks.

According to Dr. S. Upchurch, of the University of South Florida, septic systems could be safely installed in areas of the Green Swamp through much stricter construction and management criteria. However, he also indicated that the number of systems installed would decrease by as much as 75%. Once again, the blanket application of minimum state standards is not appropriate within the Green Swamp.

Sludge Dumping

Land application of sludge is a controversial activity occurring in the Green Swamp. It is the practice of bringing waste disposal materials from municipal wastewater treatment plants, individual septic tanks, or industrial activities to pasture lands and spreading it on the land surface. Sludge is brought in from numerous Polk County sources as well as from other central Florida counties. Pinellas County is a major contributor of sludge being disposed of in the Green Swamp. There have been occurrences where it has been brought in from out of state.

Sludge may be in liquid, slurry, or solid form. Industrial sludge is often composed of citrus residues from processing activities. This material is not accepted at the Polk County landfills.

The sludge is brought in by tank truck, often of 3500 gallon capacity. the tank truck drives directly to the field involved and spreads the material. Generally, it is spread about 1/2" thick. The disposal activity often occurs at all hours. Legally permitted activities contribute to a clandestine, or illegal perception when they occur in the middle of the night. Illegal sludge dumping historically has been a problem in Polk County.

Many of the roads accessing the Green Swamp are unpaved. Roads and drives accessing pasture areas are often unimproved. There have been instances of sludge trucks becoming stuck in wet areas. In some cases, the driver opens the valve and directly discharges the sludge to lighten the vehicle. This activity may then become an illegal, unpermitted direct discharge of sewage.

The disposal practice is regulated through administrative rule by DER and HRS. The administrative rules are of state wide application, and do not specifically address the special characteristics of the Green Swamp.

Although there are enforcement and monitoring mechanisms provided in rule and executed by the specific agencies, there is a substantial public perception that existing enforcement measures are underfunded and understaffed. The counties largely rely upon the permitting agencies for enforcement action.

Polk County alone has over 189 wastewater treatment plants if differing sizes. There are is excess of 170,000 septic tanks in the county. There are 40 trucking companies involved in sludge disposal. there as a substantial need for acceptable disposal sites for Polk County sludge, within Polk County. Polk County does not accept types of solid waste from other counties.

Given the unique hydrologic and geologic characteristics of the Green Swamp, other areas of Polk County may be more appropriate for this disposal activity. Further, general application of state administrative rule may not provide an appropriate degree of regulation of this activity in the Green Swamp.

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INTRODUCTION

Purpose of Report

The Polk County Comprehensive Plan contains a policy requiring the formation of a task force/committee to review opportunities for growth management and resource protection within the Green Swamp Area of Critical State Concern (Policy 2.120-F4, page 83 or the adopted Comprehensive Plan). Further, the Plan states that the Board of County Commissioners shall appoint a task force charged with the responsibility of investigating the effects of relevant land uses on the Green Swamp resources and make recommendations concerning what action, it any, the County should take to produce feasible strategies and practical solutions to protect this area.

The Board also identified the need for technical support to provide the scientific basis for task force decisions. A Technical Advisory Committee consisting of a cross-section of scientific disciplines and representing local and state agencies, as well as private enterprise was formed in the summer of 1991. One of the responsibilities of the Task Force is to evaluate the importance and uniqueness of the wildlife (flora and fauna) habitat in the Green Swamp. This chapter of the Green Swamp Technical Report has been prepared to provide background information, pertinent scientific data on requirements and impacts of various land uses, and recommendations relative to the wildlife resources of this area. It should serve as the basis for rational decisions on strategies to preserve the integrity of the Green Swamp ecosystem.

Previous Reports

Previous reports on the Green Swamp have provided little more than incidental consideration of wildlife. For example, the Final Report and Recommendations for the Proposed Green Swamp Area of Critical State Concern prepared in June 1974 by the Department of Administration, Division of State Planning, Bureau of Land Planning contains only very general descriptions of the wildlife resources including one paragraph listing about 36 specific species and various categories such as "various herons and egrets and several kinds of woodpeckers" and "other waterfowl." Consequently, land use planning goals and policies for this area have been arbitrary and not scientifically based. The April 1991 edition of the Polk County Comprehensive Plan contains general, nonspecific objectives and policies that do not allow for any measurement of success in terms of benefits to the resource. The Ecological Communities Section (2.309) also only has a narrow focus on endangered and threatened wildlife instead of a viable community of all species as the title indicates.

Uniqueness and Importance of the Green Swamp

The Green Swamp is a unique area for wildlife. The regional habitat and wildlife distribution maps provided in this report illustrate the distinct character of this diverse ecosystem. One attribute that the maps cannot display is that because the water table is close to the ground surface, upland communities such as the extensive flatwoods in this area detain rainwater for longer periods than most other flatwoods. These relatively hydric conditions present an unusual environment for the biota in this area. Because of its central east-west location, the Green Swamp also provides a future potential for preservation of Florida's fauna and flora if global warming causes inundation of coastal areas.

There are a number of facts that demonstrate the importance of the Green Swamp ecosystem. The habitats in this area remain relatively intact with few highways and other land uses causing fragmentation of the natural landscape. The diversity of vegetation communities provides wildlife in this area with an excellent assortment of foraging opportunities to compensate for the seasonal availability of foods in any given habitat. The interconnectedness of different habitats also accommodates movements from temporarily unsuitable areas that are inundated by rain water or burned into acceptable adjacent areas. Because of its relatively central longitudinal location, ranges of northern and southern wildlife species

overlap in this area. As a result, almost 40% of Florida's native vertebrate wildlife (excluding salt water fish) contribute to the natural integrity of the Green Swamp. In a recent analysis of wading bird nesting population trends, Runde (1991) also reported that as wading bird populations continue to become more fragmented and less abundant in south Florida, breeding areas in central Florida have become more important to the perpetuation of these species.

The natural linkages of the Green Swamp to other systems is another trait that adds to its significance. This connectedness allows animal movements which are necessary to maintain genetic diversity in populations of far ranging species such as the Florida black bear (Ursus americanus floridanus). This area could support a viable bear population if linkages to other bear populations are preserved and also if poaching is controlled. Because of its function as a hub that interconnects to other systems through several natural river corridors, impacts on the Green Swamp also affect areas outside of its designated boundaries. The black bear serves as a flagship species that illustrates the need for a landscape approach to conservation strategies for this area.

Florida has the second largest number of federally listed threatened and endangered species in the nation. About 1/5 of the state and federally listed vertebrate species in this state (111) can be found in the Green Swamp. This area is also one of the few remaining, documented nesting locations of the short-tailed hawk (Buteo brachyurus; Millsap et al. 1989), a species that is in just as much jeopardy of extinction as the snail kite and in more jeopardy than the manatee (Trichechus manatus latirostris) and other legally listed endangered species Millsap et al. (1990).

Synthesis of Pertinent Wildlife Issues

The ecological and recreational values (about $5.2 billion annually) of Florida's wildlife resources are becoming more and more jeopardized by land uses that detrimentally impact wildlife and wildlife habitats. Many of these potential land use conflicts are encroaching into the natural areas in the Green Swamp.

From 1980 to 1987, urban development caused the deforestation of an additional 5% of the total Florida timberland surveyed in 1980 (Brown 1987). As development continues to spread across the landscape, protecting wildlife from local, regional, and statewide extinction becomes increasingly difficult. Cumulative effects of sub-DRI developments are often overlooked, resulting in the slow degradation of habitats. Land use decisions made without full knowledge of their potential consequences have altered and fragmented wildlife habitats, destroyed critical nesting and feeding areas, and polluted aquatic and terrestrial environments. Growth management objectives and policies that only state general needs are not measurable and do not adequately address the ultimate problem of species' extinctions.

Whenever the ground, understory or canopy layers in a natural vegetation community are altered, food and cover requirements for certain wildlife are removed. When an essential habitat component is diminished to a level that is not enough for a species to survive, that species can no longer live there. In other words, it becomes extinct in that area.

Of course, there are different levels of extinction. Species first become extinct on individual sites. When enough sites are altered, the extinction spreads to a township level. County, region, state, nation, and world are other levels of extinction.

Species that are legally classified as Endangered Species already have become extinct in much of their former range and are found only where their essential requirements remain. Land use around these critical habitat areas is restricted. The rationale for these mandates is to prevent endangered species from becoming extinct at the state level. Very few species that have reached this stage in the extinction process have been recovered to the point where they no longer need special protection. Even the best endangered species recovery plan only helps to maintain the status quo and places the burden of habitat

protection on the few landowners with critical habitat on their properties. This method is also species specific and does not address the needs of other wildlife that are rapidly approaching statewide endangerment or extinction.

Another problem with the common practice of trying to address listed species (Endangered, Threatened, and Species of Special Concern) needs is the misconception that these are the only species that are in jeopardy of extinction. A recent study of the biological vulnerability of all of Florida's native vertebrates concluded that 49 species that are not legally listed are in just as much jeopardy of extinction as list species (Millsap et al. 1990). Yet a separate data base produced from Florida's breeding bird surveys shows that 14 native birds are experiencing significant decreasing population trends (Cox 1987).

A proactive, holistic wildlife protection strategy designed to preserve enough habitat for viable populations of wildlife is more ecologically sound and equitable for landowners. Growth management standards that protect existing species from extinction, within various jurisdictions, need to be developed. Then implementation of conservation plans will be based on scientific data and can be evaluated easily through periodic wildlife surveys.

The small "conservation areas" and "wildlife corridors" that are included in individual DRIs are usually not adequate to protect species that are most adversely affected by development activities. These token habitats only provide enough area for common species such as cardinals, mockingbirds, mourning doves, blue jays, and others that merely need a well-landscaped yard to survive. Large, interconnecting systems that include several wetland and upland vegetation community types are necessary to preserve viable populations of all wildlife species within the Green Swamp.

The need for managing growth in a manner that is compatible with wildlife preservation efforts is addressed in the State and Regional Planning Act of 1984 (Chapter 186 of Florida Statutes) and the Local Government Comprehensive Planning and Land Development Regulation Act of 1985 (Chapter 163 of Florida Statutes). Within the State, Regional, and Local Comprehensive Plans mandated by these Acts, Conservation Elements were established "to promote the conservation, use and protection of natural resources." An important aspect of this planned attempt to manage growth in an environmentally acceptable manner involves generating the necessary information base to carry out specific requirements of the minimum criteria rule (Section 9J-5 Florida Administrative Code).

The Model Conservation Element provided by the Florida Game and Fresh Water Fish Commission suggests excellent policies such as maintaining upland buffers, establishing wildlife corridors, and maintaining the current complement of wildlife species (Florida Game and Fresh Water Fish Commission 1987.) However, no information is available to tell planners the proper dimensions or the specific ingredients of a local refuge system that will maintain current biological diversity. Without the credibility of research, recommendations that will benefit wildlife have gone unheeded because of the intense economic and political pressures to develop natural areas near and within cities (Murphy 1988).

Preserving viable populations on each property parcel certainly is not feasible. However, establishing a properly designed conservation reserve system in the Swamp can protect all existing species from extinction. Setting aside small, token habitats on each individual site will not prevent extinctions unless the set-asides are part of a planned conservation reserve system for the entire Swamp.

Scope of Report

Developing an effective management and protection plan for the wildlife resources in the Green Swamp will be based on: (1) a literature review of the Green Swamp wildlife resources and appropriate wildlife conservation principles, (2) an assessment of the status of the resource, (3) an identification and

evaluation of existing and potential threats, and (4) an identification of actions necessary to minimize land use impacts and give the best assurance for preserving the wildlife integrity of the Swamp.

Due to the short time frame of this study, existing sources of information were used to assess the current status of the wildlife resource and their habitats. A comprehensive review of literature that relates to wildlife in the Swamp and to wildlife conservation issues that apply to the study area was conducted. An aerial survey was made of the basin. Aerial photos and maps of vegetation communities and land use trends were also analyzed.

The following data bases were obtained from several sources or created during the study to develop a description of the wildlife resources in the basin:

* Distribution of documented occurrences of listed species. Florida Natural Areas Inventory, Florida Game and Fresh Water Fish Commission.
* Distribution of wading bird rookeries. Nongame Section of Florida Game and Fresh Water Fish Commission.
* Breeding bird survey data. U.S. Fish and Wildlife Service, Florida Audubon (Breeding Bird Atlas).
* Fisheries data. Florida Game and Fresh Water Fish Commission.
* Species lists. Created from information obtained from various references that describe species' distributions and habitat uses.

A more accurate method of determining current baseline data on wildlife species within the Green Swamp would be through systematic species surveys. The need for this is exemplified by documentation of only a few of the listed (endangered, threatened, and special concern) species that are assumed to occur in the Swamp. The brief surveys that are conducted during DRI proposal preparation would be unlikely to detect inconspicuous species such as the gopher frog (Rana areolata aesopus).

DESCRIPTION OF WILDLIFE RESOURCES

Habitat Description

This section addresses the Green Swamp region as the area bounded by SR 50 to the north, U.S. 27 to the east, approximately to CR 600 to the south, and U.S. 301 to the west; and includes southern portions of Sumter and Lake counties, northern Polk County, a small portion of northeastern Hillsborough County, and eastern extremes of Pasco and Hernando counties.

The Green Swamp is not, as its name implies, a continuous wooded wetland, but a complex mosaic of upland and wetland vegetational types, ranging from small areas of xeric oak scrub; through mesic woodlands, pine flatwoods, prairie, agricultural and other disturbed uses; through marsh, cypress and wet bottomland woods; to open-water systems. Based on Soil Conservation (SCS) information (SCS, 1971, 1977, 1982, 1988, 1990) on the distribution of major soil types, most of this area would support a native vegetation dominated by (1) low hammocks of live oak, laurel oak, water oak, runner oak, cabbage palm, and slash and longleaf pine in the drier areas; (2) seasonally wet flatwoods supporting slash pine, longleaf pine, cabbage palms, gallberry, fetterbush, wax myrtle, saw palmetto, and a variety of grasses and sedges in more poorly drained areas; and (3) wooded swamps composed of cypress, blackgum, bay, red maple, water oak, ironwood, pond pine, and maidencane and pickerelweed marshes in sloughs, river floodplains, and other areas of seasonally ponded water. Except in the swamps, the natural soil fertility is usually low, and some of the flatwoods soils are sufficiently wet to place severe limitations on agricultural uses, even if drainage systems were to be constructed.

Today's general distribution of vegetation associations within and surrounding the Green Swamp is shown in Map 2-1, a Classified Landsat Imagery map developed by the Florida Game and Fresh Water Fish Commission (GFC). Each color represents a vegetation association. Figure 2-1 provides the color key for Map 2-1. Because of the scale, this map shows only general vegetational trends; however, a larger map that shows more detail is available at the Polk County offices. This map reveals several prominent features: (1) a set of ridges separated by cypress swamps following the old shorelines along the eastern side of the swamp region; (2) a large, relatively open grassland (agricultural) area dotted with cypress and prairie in north-central and northwestern Polk County; (3) hardwood forest and hardwood swamp along the Withlacoochee River and Gator Creek; (4) prairie interspersed with cypress in Lake County; (5) cypress and hardwood swamp north of the Withlacoochee River; and (6) an area of pinelands and hardwood forests in the northwest portion of the Green Swamp region. This pattern might be attributable to a number of factors, including the management of the Withlacoochee State Forest, Richloam Wildlife Management Area, and the Green Swamp Wildlife Management Area; historic and current silviculture; conversion of higher lands to agriculture and low-density residential uses; soil types; and drainage patterns, both natural and artificial.

The description of each of the vegetation associations is included as Appendix E, and Figure 2-2, provides the acreage of each within the area delineated by Map 2-1. Vegetation types typically intergrade, and it can be a matter of interpretation as to whether a given Landsat "signature" indicates a native dry prairie; an area of pine flatwoods that has been timbered and then managed for cattle, yet retains scattered pines; or a cypress swamp that has been heavily timbered and drained, with a few trees remaining in wetter areas. For purposes of this wildlife resource description, the vegetation associations found within the Green Swamp region have been divided into the following categories.

Xeric: This category includes sand pine scrub, xeric oak scrub, and sandhill communities.

Pine flatwoods: This category intergrades with prairie when an area that was historically a pineland has been logged, leaving a saw palmetto/gallberry/fetterbush understory and scattered pines. Some of these areas may be used for low-density cattle grazing.

Mesic upland woodland: For the most part, this category includes dry to mesic upland hardwood forests; however, the color coding used in Map 2-1 does not readily distinguish between dry

hardwood forests, mesic hardwood forests, and seasonally wet hardwood forests. This discussion includes seasonally wet hardwood forests under the category of hardwood swamp (see below).
Prairie: This category corresponds generally to the Classified Landsat Imagery designation of dry prairie; however, in central Florida, many areas with the dry prairies signature may have originally been pinelands (see "pine flatwoods" above), as opposed to the natural dry prairies north of Lake Okeechobee. Because some palmetto prairies are also managed for cattle grazing, they may intergrade with the grassland (agricultural) signature.
Marsh: For the most part, this category includes fresh water marsh, wet prairie, and shrub swamp, both temporary and at the edges of permanent waterbodies.
Cypress swamp: This category is the same as described in Appendix E.
Hardwood swamp: Bay swamps, hardwood swamps, and seasonally wet hardwood forests are included in this category.
Open water: As its name implies, this category includes rivers, streams, natural and artificial ponds and lakes, and borrow pits.
Disturbed: This category includes urban areas, pastures, citrus groves, and mines. In the Green Swamp region, there are few areas of urban development, relatively small areas of citrus grove, and some sod farming; however, there are substantial areas of variously improved pasture and relatively low-density residential development.

General Wildlife-habitat Relationships

Depending on the amount of rainfall, the nature of some habitats varies considerably during the year, as well as from year to year. Since much of the Green Swamp region is relatively flat and poorly drained, large areas that contain no surface water during periods of low rainfall may be covered by shallow water and function as hydric systems during wet periods. This variation has significant implications for the seasonal distribution of wildlife. For example, a low-lying prairie may support a variety of sparrows, rodents, and other upland species during dry periods; amphibian breeding during wet periods; and a fish population during extended flood conditions. Wading birds would be attracted to these seasonally wet areas, especially as they dry and concentrate the amphibian and fish populations into increasingly smaller pools. During periods of low rainfall, this area would revert to a drier prairie habitat that supports those species that depend on seeds and insects for a food base.

An understanding of the Green Swamp wildlife communities cannot ignore the importance of the interaction between wetlands and uplands. Most wildlife species that live on uplands need water for drinking, but many species require wetlands for breeding and uplands for foraging, or vice versa. For example, although the Florida sandhill crane typically nests in shallow, isolated marshes composed primarily of pickerelweed, maidencane, and smartweed (Nesbitt and Williams, 1990); it forages on dry, open land within a few weeks, when the chicks are able to move about freely. On the other hand, gopher frogs (a state-listed species of special concern) will travel over one mile of uplands to reach a marsh in which to breed (Moler and Franz, 1987). It is clear from these examples that any consideration of habitat preservation must address not just wetlands, but also the quality and quantity of adjacent uplands.

An analysis of wildlife use of agricultural areas requires special consideration. The high number of species recorded in disturbed habitats (predominantly low-density residential and agricultural areas) is not necessarily an indication of high-quality habitat; rather, in many cases it is attributable to: (1) the amount of native habitat retained as islands of vegetation; (2) proximity to large nearby areas of native habitats; (3) the variety of habitats that are somewhat mimicked by agricultural practices, depending on the intensity of disturbance; (4) the temporary or residual use of lower quality habitat by species whose native habitat has largely disappeared in the area; and (5) the number of generalist species (those that can use a wide variety of habitats) that tolerate disturbance. Agricultural areas vary widely in habitat quality for wildlife, usually depending on the specific use, the extent of Map 2-1 Landsat


background
Coastal strand
Dry prairie
Pinelands
Sand pine scrub
Sandhill
Xeric oak scrub
Mixed hardwood–pine forests
Hardwood hammocks and forests
Tropical hardwood hammock
Coastal salt marsh
Freshwater marsh & wet prairie
Cypress swamp
Hardwood swamp
Bay swamp
Shrub swamp
Mangrove swamp
Bottomland hardwoods
Open water
Grassland (agriculture)
Shrub and brushland
Exotic plant communities
Barren

Figure 2-2. Approximate acreage of vegetation types in Green Swamp (depicted by Map 2-1).

Vegetation type	Acres	% of total
Upland		
dry prairie	30,813	6.08
pinelands	67,666	13.35
sand pine scrub	643	0.13
sandhill	1,131	0.22
xeric oak scrub	1,395	0.28
mixed hardwood-pine forests	9,545	1.88
hardwood hammocks and forests	24,245	4.78
Wetland		
freshwater marsh and wet prairie	16,191	3.19
cypress swamp	125,764	24.80
hardwood swamp	29,526	5.82
bay swamp	1,236	0.24
shrub swamp	5,287	1.04
Aquatic		
open water	13,704	2.70
Disturbed		
grassland (agriculture)	101,173	19.95
shrub and brushland	43,274	8.54
barren	35,418	6.99
TOTAL	507,011	

Source: Data derived from the Office of Environmental Services of Florida Game and Fresh Water Fish Commission's Classified Landsat Imagery.

specific vegetation associations in the vicinity of nests of species whose long-term survival is in jeopardy.

Mammals: Use of the Green Swamp region by mammals has not been well documented. Most carnivore species are tolerant of a broad range of habitats, except for the river otter, which is found in streams, lakes, and ditches; the rodents are rather evenly divided between those that live in forest and those that live in open uplands, except for the marsh rice rat, round-tailed muskrat, and nutria, which are wetland dependent; and the bats are heavily dependent on trees and, in the case of southeastern bats, southeastern (Raffinesque's) big-eared bats, and evening bats, abandoned or rarely disturbed buildings (Figure 2-6). Black bears are still found within the Green Swamp, and a sprinkling of habitat remains, but the population is not large, due to habitat fragmentation and hunting (J. Wooding, personal communication to E. Hemmert).

Figure 2-3. Amphibians by habitat (continued).

Species	Habitats						
	XS	FW	HH	CS	SH	M&R	EW
Newt Family							
Peninsula Newt			f	fn	fn	fn	fn
Siren Family							
Narrow-striped Dwarf Siren				fn	fn	fn	fn
Eastern Lesser Siren				fn	fn	fn	fn
Greater Siren				fn	fn	fn	
Slender Dwarf Siren				fn	fn	fn	

[1] XS = Xeric Scrub

[2] FW = Flatwoods

[3] HH = Hardwood Hammock

[4] CS = Cypress Swamp

[5] SH = Swamp Hardwood

[6] M&R = Freshwater Marsh and River

[7] EW = Ephemeral Wetland

[8] f = use habitat to obtain food resources

[9] n = use habitat for nesting/breeding

Figure 2-4. Reptiles by habitat (continued).

Species	Habitats					
	XS	FW	HH	CS	SH	M&R
Skink Family						
Peninsula Mole Skink	fn					
Five-lined Skink	fn	fn	fn			
Southeastern Five-lined Skink	fn	fn	fn			
Broadhead Skink			fn		f	
Ground Skink	fn	fn	fn		f	
Whiptail Family						
Six-lined Racerunner	fn	fn	fn			
Colubrid Family						
Florida Scarlet Snake	fn	fn		f	f	
Southern Black Racer	fn	fn	fn		f	
Southern Ringneck Snake			fn	fn	f	f
Eastern Indigo Snake	fn	fn	fn		f	
Corn Snake	fn	fn	fn			
Yellow Rat Snake		fn	fn	f	f	
Eastern Mud Snake		n	n	f	f	f
Eastern Hognose Snake	fn	fn	fn			
Southern Hognose Snake	fn	fn	fn			
Kingsnake	fn	fn	fn	f	f	
Scarlet Kingsnake	fn	fn	fn			
Eastern Coachwhip		fn	fn			
Green Water Snake				fn	fn	fn
Florida Water Snake						fn
Brown Water Snake				fn	fn	fn
Rough Green Snake	fn	fn	fn		f	
Florida Pine Snake	fn	fn				
Striped Crayfish Snake				fn	fn	fn
Glossy Crayfish Snake				fn	fn	fn
Pine Woods Snake	fn	fn				
South Florida Swamp Snake		n	n	f	f	f
Short-tailed Snake	fn	fn	fn			
Florida Brown Snake		fn	fn	f	f	f
Peninsula Ribbon Snake		n	n	f	f	f
Eastern Garter Snake			fn	fn	fn	
Florida Redbelly Snake		fn	fn			

Figure 2-5. **BIRD** use of habitats for feeding and nesting in the Green Swamp area. Species that are present only during the non-breeding season are not included.

Species	Habitats						
	XS[1]	FW[2]	HH[3]	CS[4]	SH[5]	M&R[6]	EW[7]
Grebe Family							
Pied-bill Grebe						f[8]n[9]	
Cormorant Family							
Double-crested Cormorant					fn	fn	fn
Darter Family							
Anhinga				fn	fn	fn	
Bittern and Heron Family							
Great Blue Heron		n	n	fn	fn	fn	f
Cattle Egret	f	fn	fn	n	n	n	f
Green-backed Heron					fn	fn	fn
Great Egret		n	n	fn	fn	fn	f
Little Blue Heron		n	n	fn	fn	fn	f
Snowy Egret		n	n	fn	fn	fn	f
Tricolored Heron		n	n	fn	fn	fn	f
American Bittern						fn	
Least Bittern						fn	
Black-crowned Night Heron		n	n	fn	fn	fn	f
Yellow-crowned Night Heron		n	n	fn	fn	fn	f
Ibis and Spoonbill Family							
White Ibis		n	n	fn	fn	fn	f
Glossy Ibis				fn	fn	fn	f
Stork Family							
Wood Stork		n	n	fn	fn	f	f
Goose and Duck Family							
Wood Duck		n	n	fn	fn	f	f
Mottled Duck						fn	f
Mallard Duck						fn	f
Ring-necked Duck						fn	
Green-winged Teal						f	f
Blue-winged Teal						f	f
Hooded Merganser						f	f
Ruddy Duck						f	f

Figure 2-5. Birds by habitat (continued).

Species	Habitats						
	XS	FW	HH	CS	SH	M&R	EW
Plover Family							
Killdeer	fn	fn				f	
Stilt Family							
Black-necked Stilt						fn	
Sandpiper Family							
Greater Yellowlegs						f	f
Lesser Yellowlegs						f	f
Solitary Sandpiper						f	f
Spotted Sandpiper						f	f
Western Sandpiper						f	f
Least Sandpiper						f	f
Pectoral Sandpiper						f	f
Common Snipe						f	f
American Woodcock		f	f			f	
Tern and Skimmer Family							
Least Tern						fn	
Black Skimmer						fn	
Pigeon and Dove Family							
White-winged Dove	fn	fn					
Common Ground Dove	fn	fn	fn				
Mourning Dove	fn	fn	fn				
Cuckoo Family							
Yellow-billed Cuckoo		fn	fn	fn	fn	fn	
Barn-owl Family							
Common Barn Owl		fn	fn				

Figure 2-5. Birds by habitat (continued).

Species	Habitats						
	XS	FW	HH	CS	SH	M&R	EW
Swallow Family							
Purple Martin Swallow	n	n	n	fn	fn	f	
Northern Rough-winged Swallow		n	n	n	f	f	f
Tree Swallow					f		
Bank Swallow					f		
Barn Swallow					f		
Jay and Crow Family							
Florida Scrub Jay	fn						
American Crow	fn	fn	fn				
Fish Crow		fn	fn			f	
Blue Jay	fn	fn	fn	fn	fn		
Titmouse Family							
Tufted Titmouse	fn	fn	fn	fn	fn		
Carolina Chickadee		fn	fn	fn	fn	fn	
Nuthatch Family							
Brown-headed Nuthatch		fn					
Wren Family							
Carolina Wren			fn	fn	fn	fn	
House Wren	f	f	f				
Sedge Wren						f	f
Old World Warbler and Kinglet Family							
Blue-gray Gnatcatcher		fn	fn	fn	fn		
Eastern Bluebird		fn	fn				
Ruby-crowned Kinglet		f	f	f	f		
Veery			f	f	f		
Swainson's Thrush			f	f	f		
Hermit Thrush			f	f	f		
American Robin		f	f	f	f		
Wood Thrush			f	f	f		

Figure 2-5. Birds by habitat (continued).

Species	Habitats						
	XS	FW	HH	CS	SH	M&R	EW
Cerulean Warbler		f	f				
Black-and-white Warbler	f	f	f	f	f		
American Redstart	f	f	f	f	f		
Ovenbird			f	f	f		
Louisiana Waterthrush				f	f		
Kentucky Warbler		f	f	f	f		
Connecticut Warbler		f	f	f	f		
Tanager Subfamily							
Summer Tanager		fn	fn				
Cardinal Subfamily							
Northern Cardinal	fn	fn	fn	fn	fn		
Blue Grosbeak		fn	fn				
Towhee and Sparrow Subfamily							
Bachman's Sparrow			fn				
Rufous-sided Towhee		fn	fn	fn			
Chipping Sparrow		f					
Field Sparrow		f					
Vesper Sparrow		f					
Savanah Sparrow		f					
Swamp Sparrow				f	f		
Grasshopper Sparrow		f					
Blackbird and Oriole Subfamily							
Red-winged Blackbird						fn	
Brown-headed Cowbird		fn	n	n	n		
Boat-tailed Grackle		fn			fn		
Common Grackle		fn	fn				
Eastern Meadowlark			fn				
Rusty Blackbird		f				f	
Finch Family							
American Goldfinch	f	f	f				

Figure 2-6. **MAMMAL** use of habitats for feeding and nesting/breeding in the Green Swamp area.

Species	Habitats					
	XS[1]	FW[2]	HH[3]	CS[4]	SH[5]	M&R[6]
Opossum Family						
Opossum	f[7]n[8]	fn	fn	fn	fn	fn
Shrew Family						
Least Shrew		fn				fn
Southeastern Shrew				fn	fn	fn
Southern Short-tailed Shrew		fn	fn	fn	fn	
Mole Family						
Eastern Mole	fn	fn	fn			
Twilight Bat Family						
Big Brown Bat		fn	fn	fn	fn	f
Red Bat			fn	fn	fn	f
Yellow Bat			fn	fn	fn	f
Evening Bat	fn	fn	fn	fn	fn	f
Eastern Pipistrelle Bat	fn	fn	fn	fn	fn	f
Rafinesque's Big-eared Bat	fn	fn	fn	fn	fn	f
Seminole Bat	fn	fn	fn	fn	fn	f
Southeastern Bat	fn	fn	fn	fn	fn	f
Free-tailed Bat Family						
Brazilian Free-tailed Bat	fn	fn	fn	fn	fn	f
Armadillo Family						
Nine-banded Armadillo	fn	fn	fn	f	f	
Rabbit Family						
Eastern Cottontail Rabbit		fn	fn			
Marsh Rabbit						fn
Squirrel Family						
Southern Flying Squirrel	fn	fn	fn	fn	fn	
Gray Squirrel	fn	fn	fn	fn	fn	
Sherman's Fox Squirrel	fn	fn				

Figure 2-6. Mammals by habitat (continued).

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[1] XS = Scrub or Sandhill

[2] FW = Flatwoods

[3] HH = Hardwood Hammock

[4] CS = Cypress Swamp

[5] SH = Swamp Hardwood

[6] M&R = Freshwater Marsh and Rivers

[7] f = use habitat to obtain food resources .

[8] n = use habitat for nesting/breeding

out the importance of this kind of wetland for foraging and nesting birds, such as the Florida sandhill crane (state-listed as threatened), wood stork (federally and state-listed as endangered), and white ibis (under consideration by the state for listing as either endangered or threatened). For example, the wood stork feeds entirely by touch, sweeping its open bill through the water and snapping it shut in a quick reflex when it encounters a fish or other prey item. Because of this feeding behavior, wood storks rely on shrinking pools of water that concentrate prey.

Figure 2-7. Green Swamp wildlife species that have important ecological and/or legal status (continued).

Scientific Name Common Name	GFC	FWS	CITES	FCREPA
BIRDS				
Ixobrychus exilis least bittern				SSC
Casmerodius albus great egret				SSC
Egretta thula snowy egret	SSC			SSC
Egretta caerulea little blue heron	SSC			SSC
Egretta tricolor tricolored heron	SSC			SSC
Nycticorax nycticorax black-crowned night heron				SSC
Nycticorax violaceus yellow-crowned night heron				SSC
Eudocimus albus white ibis	**			SSC
Plegadis falcinellus glossy ibis				SSC
Mycteria americana wood stork	E	E		E
Pandion haliaetus osprey			II	SSC
Haliaeetus leucocephalus bald eagle	T	E	I	T

Figure 2-7. Green Swamp wildlife species that have important ecological and/or legal status (continued).

Scientific Name Common Name	GFC	FWS	CITES	FCREPA
Aphelocoma coerulescens coerulescens Florida scrub jay	T	T		T
Setophaga ruticilla American redstart				R
Seiurus motacilla Louisiana waterthrush				R
Aimophila aestivalis Bachman's sparrow			C2	
MAMMALS				
Sorex longirostris southeastern shrew				R
Myotis austroriparius southeastern bat		C2		
Plecotus rafinesquii southeastern big-eared bat		C2		R
Eptesicus fuscus big brown bat				R
Sciurus niger shermani Sherman's fox squirrel	SSC	C2		T
Podomys floridanus Florida mouse	SSC	C2		T
Neofiber alleni round-tailed muskrat		C2		SSC

Figure 2-8. Wildlife in the Green Swamp that have important ecological status.

Species	Ecological Status	
	Endemic[1]	Imperiled[2]
Fish		
Seminole Killifish	1	
Flagfish	1	
Amphibians		
Florida Cricket Frog	4	
Florida Chorus Frog	3	
Peninsula Newt	3	
Narrow-striped Dwarf Siren	3	
Reptiles		
Florida Snapping Turtle	4	
Florida Chicken Turtle	3	
Peninsula Cooter	3	
Suwannee Cooter	1	
Florida Redbelly Turtle	2	
Florida Box Turtle	4	
Striped Mud Turtle	4	
Florida Mud Turtle	3	
Florida Worm Lizard	1	
Florida Scrub Lizard		3
Peninsula Mole Skink	3	3
Florida Scarlet Snake	3	
Florida Water Snake	4	
Rough Green Snake	3	
South Florida Swamp Snake	3	
Short-tailed Snake	1	2
Eastern Diamondback Rattlesnake		3
Birds		
Short-tailed Hawk		1
American Swallow-tailed Kite		2

Figure 2-9. Number of native wildlife species associated with various habitats that occur within the Green Swamp region. Migratory winter birds are included.

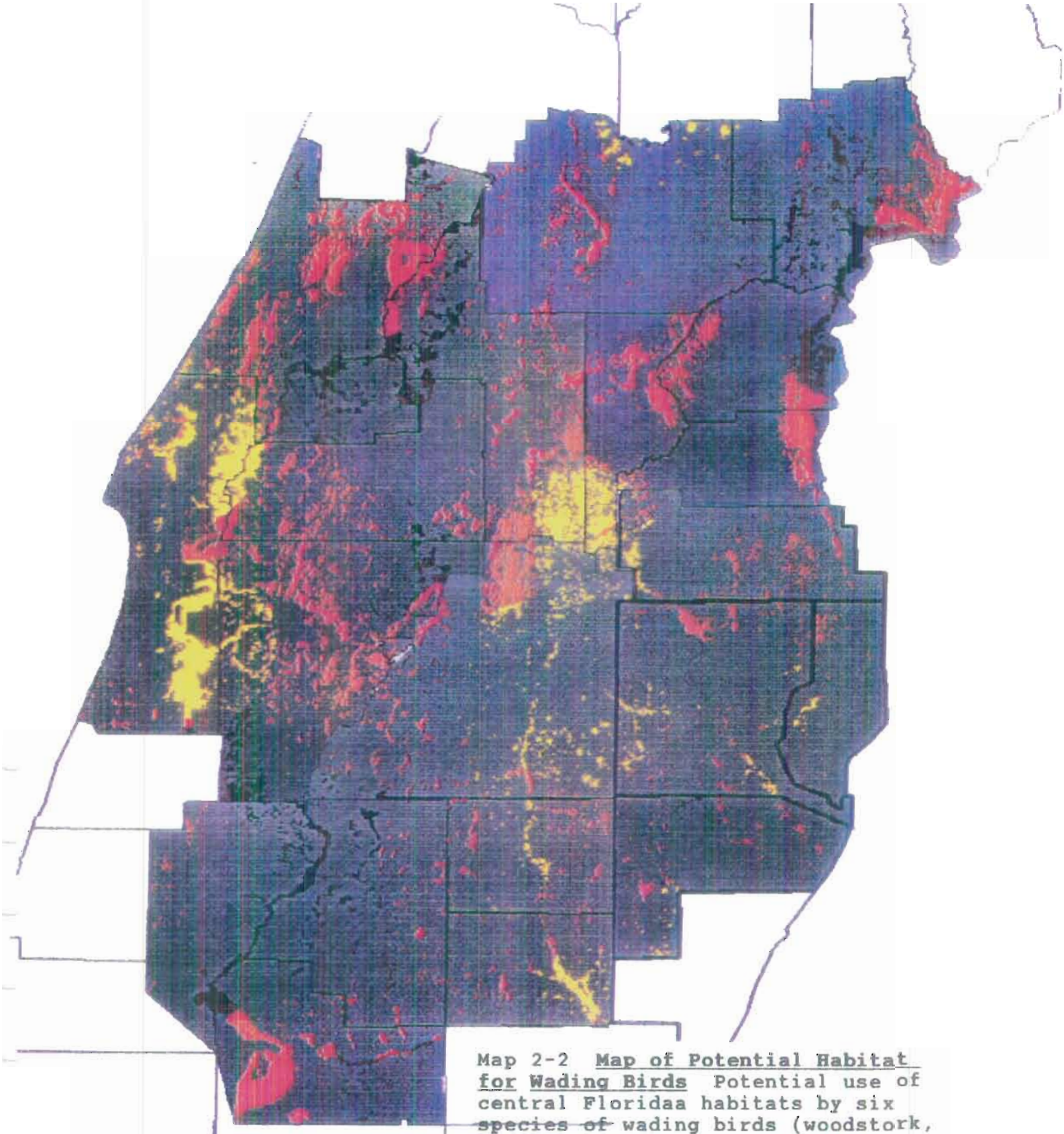
Habitat Type	Fishes	Amphibians	Reptiles	Birds	Mammals	Totals
Xeric	-	8(30) [a]	38(67)	47(29)	27(64)	120(36)
Pine flatwoods	-	16(59)	43(75)	107(66)	31(74)	197(60)
Mesic Hammock	-	16(59)	43(75)	99(61)	31(74)	189(57)
Cypress swamp	32(74)	25(93)	28(49)	69(42)	25(60)	179(54)
Hardwood swamp	32(74)	25(93)	33(58)	74(45)	25(60)	189(57)
Marsh	32(74)	18(67)	23(40)	66(40)	18(43)	157(47)
Ephemeral Wetlands[b]	-	20(74)	-	32(20)	-	52(16)
Open water	43(100)	20(74)	26(46)	16(10)	4(9)	109(33)
Dry prairie/ palmetto prairie	-	+ [c]	+	37(23)	+	+
Disturbed	-	12(44)	29(51)	124(77)	22(52)	187(57)
TOTAL	43	27	57	162	42	331(100)

[a] Numbers in parentheses indicate percentages of total. Note that the percentages add to greater than 100%, since one species may be found in several habitats.

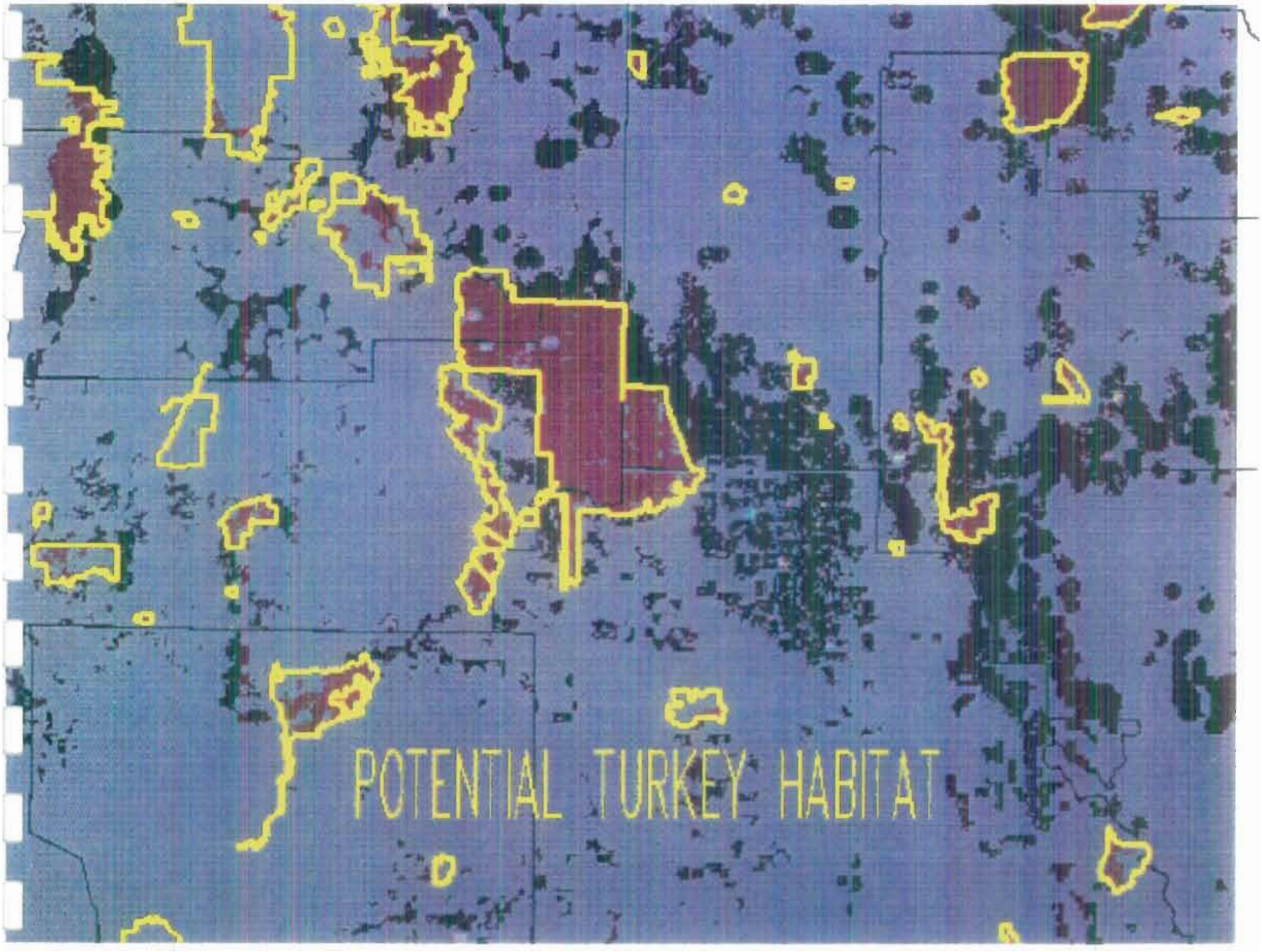
[b] Numbers reflect species that are not only associated with but are dependent on ephemeral wetlands.

[c] Species within this group may occur in dry prairie/palmetto prairie habitat, but available sources do not indicate which species require this habitat specifically.

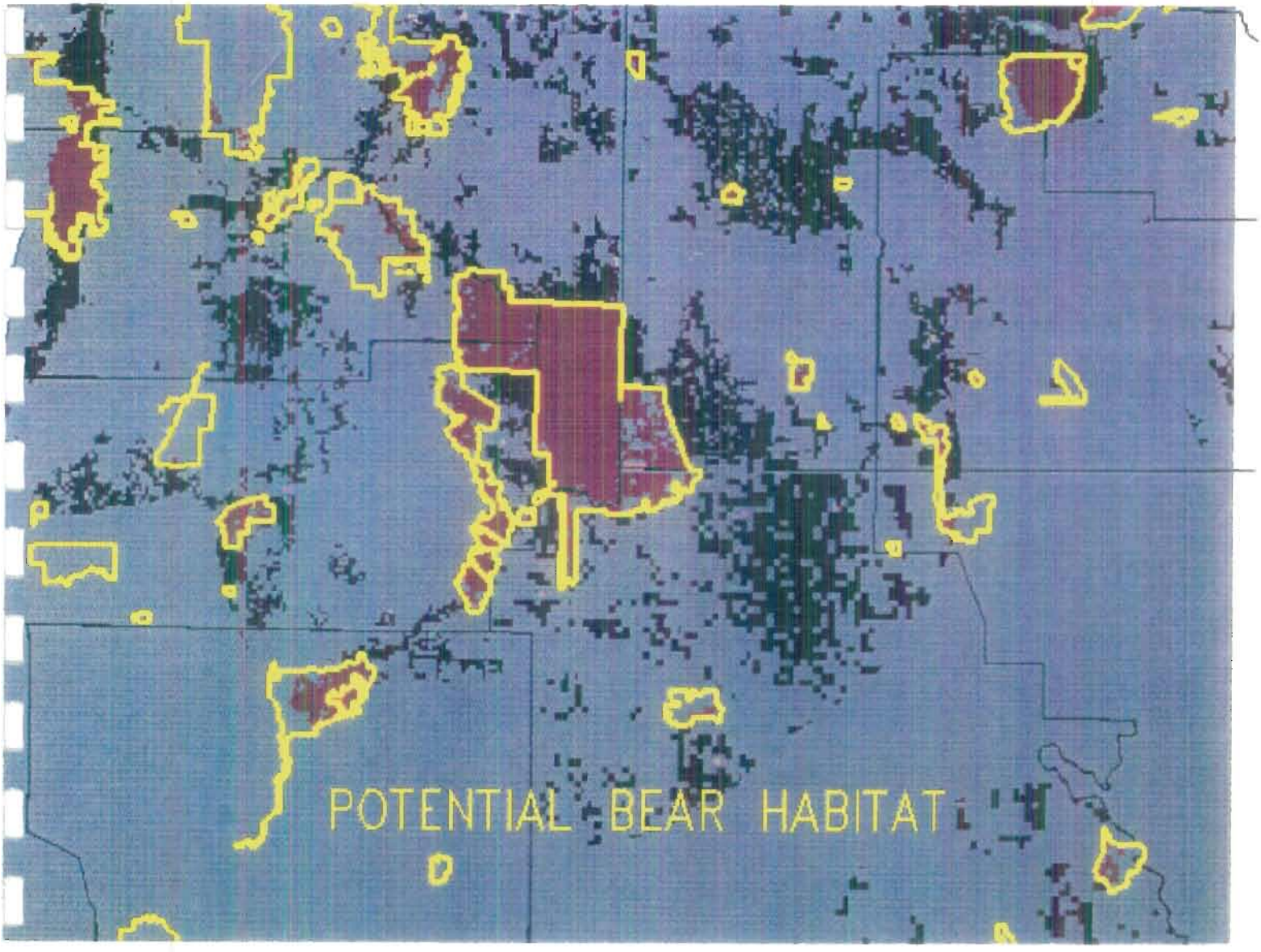
Sources: Fish: Barnett, 1972; personal communication.
Amphibians: Ashton and Ashton, 1988b.
Reptiles: Ashton and Ashton, 1985, 1988a.
Birds: Kale and Maehr, 1990.
Mammals: GFC, 1987.



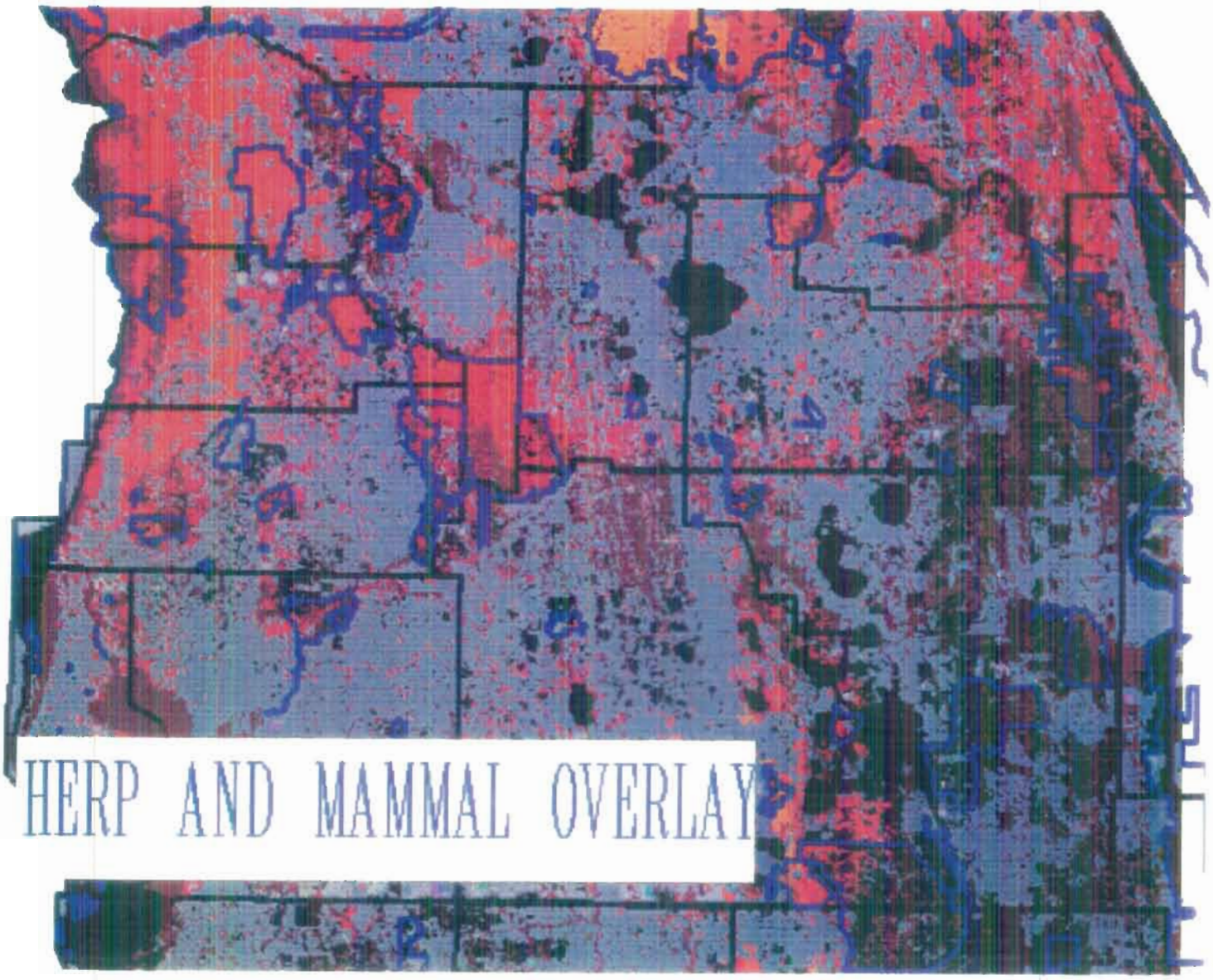
Map 2-2 **Map of Potential Habitat for Wading Birds** Potential use of central Floridaa habitats by six ~~species of~~ wading birds (woodstork, little blue heron, snowy egret, great egret, tricolored heron, and white ibis). The bright yellow areas signify those that are used by all six species, and progressively darker areas signify use by fewer species, with the darkest brown showing areas used by only one of six species. Areas were determined by locating rookeries containing any of these six species and delineating an area within a 25-km (15.5 miles) radius, the average area that wading birds may be expected to fly from the rookery to forage during the breeding season.



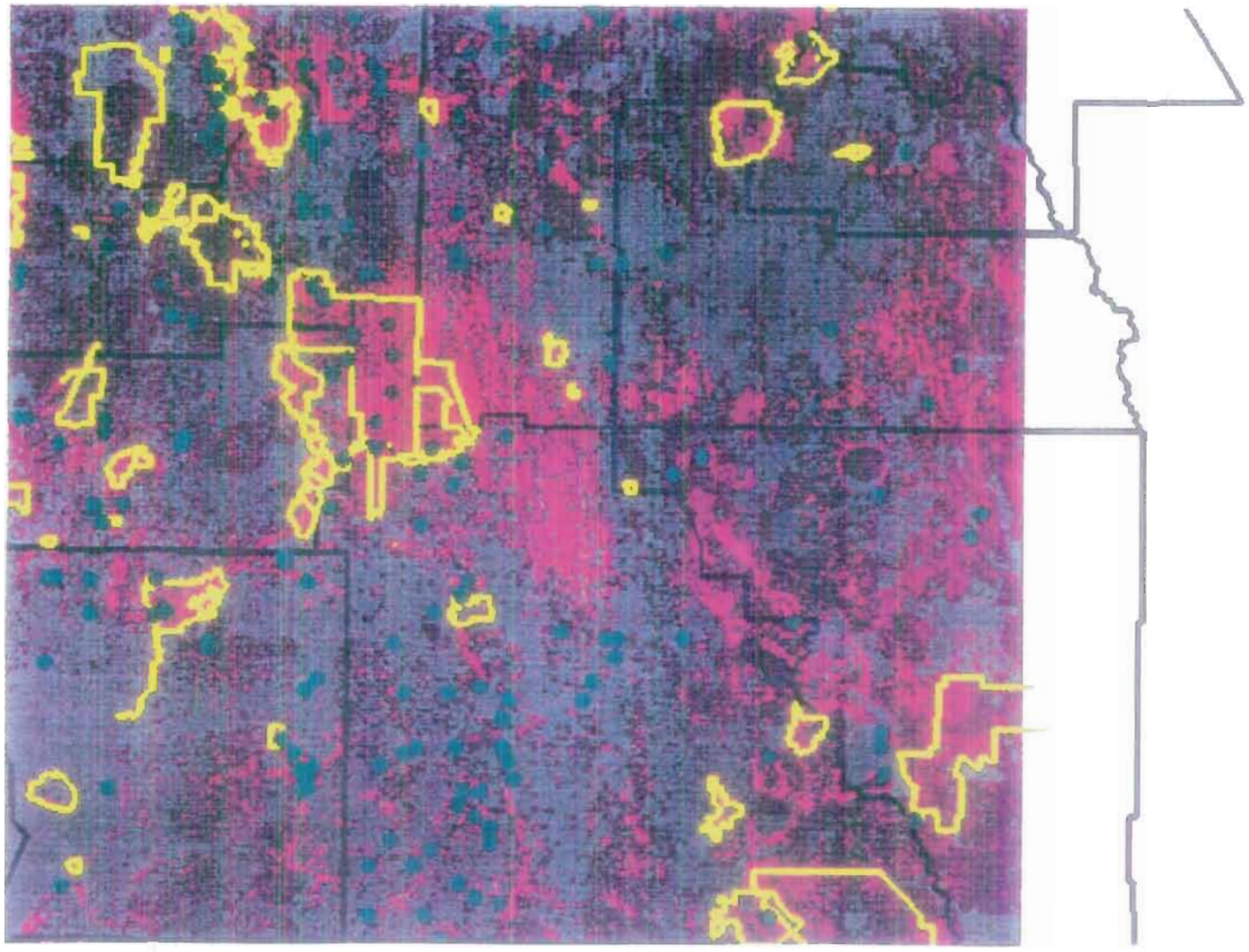
Map 2-3 **Map of Potential Green Swamp Turkey Habitat** Potential wild turkey habitat in the Green Swamp region and surrounding area. Yellow lines delineate public conservation lands, brick red indicates potential habitat on the public lands, and dark purple indicates potential habitat on private lands. Note similarity to Potential Bear Habitat Map.



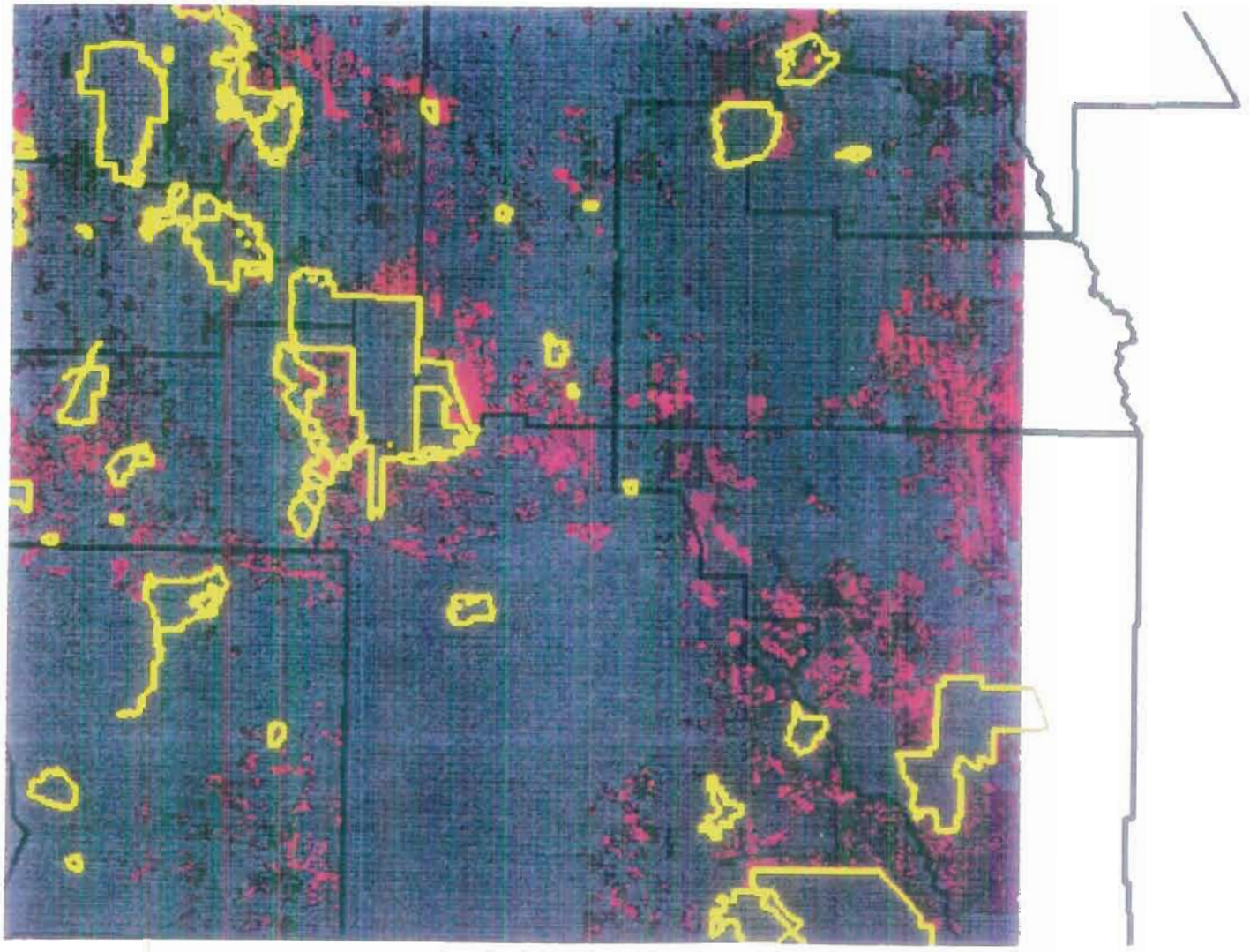
Map 2-4 **Map of Potential Green Swamp Black Bear Habitat** Potential black bear habitat in the Green Swamp and surrounding area. Yellow lines delineate public conservation lands, brick red indicates potential habitat on the public lands, and dark purple indicates potential habitat on private lands. Note similarity to Potential Turkey Habitat Map.



Map 2-5 **Map of Use by Amphibians, Reptiles, and Mammals**
Use of Green Swamp and surrounding habitats by amphibians, reptiles, and mammals. Bright orange areas are those used by the largest number of species, while the dark brown areas are those used by the fewest. The FG&FWFC used a standard list of over 30 species of amphibians and reptiles and over 30 species of mammals to generate this map. Not all of those species occur in the Green Swamp region.



Map 2-6 **Map of Potential Habitat of Multiple Species** Habitat in the Green Swamp and surrounding area used by little blue herons, woodstorks, great egrets, snowy egrets, tricolored herons, white ibis, limpkins, sandhill cranes, short-tailed hawks, swallow-tailed kites, black bears, and wild turkeys. Dark brown areas indicate where habitats for 1-3 species coincide, brighter brown the areas where 4-6 species overlap, brightest pink where habitats for 7-12 species overlap. Green dots indicate bird rookeries, and yellow lines delineate public conservation lands.



Map 2-7 **Map of Habitat on Large, Private Lands** Habitat use on single-owner, private lands larger than 300 acres in the same area. The species and color code used to generate this map are the same as was used in the Multiple Species Map.

ANALYSIS OF ISSUES

There are several issues involving ecological functions and wildlife resources of the Green Swamp even though literature on these topics that is specific to the Green Swamp is limited. Considerable information is available on general ecological concepts and wildlife relationships that can be applied to this area. We have analyzed these issues and provide the following as scientific justification for subsequent recommendations.

Biological Diversity

Most wildlife species require more than one habitat type in order to obtain their year round needs. Decreases in landscape diversity have limited the amount of resources available for wildlife. Several authors have substantiated the close association and interaction of wildlife in wetland and adjacent upland communities. Fredrickson (1978) reported that various species more commonly associated with wetlands or uplands make seasonal or daily shifts into different habitat types to escape flooding, to forage, to disperse or to hibernate. Examples that he cited are: turkey, river otter, swamp rabbit, deer, bobcat, and gray fox. Other species such as raccoon, gray squirrel, tree frogs and many woodland bird species occur with similar frequency in both wetlands and uplands. Fredrickson also points out the paucity of specific data describing the relationship between remnant lowland area size and animal numbers and distribution.

Bottomland hardwoods are integrally coupled to the surrounding uplands (Wharton et al. 1982). Terrestrial lowland fauna may be coupled to the uplands, as when deer that base their home range in floodplains, graze in uplands. Conversely, upland forms such as the black racer, slimy salamander and pine vole may use the floodplain at drawdown. Although many species breed in both habitat types, their densities may differ considerably between adjacent areas. However, the lower density populations may serve as important recruitment sources. The narrow greenbelts of bottomland hardwoods also provide routes for migration and restocking.

Many semi-aquatic Florida turtles such as the mud turtle and snapping turtle loaf and feed in marshes and need sandy upland sites to lay eggs (Weller 1978). The river cooter is an example of another turtle that is largely confined to permanent water but must trek to adjacent uplands to deposit eggs (Patrick et al. 1981). Paul Moler (Herpetologist, Florida Game and Fresh Water Fish Commission, Gainesville, pers. comm.) said documented cases of Florida aquatic turtles laying eggs several hundred yards from a river is not uncommon. Weller (1978) also indicated a need for more information relating to the wetland-upland interface. He stated, "Upland areas often serve as buffers, nesting areas, or food resources for wetlands wildlife but their relative importance is undocumented."

The eastern indigo snake is classified as a wetland species but frequently occurs in dry, sandy areas (Kockman 1978). Speake et al. (1978) found that indigo snakes concentrated on the higher ridges of sandhill habitat during winter and moved down into stream bottom thickets in summer. Shelter provided by gopher tortoise burrows is critical to the survival of this snake while it is in upland areas. Peak mast production occurs at different times of the year in uplands and lowlands (Harris et al. 1979). Winter and spring is the fruiting season for most bottomland species while upland plants bear fruit in the summer and fall. Correspondingly, both upland and wetland nesting birds often concentrate in wetland areas during the non-nesting season (Wharton et al. 1981). Wild turkeys may be found in a variety of wet and dry habitats and in Florida normally depend on acorns as a staple food. But they also have been known to eat crawfish (Wild turkeys were recently reintroduced into the Rock Springs Run State Reserve on the Wekiva River). During the egg-laying season, female wood ducks eat a large percentage of invertebrates obtained from the wetland-upland transitional areas (Fredrickson 1979). Pileated woodpeckers nest and roost primarily in wet hardwoods and cypress habitats but forage in uplands (Hoyt 1957, Jackson 1978). Conner et al. (1975) did not find any pileated woodpecker nest trees farther than 150 meters from water in southwestern Virginia.

Landers et al. (1979) found that black bears also respond to seasonal differences in mast production. In North Carolina, they shift their food preferences from predominantly bottomland species in the winter and spring to predominantly upland fruits and nuts in summer and fall. Florida bears primarily inhabit "swamps" in the center of the state but are long distance travellers utilizing both wetlands and uplands (Williams 1978). They eat acorns, palmetto berries and the terminal bud ("swamp cabbage") of the Cabbage Palm.

Jennings (1951) observed that gray squirrels in the Gulf Hammock region of Levy County, Florida were dispersed through all habitats while food was plentiful in the fall. When red maple and elm began to bud and produce seed in mid-January, the squirrels began to concentrate in the hydric hammocks and swamps to utilize this food source. As upland foods became available in the spring and the lowland areas flooded, the squirrels moved to higher elevations.

Kantola (1986) found higher fox squirrel densities in transitional areas than in either upland or lowland areas on the Ordway Reserve in Putnam County, Florida. However, she also reported that home-range size and use within transitional areas and uplands may vary with seasonal food abundance, reproductive activity and climate.

More than 33% of the 30 small vertebrates species caught by pit-fall traps in the floodplain of the Chattahoochee River in Georgia were classified as upland species (Wharton et al. 1981). Whereas only 14% of 21 small vertebrates sampled by the same method along the Alcovy River in Georgia received the same classification. This dissimilarity was attributed to vegetation structural differences in the floodplain.

Many researchers have been interested in the response of small mammals to flooding. Most studies concluded that floodplains were marginal habitats for these species. However, Batzli (1977) found that Illinois floodplain populations of the white-footed mouse were remarkably similar in density, adult survival and age structure to that in the adjacent upland areas. The exchange of individuals between these two communities consisted mainly of a few floodplain mice occasionally moving into the uplands. He suggested that mature trees with abundant holes and cavities may be necessary refuges for small mammal survival during flooding.

In a blackwater creek bottom in South Carolina's inner Coastal Plain, Gentry et al. (1968) found that the cotton mouse, short-tailed shrew, and southeastern shrew were two, three and ten times, respectively, more abundant in the bottomland hardwood than in the adjacent uplands. Whereas, golden mouse specimens were collected only from the hardwoods.

Because wetlands often are the last land to be developed, some species normally considered upland wildlife are sometimes forced to adapt to wetlands that can supply their habitat needs (Schitoskey and Linder 1978). When upland requirements for animals are destroyed, they may concentrate in the nearby wetlands. Ozoga and Verme (1968) reported that deer mice, which are upland-dependent, were also found in the wetlands. White-tailed deer, an edge species, is known to adapt well to the swamps and lowland areas (Verme 1961, Verme 1965, Sparrowe and Springer 1970). Weller and Spatcher (1965) found that upland bird species such as the meadowlark and mourning dove nested in unflooded portions of wetlands.

High densities of prey species also attract upland predators such as the skunk, raccoon and red fox. Bailey (1971) found that striped skunk densities were greater in wetlands than in uplands where cultivation and other development adversely affected upland feeding sites. This situation is suspected to cause an abnormally high skunk predation rate on waterfowl eggs. Another example is prairie raccoons feed in farmyards during early spring. However, as the growing season progresses, use of wetlands increases where relatively more foods are available than in the adjacent cultivated uplands.

Bobcats in the Welaka Reserve showed a preference for bottomland hardwoods (Progulske 1982). More than 20% of the 269 recorded locations of two radio-collared bobcats from July 1980 to December 1981 were in this type of overstory habitat. The other locations were spread among seven different upland habitat types.

Melquist and Hornocker (1983) found that although Idaho otters generally followed stream-beds, they often took shortcuts across peninsulas formed by stream meanders. Overland travel of up to about 3 kilometers was recorded. Extensive cross-country movements considerably reduced the distance an animal would normally have had to travel to reach the same destination by water. However, these movements also subjected the animals to highway hazards. Three of nine known mortalities were road-kills. In Great Britain, Chanin and Jefferies (1978) reported that in some areas dead otters were found repeatedly at the same location on roads over a number of years.

In a report that synthesized extant literature for Southeastern bottomland hardwood swamp habitats, Wharton et al. (1982) stated that bottomland animals do not occur in the same distinct zonal pattern as plants ranging from aquatic to upland ecosystems. Wetland inhabitants are opportunists, and many move freely into irregularly flooded or dry zones over the year. They also noted that some overlap among zones occurs, especially in the transitional areas characterized by periodic annual flooding and a duration of flooding during a portion of the growing season. Their examples of overlapping species that might occur along the Wekiva River are: the mole salamander, slimy salamander, narrowmouth toad, spadefoot toad, cricket frogs, chorus frogs, box turtle, five-lined skink, southeastern five-lined skink, brown snake, garter snake, ribbon snakes, rat snakes, kingsnake, southern black racer, coachwhip snake, barred owl, downy and red-bellied woodpeckers, cardinal, turkey, common yellowthroat, wood thrush, eastern wood peewee, white-breasted nuthatch, Swainson's warbler, carolina wren, yellow-throated vireo, cotton mouse, golden mouse, short-tailed, least and southeastern shrews, woodrat, marsh rabbit, pine vole, and eastern mole.

The use of various bottomland hardwood ecological zones by wildlife differs by species, season and flooding regime (Larson 1981). Some are site specific during the breeding period while at other times they may use a broad range of ecological zones. Larson also referred to many of the species examples used by Wharton et al. (1981).

Many studies have documented wetland wildlife species use of adjacent uplands. Removal or alteration of this important habitat type could destroy critical requirements for many species and thus render the riverine system no longer inhabitable for them.

Importance of Habitat Quality

Food, cover, and water are life-sustaining elements for all wildlife species. If every requirement for an animal is available in a particular area, the area is considered to be good quality habitat for that species; if one or more of a species' requirements is not available, the area is not suitable.

Some habitats are more suitable (of greater quality) than others and produce greater densities of wildlife than those of poorer quality. Much of the variability observed in numbers of species and numbers of individuals between populations in similar or different habitat types results from differences in available food, cover, water, and other requirements (Black and Thomas 1978). Habitats with a high suitability (abundant food, cover, and water resources readily available) have a greater potential to support more individuals per area. The number of individuals within a population for which a particular area is able to supply all energetic and physiological requirements over a long period, barring no major perturbations, is called carrying capacity (Smith 1974). Numbers of species and numbers of individuals within species often fluctuate due to a variety of causes including diseases, catastrophic events, predation, and competition. However, the carrying capacity potential of an area remains relatively unchanged. Therefore,

the extent of a buffer required to perpetuate populations is highly dependent on the long-term quality of the habitat in question.

By far, the most common cause of wildlife population reduction is natural landscape alteration through agriculture, silviculture, or construction activities. Altering or changing natural conditions to which species are adapted often harms native wildlife communities by destroying key elements that make a habitat suitable. An obvious example is the removal of snags (dead trees) that provide essential nesting structures, food sources, and perches for many birds, mammals, reptiles, and amphibians. A common misconception is that no harm is done because there are plenty of other undeveloped areas containing the same requirements. On the contrary, other areas that have the necessary elements for a particular species are probably already occupied at a saturation level, leaving no room for individuals that are ousted by development occurring elsewhere. Therefore, the most effective method of protecting wildlife resources would be to preserve areas in their most natural conditions.

Habitat Fragmentation

The effects of fragmenting or reducing habitat size on animal communities (especially birds) has been a popular research topic during the last two decades. These investigations have provided the scientific bases for the proper design of nature preserves surrounded by areas with little or no habitat values.

Most early work on this problem was essentially a confirmation of the familiar species-area relationship, larger pieces of habitat support more species than similar but smaller pieces (Arrhenius 1921, Gleason 1922, Preston 1960 and 1962, MacArthur and Wilson 1967).

The original intent of this theory proposed by MacArthur and Wilson (1967) was to explain species richness on oceanic islands that are isolated from mainlands. More recently, forest fragments also have been portrayed as islands because they are patches of natural habitats surrounded by a sea of culturally modified land (Terborgh 1974, Sullivan and Shaffer 1975, Wilson and Willis 1975, Diamond and May 1976, Forman et al. 1976, Galli et al. 1976, and many others).

The process of habitat fragmentation is accompanied by insularization of fragments, i.e., isolated pieces of habitat surrounded by dissimilar habitat. Eventually, fewer native species will be found in a habitat island than in a sample area of equal size within an extensive block of habitat (Harris 1984). The number of species may not change much, or may even increase in isolated habitats, but species composition will shift toward the more common non-forest-dependent species such as cardinals, pigeons, doves, blue jays, house sparrows, and mockingbirds. These adaptable species are prevalent in the developed landscape and do not need reserves or special protection for survival.

The equilibrium number of species found on an area is a function of immigration to the area and extinction of species originally present. In general, species capable of flight exhibit significant immigration to isolated habitat islands. Cursorial (non-flying) animals are less likely to disperse across inhospitable terrain (Frankel and Soule 1981). McLellan et al. (1986) suggest that extinctions of species increase rapidly once a critical percentage of the originall habitat has been destroyed.

Smaller forest islands surrounded by clear cuts or agricultural fields contain fewer bird species than larger contiguous stands (Lynehan et al. 1967, Moore and Hooper 1975, Forman et al. 1976, Galli et al. 1976, McElveen 1978, Wilson and Carothers 1979, Stauffer and Best 1980, Martin 1980, Robbins 1980, Tassone 1981, Ambuell and Temple 1983, Lynch and Whigham 1984, Blake 1986, Blake and Karr 1987, Temple 1986).

Similar results have been shown from Florida studies. Harris and Wallace (1984) reported that the number of breeding bird species occupying habitat islands in north central Florida hammocks increased as a

direct function of island size. Of the 45 bird species that commonly breed in expansive tracts of north Florida hardwood forests, only 24 used the 12 forest island fragments.

Research in urban areas also has suggested that the species-area concept applies when forest fragments are surrounded by development. In study areas bounded by housing developments, farm land, streams, and rail roads, Burr and Jones (1968) found bird species diversity to be directly related to urban parkland habitat size in Delaware. Gavareski (1976) reported identical numbers of non-urban bird species (29) in a large rural forest and a large undeveloped urban park but only 21 non-urban species in a small undeveloped urban park in Seattle, Washington.

Few studies have tested the validity of this model with other taxa. Variations in mammalian species richness were reported by Kitchener et al. (1980b) and Matthiae and Sterns (1981). Shreeve and Mason (1980) found the number of butterfly species to be directly correlated with the area.

There are many potential interpretations of the species-area relationship. Four general explanations are (1) larger areas support more kinds of habitats (and thus more habitat-specific species), (2) larger areas offer bigger "targets" for organisms dispersing across the landscape, (3) larger areas maintain larger populations that are less vulnerable to extinction due to random or deterministic population fluctuations, and (4) larger areas support animals with large territory and home range size that cannot be supported in small areas. Any one of these explanations is powerful enough to support the general recommendation that nature preserves should be as large as possible (Soule and Wilcox 1980, Frankel and Soule 1981, Schonewald-Cox et al. 1983, Harris 1984, Soule 1986).

A great deal of recent literature in the field of island biogeography has discussed the effects of inbreeding and genetic drift on wildlife due to genetic isolation and small population sizes (Miller 1979, Soule 1980, Senner 1980, Wilcox 1980, Franklin 1980). Inbreeding has the effect of decreasing population heterozygosity (genetic variation) by increasing the chance that progeny will receive duplicate alleles from a common ancestor. This loss of genetic variation can have both immediate and future implications for a species' survival. Inbreeding can lower species vigor and fecundity within a few generations (Soule 1980). The very reduced population of Florida panthers may be suffering from the effects of inbreeding. All five males examined have had greater than 93% abnormal sperm (Roelke 1986). Over the long term, inbreeding also can limit the ability of a population to evolve to meet changing environmental conditions (Soule 1980, Harris et al. 1984).

In order to develop a conservation strategy that addresses the need to assure continued perpetuation of all currently existing wildlife populations within a large geographic area, minimum viable or minimum functional population requirements must be met. A minimum viable population is the lowest number of individuals that can assure the capability of the population to persist through time dealing successfully with agents of extinction (Shaffer 1981). Put in more specific terms, a minimum viable population can be defined as the smallest population that will give a 99% probability of surviving at least 1,000 years (Shaffer 1981). Too small a population is subject to extirpation due to the accumulation of detrimental genetic make-up through inbreeding (Ralls and Ballou 1983). It is well recognized that population extinction is inversely related to population size in its frequency of occurrence (MacArthur 1972, Diamond 1984). Genetic variability provides a basis for populations to adapt to a changing environment.

Minimum viable populations are dangerously close to extinction or extirpation and should not be considered as bottom line constraints in land-use decisions. If the intent of creating preserves is to prevent the extirpation of species from an area, then specific standards should be set to higher, ecologically functional levels rather than minimum viable levels.

It is important to note that the process of extirpation for longer-lived species may take several decades. Therefore, the impacts of some ineffective land-use decisions will not be realized for several generations.

Once the minimum viable population size is determined then the minimum area required to support that population can be calculated by extrapolating the home range size of the average individual. In landscapes with isolated wetland habitats, area requirements should be satisfied in large contiguous blocks. In flowing water wetlands that are situated between two larger habitat islands, area requirements may be satisfied merely by providing the appropriate link or wildlife corridor.

Many recent studies have examined methods of determining minimum viable population size (Shaffer 1981, LaCava and Hughes 1984, Samson et al. 1985, Reed et al. 1986, Cox et al. 1987). Because this is an evolving science, accurate and undisputable figures are not available for population sizes that will be able to remain genetically viable over time. Cox et al. (1987) stated that 40-50 gopher tortoises satisfied several conditions for population viability for at least several hundred years. LaCava and Hughes (1984) determined that a population of 46 northern goshawks was adequate to maintain genetic variability. Reed et al. (1986) calculated the minimum population of goshawks to be 122 plus the number of nonbreeders.

These authors also disagreed with the minimum number of elk that could remain genetically viable. The LaCava and Hughes (1984) estimate was 214 and Reed et al. (1986) concluded that twice as many individuals (426) were required.

The major variables in the population models used to calculate minimum viable population size include: the number of breeding males and females, the number of young born, the probability that a newborn survives to the mean age of reproduction, and the mean age of all males and females that reproduce. Wildlife species composition in east central Florida's significant wetlands vary tremendously with respect to these factors.

Reed et al. (1986) recommended an effective population size of more than 50 for short-term survival of species and 500 for long-term population and species survival. Franklin (1980) warned that populations as large as 300 individuals may be needed to provide for minimum levels of persistence for populations faced with consistently harsh conditions over 200 years. Land managers and planners should, of course, aim above the minimum levels whenever possible because the consequences of falling below are extreme and these population models have not been substantially validated.

Other literature has questioned the effectiveness of fragmented parks and preserves in maintaining viable populations of animals which require large ranges or activity areas (Pickett and Thompson 1978, Lovejoy and Oren 1981, Harris and Noss 1985, Harris 1984, Noss and Harris 1986). In Florida, black bears may range over 15,000 acres and bobcats over 5,000 acres. An otter may require several miles of linear river and riparian habitat (Harris 1985).

Application of the species-area relationship or island biogeography theory is useful in determining the minimum area needed to support viable or functional populations of species in these fragments (Diamond 1975, 1978). Rosenberg and Raphael (1986) found that highly isolated Douglas-fir forest stands (>50% insularity) should be at least 125 acres to preserve the full complement of associated vertebrate species. Harris and Wallace (1984) found that small (< 75 acres), mesic hardwood hammock islands in Florida supported only 53% of the bird species that normally breed in this habitat type.

The best strategy for isolated preserve design has been a topic of considerable debate during the past decade. Simberloff and Abele (1976) suggested that the species-area relationship does not imply that a large reserve is always the optimum conservation strategy. Pickett and Thompson (1978) introduced the concept of "minimal dynamic area" as the smallest area capable of maintaining all ecosystem components in the face of a natural disturbance. Kushlan (1979) has shown that shape and area were inadequate design criteria to predict wildlife diversity in Everglades National Park. Frankel and Soule (1981) and Cole (1981) refuted this concept and emphasized large preserves. Higgs (1981) took

exception to this generality. Temple (1986) presented the core-area (the area of forest more than 100 m from an edge) model for recommending preserves. Seagle (1986) suggested that elements of both the area-per se and habitat-diversity hypotheses contribute to the development of species-area relationships through interaction between area and landscape dynamics. Soule and Simberloff (1986) have focused attention from the minimum-sized fragment that will contain a species to the area necessary to maintain minimum viable populations of species.

It is important to note that not only will some species not use small preserves, but there are no species that are restricted to small habitat patches. This is highly relevant to the design of wildlife preservation areas. Spatial requirements for wildlife species occurring in the Green Swamp can be found in Figures 2-10 through 2-12. These figures represent only the width of an area required to provide food and cover for one individual. Much larger areas are necessary to perpetuate populations.

Wildlife Corridors

Wildlife corridors can be defined as bands or parcels of land that allow safe passage of wildlife between larger blocks of habitat. This contiguity effectively increases the size of protected lands and their ability to maintain viable wildlife populations. Genetic variation is maintained because genetic material is carried freely back and forth along the corridor and among large habitat blocks by dispersing wildlife. Scattered animals also can recolonize areas that have suffered from local extinctions (Fahrig and Merriam 1985).

MacClintock et al. (1977) provided evidence that forested corridors increased the number and diversity of breeding birds in the smaller forest patches that were connected to larger habitat tracts. Wildlife populations in isolated blocks of forest have been shown to have lower growth rates than populations in forest blocks interconnected by corridors (Fahrig and Merriam 1985). Harris (1984) suggested the use of riparian corridors to link isolated habitat islands. Kautz (1984) recommended preserving forested corridors approximately 100 meters wide. Noss (1987) stated that more research is needed to develop optimal connectivity strategies but active methodologies to prevent fragmentation must proceed quickly, with or without sufficient data. Brown et al. (1990) provided evidence to show that 550 foot wide corridors (buffers) on one side of a river would be sufficient space to maintain about 50 % of the species associated with swamp wetlands. Smaller buffers would give the same results in marsh systems and larger buffers are required in sandhills.

Forman (1983) has stated that width is the most important variable affecting corridor function. Stauffer (1978) found that bird species richness increased significantly with the width of wooded riparian habitat and half of the species were restricted to wider strips. Tassone (1981) reported similar results from a study of hardwood leave strips in large clear cut areas. Acadian flycatchers were only infrequently found in corridors less than 50 meters. Hairy and pileated woodpeckers required minimum strip widths of 50 and 60 meters respectively, while the northern parula required at least 80 meters. In a preliminary study, Smith (unpub.) found that prothonotary and hooded warblers were not recorded in urban riparian habitats up to 450 feet wide in Gainesville, Florida, but were found in a nearby large state preserve, San Felasco Hammock.

The importance of stream and river-associated habitats as wildlife corridors has received much attention. However, to function effectively as an area through which animals will travel and gain access to larger connected habitat areas, the corridor must be of sufficient size and quality to provide essential requirements for animals to be attracted to it. Cursorial (non-flying) animals are especially unlikely to disperse across unsuitable terrain (Frankel and Soule 1981). Brown et al. (1990) presented a scientific basis for wildlife buffers (development set backs) of 322 to 732 feet for significant wetlands in east central Florida.

Figure 2-10. Spatial requirements expressed as width of land (not water) needed by one individual for wildlife species that breed in the Green Swamp and occur almost exclusively in **WETLAND** habitats.

Species	Width Needed (ft)[1]	Basis of Need[2]	References[3]
Two-toed Amphiuma	50	habits very aquatic, needs enough adjacent land to provide good quality water	A 1
Narrow-striped Dwarf Siren	50	habits very aquatic, needs enough adjacent land to provide good quality water; endemic species	A 1
Eastern Lesser Siren	50	habits very aquatic, needs enough adjacent land to provide good quality water	A 1
Greater Siren	50	habits very aquatic, needs enough adjacent land to provide good quality water	A 1
Slender Dwarf Siren	50	habits very aquatic, needs enough adjacent land to provide good quality water	A 1
Green Water Snake	50[4]	needs land for sunning and giving birth (linear home range in and adjacent to river: mean home range for 3 species in Nerodia genus = 5.7 ha)	R 1, R 2
Florida Water Snake	50	needs land for sunning and giving birth (linear home range in and adjacent to river: mean home range for 3 species in Nerodia genus = 5.7 ha); endemic species	R 1, R 2
Brown Water Snake	50	needs land for sunning and giving birth (linear home range in and adjacent to river: mean home range for 3 species in Nerodia genus = 5.7 ha)	R 1, R 2
Striped Crayfish Snake	50	needs land for sunning and laying eggs (similar to water snakes)	R 3
Glossy Crayfish Snake	50	needs land for sunning and laying eggs (similar to water snakes)	R 3
Florida Cottonmouth	50	needs land for sunning and giving birth (linear home range in and adjacent to river = 0.4 - 1.2 ha);	R 1
South Florida Swamp Snake	50	needs land for sunning and laying eggs (similar to water snakes) endemic species	R 4
Eastern Mud Snake	50	needs land for sunning and laying eggs (similar to water snakes)	R 4
Pied-billed Grebe	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1

Figure 2-10. Spatial requirements in **WETLAND** habitats (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References[3]
American Bittern	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
Eastern Least Bittern	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
American Coot	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
Common Moorhen	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
Purple Gallinule	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
King Rail	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
Red-winged Blackbird	50	habitat requirements restricted to littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
Black-necked Stilt	50	habitat requirements restricted to littoral zones and open shores of marshes, needs enough adjacent land to provide good quality water	B 1
Round-tailed Muskrat	50	habitat requirements restricted to littoral zones of marshes, needs enough adjacent land to provide good quality water; endemic species	M 1, M 2
Marsh Rice Rat	50	habitat requirements restricted to littoral zones of marshes, needs enough adjacent land to provide good quality water	M 1
Mallard Duck	50	very tolerant of humans	B 1
Least Tern	33-144	similar to other water birds, range of distances from humans tolerated while nesting	B 3
Black Skimmer	33-144	similar to other water birds, range of distances from humans tolerated while nesting	B 3
Double-crested Cormorant	50, 30-132	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting	B 2, B 3
Anhinga	50, 48-141	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting	B 2, B 3
River Otter	100	needs land for denning (linear home range in and adjacent to river = 1.7 - 3.6 miles of linear riparian habitat); imperiled species	M 3
Mottled Duck	120	minimum distance from humans tolerated while feeding	B 2

Figure 2-10. Spatial requirements in **WETLAND** habitats (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References[3]
Florida Cricket Frog	180	adults forage in upland timber areas (similar to green treefrog which were found up to 180 feet from water); endemic species	A 1
Limpkin	180, 39-165	similar to herons' tolerance to humans while feeding and nesting; listed species	B 1
Green-backed Heron	180, 39-165	similar to other herons' tolerance to humans while feeding and nesting	B 1
Glossy Ibis	240,38-120	similar to white ibis	B 2, B 3
Ring-necked Duck	300	similar to wood duck	B 1
Bullfrog	350	maximum distance found from permanent water	A 2
Pig Frog	350	similar to bullfrog	A 1
Hooded Warbler	450	minimum width of forested corridor bordered by development where species was found	B 4
Prothonotary Warbler	450	similar to hooded warbler	B 1
Marsh Rabbit	700	maximum distance found from shore	M 4

[1] Width needed values were determined by using spatial information reported in the literature including: home range (diameters were calculated), maximum distance a wetland species was found from the nearest water source, maximum distance a radio-tagged, wetland individual traveled from a water body to which it returned, minimum distance from humans tolerated, distance between captures of the same individual. If no spatial data were found for a species, width values for other species that are closely related, similar sized, found in comparable habitats, and categorized in similar guilds were used. Professional judgements also were needed to assure that the application of the literature data to determine a protection zone width was ecologically sound (e.g. alligators and otters have linear movement patterns that follow the river channel rather than circular home ranges that include extensive uplands).

[2] Information provided here includes: description of literature data or other explanation for "width needed" value; and an indication if species is endemic, imperiled, or listed.

[3] References listed in Appendix C.

[4] Highlighted numbers indicate that spatial data for a particular species were found in the literature.

Figure 2-11. Spatial requirements expressed as width of land (not water) needed by one individual for wildlife species that breed in the Green Swamp and occur in both **WETLAND** and **UPLAND** habitats.

Species	Width Needed (ft)[1]	Basis of Need[2]	References[3]
American Alligator	50[4]	needs land for sunning and nesting (linear home range in and adjacent to river = 4.9 - 863.0 ha); listed species	R 5
Killdeer	50	needs undisturbed, open area for ground nest	B 1
Chimney Swift	50	very tolerant of humans	B 1
Purple Martin Swallow	50	very tolerant of humans	B 1
Northern Rough-wing Swallow	50	very tolerant of humans	M 6
Big Brown Bat	50	very tolerant of humans	M 5
Red Bat	50	very tolerant of humans	M 5
Yellow Bat	50	very tolerant of humans	M 5
Evening Bat	50	very tolerant of humans	M 5
Eastern Pipistrelle Bat	50	very tolerant of humans	M 5
Rafinesque's Big-eared Bat	50	very tolerant of humans	M 5
Brazilian Free-tailed Bat	50	very tolerant of humans	M 5
Seminole Bat	50	very tolerant of humans	M 5
Southeastern Bat	50	very tolerant of humans	M 5
Nine-banded Armadillo	50	very tolerant of humans	M 5
Rough Green Snake	51, 78	home range diameter (mean home range size = 0.019 ha, mean distance between captures of same marked individual = 78 feet); endemic species	R 1
Green Anole	51, 78	similar to rough green snake	R 6
Broadhead Skink	51, 78	similar to rough green snake	R 6
Ground Skink	51, 78	similar to rough green snake	R 6
Great Egret	60, 45-84	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting	B 2, B 3
Great Blue Heron	60, 48-144	similar to great egret, range of distances from humans tolerated while nesting	B 3
Cattle Egret	60, 33-63	similar to great egret, range of distances from humans tolerated while nesting	B 3
Osprey	60	very tolerant of humans	B 1
Ruby-throated Hummingbird	60	very tolerant of humans	B 1
Belted Kingfisher	60	very tolerant of humans	B 1

Figure 2-11. Spatial requirements in both **WETLAND and UPLAND** habitats (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References[3]
Common Flicker	60	very tolerant of humans	B 1
Red-bellied Woodpecker	60	very tolerant of humans	B 1
Great Crested Flycatcher	60	very tolerant of humans	B 1
Fish Crow	60	very tolerant of humans	B 1
Northern Cardinal	60	very tolerant of humans	B 1
Brown-headed Cowbird	60	very tolerant of humans (thrives in open areas)	B 1
Boat-tailed Grackle	60	very tolerant of humans	B 1
Blue Jay	60	very tolerant of humans	B 1
Carolina Wren	60	very tolerant of humans	B 1
Gray Squirrel	60	very tolerant of humans	B 1
Raccoon	60	very tolerant of humans (linear home range adjacent to river, maximum length of home range = 1 mile)	M 6
Opossum	60	very tolerant of humans	M 5
Southern Flying Squirrel	60	tolerant of humans	M 5
Southeastern Shrew	60	tolerant of humans but not cats	M 5
Least Shrew	60	tolerant of humans but not cats	M 5
Southern Short-tailed Shrew	60	tolerant of humans but not cats	M 5
Eastern Wood Rat	71	similar to cotton mouse	M 5
Eastern Harvest Mouse	71	similar to cotton mouse	M 5
Golden Mouse	71	similar to cotton mouse	M 5
Florida Brown Snake	93, 177-591	diameter of home range, ranges of mean distances between captures of same marked individuals	R 1
Southern Ringneck Snake	93, 177-591	similar to Florida brown snake	R 4
Eastern Coral Snake	93, 177-591	similar to Florida brown snake	R 4
Southern Dusky Salamander	93, 177-591	similar to Florida brown snake	A 1
Dwarf Salamander	93, 177-591	similar to Florida brown snake	A 1
Slimy Salamander	93, 177-591	similar to Florida brown snake	A 1
Tufted Titmouse	166	diameter of smallest isolate forest patch in which species was found	B 5, B 6
Carolina Chickadee	166	similar to tufted titmouse	B 1
Red-eyed Vireo	180	minimum width of forested corridor bordered by development where species was found	B 4

Figure 2-11. Spatial requirements in both **WETLAND and UPLAND** habitats (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References[3]
Green Treefrog	180	maximum distance found from water	A 3
Squirrel Treefrog	180	similar to green treefrog	A 1
Cope's Gray Treefrog	180	similar to green treefrog	A 1
Little Grass Frog	180	similar to green treefrog	A 1
Southern Toad	180	similar to green treefrog	A 1
Little Blue Heron	180, 39-63	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting; listed species	B 2, B 3
Black-crowned Night Heron	180, 51-69	similar to little blue heron, range of distances from humans tolerated while nesting	B 3
Yellow-crowned Night Heron	180, 51-69	similar to little blue heron and black-crowned night heron	B 1
Florida Chorus Frog	180	similar to green treefrog; endemic species	A 1
Ornate Chorus Frog	180	similar to green treefrog; endemic species	A 1
Common Yellowthroat	203-2,865	home range diameters (densities of 1.75 to 348 pair/100 ha reported)	B 7, B 8
Snowy Egret	240, 123-165	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting; listed species	B 2, B 3
Tricolored Heron	240, 75-141	similar to snowy egret, range of distances from humans tolerated while nesting; listed species	B 3
White Ibis	240, 38-120	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting	B 2, B 3
Wood Duck	300	minimum distance from humans tolerated while feeding	B 2
Penninsula Ribbon Snake	333	home range diameter	R 1
Southern Leopard Frog	350	similar to bullfrog	A 1
Dusky Pigmy Rattlesnake	368	home range diameter (home range = 0.98 ha)	R 1
Southern Black Racer	506-1,174, 336-525	range of home range diameters, ranges of mean distances between captures of same marked individuals	R 1
Acadian Flycatcher	300-600, 450	range of home range diameters, minimum width of forested corridor bordered by development where species was found	B 4
Downy Woodpecker	740	home range diameter	B 9
Hairy Woodpecker	740	similar to downy woodpecker	B 1
Yellow-billed Cuckoo	745	diameter of smallest isolated forest patch in which species was found	B 5

Figure 2-11. Spatial requirements in both **WETLAND and UPLAND** habitats (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References[3]
Yellow Rat Snake	1,155-1,297, 525-585	range of home range diameters, ranges of mean distances between captures of same marked individuals	R 1
Fl. Scarlet Snake	1,155-1,297, 525-585	similar to yellow rat snake; endemic species	R 4
Sandhill Crane	1,200	tends to nest away from roads and other development activity, only occurs in open prairies and marshes; endemic, imperiled, and listed species	B10
Northern Parula Warbler	1,183	diameter of smallest isolated forest patch in which species was found	B 6
Palm Warbler	1,183	similar to northern parula warbler	B 1
Blue-gray Gnatcatcher	1,183	similar to northern parula warbler	B 1
Yellow-throated Vireo	1,183	similar to northern parula warbler	B 1
White-eyed Vireo	1,183	similar to northern parula warbler	B 1
Striped Mud Turtle	1,350	maximum distance a radio-tagged individual traveled round-trip from shore to uplands (needs sandy soil for nesting); endemic species	R 7
Florida Snapping Turtle	1,350	similar to striped mud turtle; endemic species	R 6, R 8
Florida Chicken Turtle	1,350	similar to striped mud turtle; endemic species	R 6
Peninsula Cooter	1,350	similar to striped mud turtle; endemic species	R 6
Florida Redbelly Turtle	1,350	similar to striped mud turtle; endemic species	R 6
Florida Mud Turtle	1,350	similar to striped mud turtle; endemic species	R 6
Loggerhead Musk Turtle	1,350	similar to striped mud turtle	R 6
Stinkpot	1,350	similar to striped mud turtle	R 6
Florida Softshell	1,350	similar to striped mud turtle	R 6
Suwannee Cooter	1,350	similar to striped mud turtle	R 6
Spotted Turtle	1,350	similar to striped mud turtle	R 6
Eastern Garter Snake	333-1,403, 513-636	range of home range diameters, range of mean distances between captures of same marked individiuals	R 1
Bald Eagle	1,500	restricted activity zone around nest; imperiled and listed species	B11
Wood Stork	1,500	deserve as much protection as eagles; listed species	B12
Kingsnake	1,664, 780	similar to scarlet kingsnake	R 4
Red-shld. Hawk	1,177-2,346, 2,640-2978	range of diameters of smallest isolate forest patches in which species was found, range of home range diameters	B 5, B13
Short-tailed Hawk	1,177-2,346, 2,640-2978	similar to red-shouldered hawk	B 1

Figure 2-11. Spatial requirements in both **WETLAND and UPLAND** habitats (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References[3]
Am. Sw.-tail. Kite	1,177-2,346, 2,640-2978	similar to red-shouldered hawk; imperiled species	B 1
Barred Owl	3,455-7,153	range of home range diameters	B14, B15
Great Horned Owl	3,455-7,153	similar to barred owl but prefers more opened canopy	B 1
Eastern Screech Owl	3,455-7,153	similar to barred owl	B 1
Southern Spring Peeper	4,000	maximum distance found from breeding pond	A 4
Pinewoods Treefrog	4,000	similar to spring peeper	A 1
Barking Treefrog	4,000	similar to spring peeper	A 1
E. Narrowmouth Toad	4,000	similar to spring peeper	A 1
Eastern Spadefoot Toad	4,000	similar to spring peeper	A 1
Peninsula Newt	4,000	similar to spring peeper; endemic species	A 1
Pileated Woodpecker	3,098-5,763, 2,419	range of home range diameters, diameter of smallest isolate forest patch in which species was found	B16, B 6
Eastern Indigo Snake	4,654	home range diameter; imperiled and listed species	R 9
Long-tailed Weasel	5,280-10,560	range of home range diameters; endemic species	M 2
Florida Box Turtle	5,280	home range diameter	R 6
Bobcat	4,710-12,638	range of home range diameters	M 7
White-tailed Deer	5,959	home range diameter	M 5
Wild Boar	5,959	similar to white-tailed deer	M 5
Florida Gopher Frog	6,336	distance between captures of same marked individual; imperiled and listed species	A 5
Oak Toad	6,336	similar to gopher frog	A 1
Gray Fox	7,084-10,708	range of home range diameters	M 8
Wild Turkey	10,472	home range diameter	B17
Florida Black Bear	17,287	home range diameter	M11

Figure 2-11. Spatial requirements in both **WETLAND and UPLAND** habitats (continued).

[1] Width needed values were determined by using spatial information reported in the literature including: home range (diameters were calculated), maximum distance a wetland species was found from the nearest water source, maximum distance a radio-tagged, wetland individual traveled from a water body to which it returned, minimum distance from humans tolerated, distance between captures of the same individual. If no spatial data were found for a species, width values for other species that are closely related, similar sized, found in comparable habitats, and categorized in similar guilds were used. Professional judgements also were needed to assure that the application of the literature data to determine a protection zone width was ecologically sound (e.g. alligators and otters have linear movement patterns that follow the river channel rather than circular home ranges that include extensive uplands).

[2] Information provided here includes: description of literature data or other explanation for "width needed" value; and an indication if species is endemic, imperiled, or listed.

[3] References listed in Appendix C.

[4] Highlighted numbers indicate that spatial data for a particular species were found in the literature.

Figure 2-12. Spatial requirements expressed as width of land (not water) needed by one individual for wildlife species that breed in the Green Swamp and occur almost exclusively in **UPLAND** habitats.

Species	Width Needed (ft)[1]	Basis of Need[2]	References[3]
Southern Fence Lizard	51	similar to rough green snake	R 6
Peninsula Mole Skink	51	similar to rough green snake; endemic and imperiled species	R 6
Southeastern Five-lined Skink	51	similar to rough green snake	R 6
Five-lined Skink	51	similar to rough green snake	R 6
Sixlined Racerunner	51	similar to rough green snake	R 6
E. Slender Glass Lizard	51	similar to rough green snake	R 6
Eastern Glass Lizard	51	similar to rough green snake	R 6
Island Glass Lizard	51	similar to rough green snake	R 6
Florida Scrub Lizard	51	similar to rough green snake	R 6
Eastern Kingbird	60	needs very little forest (edge species)	B 1
American Crow	60	needs very little forest (edge species)	B 1
Eastern Bluebird	60	needs very little forest (edge species)	B 1
Northern Mockingbird	60	needs very little forest (edge species)	B 1
Brown Thrasher	60	needs very little forest (edge species)	B 1
Loggerhead Shrike	60	needs very little forest (edge species)	B 1
Northern Bobwhite	60	needs very little forest (edge species)	B 1
Common Ground Dove	60	needs very little forest (edge species)	B 1
Mourning Dove	60	needs very little forest (edge species)	B 1
White-winged Dove	60	needs very little forest (edge species)	B 1
Blue Grosbeak	60	needs very little forest (edge species)	B 1
Common Grackle	60	needs very little forest (edge species)	B 1
Cotton Mouse	71[4]	home range diameter	M 9
Eastern Mole	71	similar to cotton mouse	M 5
Florida Mouse	71	similar to cotton mouse; endemic and listed species	M 2
Hispid Cotton Rat	71	similar to cotton mouse	M 5
Pocket Gopher	71	similar to cotton mouse	M 5
Oldfield Mouse	71	similar to cotton mouse	M 5
Florida Worm Lizard	93, 177-591	similar to Florida brown snake; endemic species	R 6
Florida Redbelly Snake	93, 177-591	similar to Florida brown snake; endemic species	R 6
Bachman's Sparrow	166	similar to tufted titmouse	B 1
Chuck-will's-widow	166	similar to tufted titmouse	B 1

Figure 2-12. Spatial requirements in **UPLAND** habitats (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Rufous-sided Towhee	166	similar to tufted titmouse	B 1
Scrub Jay	166	similar to tufted titmouse; endemic, imperiled, and listed species	B 1
Eastern Meadowlark	166	similar to tufted titmouse, requires open fields	B 1
Brown-headed Nuthatch	166	similar to tufted titmouse in pine forests	B 1
Gopher Tortoise	247	home range diameter; imperiled and listed species	R10
Summer Tanager	>450	minimum width of forested corridor bordered by development where species was found	B 4
Turkey Vulture	500	needs undisturbed forested area for nesting	B 1
Black Vulture	500	needs undisturbed forested area for nesting	B 1
Eastern Cottontail Rabbit	527	home range diameter	M 5
Eastern Hognose Snake	732	distance between captures of same individual	R 1
Southern Hognose Snake	732	similar to Eastern Hognose Snake	R 1
Red-headed Woodpecker	890	home range diameter	B18
Sherman's Fox Squirrel	1,053	similar to fox squirrel; endemic, imperiled, and listed species	M 2
Yellow-throated Warbler	1,183	similar to northern parula warbler	B 1
Pine Warbler	1,183	similar to northern parula warbler	B 1
Florida Pine Snake	1,155-1,297, 525-585	similar to yellow rat snake; imperiled and listed species	R 4
Pine Woods Snake	1,155-1,297, 525-585	similar to yellow rat snake	R 4
Short-tailed Snake	1,155-1,297, 525-585	similar to yellow rat snake; endemic, imperiled, and listed species	R 4
Corn Snake	1,155-1,297, 525-585	similar to yellow rat snake	R 4
Scarlet Kingsnake	1,664, 780	home range diameter, distance bewteen captures of same marked individual	R 1
Eastern Coachwhip	1,586	home range diameter	R 1
SE American Kestrel	2,622-6,627	range of home range diameters; listed species	B19, B20, B21
Common Barn Owl	2,622-6,627	similar to kestrel	B 1
Burrowing Owl	2,622-6,627	similar to kestrel; imperiled and listed species	B 1
E. Diamondback Rattlesnake	2,756	home range diameter; imperiled species	R 1
Cooper's Hawk	5,159	home range diameter	B22
Striped Skunk	5,280-10,560	similar to long-tailed weasel	M 5
Eastern Spotted Skunk	5,280-10,560	similar to long-tailed weasel	M 5
Red-tailed Hawk	10,560	home range diameter	B23

Figure 2-12. Spatial requirements in **UPLAND** habitats (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References[3]
Northern Harrier	10,560	similar to red-tailed hawk, only in marshes	B 1
Red Fox	9,113-13,544	range of home range diameters	M 8
Coyote	9,113-13,544	similar to red fox	M 8

[1] Width needed values were determined by using spatial information reported in the literature including: home range (diameters were calculated), maximum distance a wetland species was found from the nearest water source, maximum distance a radio-tagged, wetland individual traveled from a water body to which it returned, minimum distance from humans tolerated, distance between captures of the same individual. If no spatial data were found for a species, width values for other species that are closely related, similar sized, found in comparable habitats, and categorized in similar guilds were used. Professional judgements also were needed to assure that the application of the literature data to determine a protection zone width was ecologically sound (e.g. alligators and otters have linear movement patterns that follow the river channel rather than circular home ranges that include extensive uplands).

[2] Information provided here includes: description of literature data or other explanation for "width needed" value; and an indication if species is endemic, imperiled, or listed.

[3] References listed in Appendix C.

[4] Highlighted numbers indicate that spatial data for a particular species were found in the literature.

Edge Effects

The question of how large a habitat area must be to maintain biological integrity cannot be answered without considering the impacts of land uses adjacent to the preserve. The negative effects of induced edge on species have been reported by Faaborg (1980), Samson (1980), Noss (1981, 1983), Samson and Knopf (1982), Harris (1984), and Noss and Harris (1986). The type of habitat on the outside of a forest edge determines the nature of edge effects. A general principle is that the greater the contrast between habitat types, the greater the edge effect (Harris 1984). Modified areas surrounding a forest fragment are usually altered into earlier successional stages. These types of habitats are then attractive to pioneering species that invade several hundred meters into the adjacent forest fragment and alter species composition and relative abundances.

The negative impacts of induced (man-made) edges in a forested system and of the noise and domestic animal problems associated with development adjacent to natural habitat areas have been reported by Brown et al. (1989). Some of the major points will be highlighted here.

Whitcome et al. (1976) provided evidence that, in areas along forest edges avian brood parasites (brown-headed cowbirds), nest predators (small mammals, grackles, jays, and crows), and non-native nest hole competitors (e.g. starlings) are usually abundant. Gates and Gysel (1978) found that a field-forest edge attracts a variety of open-nesting birds, but such an edge functions as an "ecological trap." Birds nesting near the edge had smaller clutches and were more subject to higher rates of predation and cowbird parasitism than those nesting in either adjoining habitats. This abnormally high predation rate is related to the artificially high densities of many opportunistic animals near forest edges and in disturbed habitats including suburbs; (Wilcove et al. 1986).

The cowbird problem is a relatively new but very real dilemma in East Central Florida. This bird feeds in open areas and lays its eggs in other species' nest found along forest edges. Many birds cannot distinguish this foreign egg from their own and devote all of their energy to raising the young cowbirds. The eggs of the host species are either removed by the adult cowbird or are pushed out of the nest by the more aggressive cowbird nestling. Several species such as the Kirtland's warbler have been seriously affected by nest parasitism, and now the extinction of the Bachman's warbler is expected due to this alien source of mortality. The Florida Breeding Bird Atlas surveys in East Central Florida have revealed an increased presence of the cowbird as the naturally forested landscape is cleared and more open habitat is provided for this species.

Any forest tract has a "core area" that is relatively immune to deleterious edge effects and is always far smaller than the total area of the forest (Temple 1986). Relatively round forest tracts with small edge-to-interior ratios would thus be more secure, whereas thin, elongated forests (such as those along unbuffered riparian strips) may have very little or no core area and would be highly vulnerable to negative edge effects.

Predation and harassment of wildlife by free-ranging domestic cats and dogs are other detrimental effects of development adjacent to significant wildlife habitat areas. Several authors have documented the occurrence to wildlife prey in the diets of free-ranging cats and dogs and the effects of their predatory behavior on individual wildlife animals and populations (Errington 1936, Korschgen 1957, Smith 1966, Gilbert 1971, Jackson 1971, Gill 1975). Cats can be especially devastating on local wildlife populations. Hunting is a feline instinct, and predation rates are not related to hunger (Davis 1957, Holling 1966, Holling and Buckingham 1976). Bradt (1949) reported that a single cat, who regularly consumed domestic food, killed over 1,600 mammals and 60 birds in Michigan during an 18-month period. Local extinctions of the Anastasia beach mouse along Florida's coast (Stephen R. Humphery, pers. comm. 1989); a dove on a south Pacific island (Jehl and Parkes 1983); and diving petrels, broad-billed prions, yellow-crowned parakeet, robin, fern-bird, brown creeper, Stewart Island snipe and banded rail in New Zealand (Fitzgerald

and Veitch 1985) have been attributed to cat predation. Churcher and Lawton (1989) concluded from their study that domestic cats kill at least twenty million birds a year in Britain.

Cats and dogs can be especially devastating on ground feeding and ground breeding species. These guilds represent the majority of semi-aquatic and wetland-dependent wildlife species in some areas of Florida (Brown et al. 1989).

Sound is a physical phenomenon and defined as an oscillation in pressure of a medium measured in decibels (dB); (American National Standards Institute 1971). Sometimes, sound is noise which is defined as unwanted or undesirable sound (U.S. Environmental Protection Agency 1978). This annoyance factor of sound negatively impacts all hearing animals. Along with air and water contaminants, noise has been recognized as a serious pollutant.

The physiological impacts of noise on people is well documented. Short-term exposure to very high sound levels (120 to 130 dB) and long-term exposure to lower levels (80 dB) can cause temporary or permanent changes in human ability to hear (Carelstam 1972), and increased blood pressure, elevated rates of heartbeat and respiration, muscle tension, hormone release, cardiovascular disorders and increased susceptibility to disease (Alexandre and Barde 1981). Long-term exposure above 55 dB interferes with activity and causes annoyance for people in outdoor settings (U.S. Environmental Protection Agency 1974). However, the physiological and behavioral impacts on wildlife are little known.

Noise associated with construction, operation, and maintenance of developments can cause harmful impacts on wildlife. Animals that rely on their hearing for courtship and mating behavior, prey location, predator detection, homing, etc., will be more threatened by increased noise than will species that use other sensory modalities. However, due to the complex interrelationships that exist among all the organisms in an ecosystem, direct interference with one species will indirectly affect many others.

Unfortunately, little data is available that demonstrate the specific effects of noise on wildlife . Much of what is found in the literature lacks specific information concerning sound intensity, spectrum, and duration of exposure. There have been no systematic studies with experimental designs that show definite relationships between specific noise disturbances for various species and different sound levels. Brandt and Brown (1988) conducted an extensive literature search on this topic and found that most of our current knowledge of sound impacts on wildlife are based on observations of animal reactions to aircraft overflights and laboratory studies. Because such little research emphasis has been given to this topic, it is not surprising that results are inconclusive and sometimes contradictory.

While general understanding and consequences of noise impacts on wildlife are not very specific, a few conclusions are obvious. Short-term exposure to loud sounds can cause physiological changes in animals as it does in humans. Chronic lower level sounds (55 dB) are annoying to humans and also probably make an area relatively less desirable to wildlife. Some, but not all, species can adapt to some sounds. Human activity also disturbs wildlife and can have similar effects such as nest abandonment. Noise and human activity will negatively impact semi-aquatic and wetland-dependent wildlife from the landward side as well as the water side if the water is used for recreational purposes.

Edge effects have been shown to negatively impact wildlife species within at least 300 feet of forest boundaries. Studies of nature reserve boundaries have provided data that support the need for buffer zones of decreasing use outside reserve boundary (Unesco 1974, Dasmann 1988, Schonewald-Cox 1988). The core of these areas must be protected from cats, dogs, human activities, noise, predators, exotic competitors, parasitism and other detrimental effects of development.

Impacts of Land Uses

There are a variety of human-related land uses occurring in the Green Swamp. All of these alter the natural landscape to a greater or lesser degree and, therefore, at least indirectly impact the wildlife resources associated with these vegetation communities.

Public Recreation: Assessing impacts of human recreational activities on wildlife is a newly evolving science. Boyle and Samson (1985) summarized 106 recreational impact studies and reported that 73 percent of these concluded that even nonconsumptive activities negatively affected bird communities. Hiking and camping affect wildlife through trampling of habitat (Liddle 1975), disturbance of animals (Ward et al. 1973, Aune 1981) and less directly through discarded food or other items (Foin et al. 1977). Klein (1989) documented the effects of visitor use on avian species at Ding Darling Refuge, Florida. A majority of the species that she classified as most sensitive to humans (reacted negatively to human presence) occur in the Green Swamp. These include: pied-billed grebe, white ibis, willet, sanderling, dunlin, and blue-winged teal. The average minimum distance from humans that was tolerated by these species was 260 feet.

Human disturbance of waterbird colonies has been shown to cause nest losses through predation (Schreiber and Risebrough 1972, Hand 1980, Anderson and Kieth 1980) and nest abandonment (Hunt 1972, Ellison and Cleary 1978). Some duck species and the great-crested grebe did not winter in one reservoir since it was opened to sailboats, even though these species were observed elsewhere in the vicinity (Batten 1977). Rodgers and Burger (1981) reported that human activities in waterbird colonies may delay nesting for some pairs, eliminate late-nesting pairs, or cause late-nesting pairs to shift to other less suitable nesting sites. Tremblay and Ellison (1979) reported that visits to black-crowned night heron colonies just before or during laying provoked abandonment of newly constructed nests and either predation of eggs or abandonment of eggs followed by predation. This study also concluded that herons did not nest in areas where human interference occurred. Ellison and Cleary (1978) found similar results with double-crested cormorants. Wintering eagles were more disturbed by infrequent activities than by regular activities (Stalmaster and Newman 1978). Landin (1978) recommended protecting all wading bird nesting areas from human activities during the nesting season.

Effects of boating and swimming have been reported primarily for birds. In a comprehensive review, Liddle and Scorgie (1980) noted that wildlife is affected through sight and sound of recreationists, pollution from boats and recreational facilities, and habitat changes caused by vegetation control practices and facility construction. Beach and shore recreationists can disrupt shorebird breeding (Norman and Saunders 1969) or force birds into less preferred habitats (Erwin 1980).

Lynch and Whitcomb (1978) reported that existing urban and suburban parks in the Washington, D.C. area have failed as avifaunal preserves. From 1950 to 1970, many specialized, fragment-sensitive species were extirpated locally and replaced by generalized permanent residents. They attributed this unnatural change to inadequate size of parks, isolation from sources of potential colonists, and increasing levels of disturbances related to human activities (trampling of understory vegetation, repeated disturbance of nesting and feeding birds, predation by cats and dogs, competition for food and nest sites with native and introduced common species that invade forest patches, increased levels of brood-parasitism by the brown-headed cowbird, and increased levels of pollution by noise, light, and toxic chemicals).

Cattle Ranching: It is not known exactly when domestication of the cow took place. By 2500 B.C. several well-characterized breeds of domesticated cattle were in existence indicating that the domestication process had to have begun much earlier (Zeuner 1963). Domestication of early cattle was probably a very difficult task given the size and malevolent character of the beast. Domestication of any animal eventually involves selection of traits and characteristics that are more useful to mankind which eventually means the disappearance of the original strains of wild animals. It is important to remember that the cow is not

an alien species from outer space. Cattle, like any other species of animal on earth, originally impacted and, even to this day, impact other species of animals and plants with which they come into contact. However, impacts of today's domesticated cattle probably are quite different from the impacts of Bos primigenius of old. The major differences, have to do with the human element related to **management** of the animal.

Many variables such as type of ecosystem, current condition of the vegetation, amount of vegetation or forage available, time of year, grazing schedule, size of the area, surrounding land use, and species of wildlife present affect the impact of cattle in a given area. Because Florida data are almost nonexistent, specific interactions between cattle and wildlife in this state are unknown. Although most of the cattle-wildlife studies have been conducted in western environments, we believe that some of the same basic ecological principles apply to Florida systems. For example, research on elk, mule deer, and western white-tailed deer habitat preferences have provided evidence that there is a relationship between cattle grazing and habitat suitability for large wild herbivores. Because of this relationship, it can be assumed that different grazing practices and intensities would have different impacts on herbivores. The validity of applying results of western studies to Florida is exemplified by comparing quail studies conducted in Arizona, Illinois, Texas, and northwestern Florida. Every study concluded that overgrazing can reduce quail populations by eliminating essential escape cover. Data found through our literature search suggest that if grazing is controlled at some level, it can be compatible with wildlife conservation efforts. Financial support for this type of research in Florida has been lacking but desperately needed.

Several cattle-wildlife studies have focused on the competition of wildlife and cattle for food resources in western rangelands. Landowner interest in managing game species as a valued commodity has stimulated some research on the compatibility of cattle grazing and game management.

Late-spring through early-fall grazing of longleaf pine-bluestem range in central Louisiana had little impact on deer forage availability (Thill and Martin, Jr. 1989). However, during late fall through early spring, diet overlap was highest and even moderate cattle stocking significantly reduced available deer forage.

Some studies have been designed to describe general interactions between cattle and wildlife but have not provided the data needed to assess whether modification of forage base or some other factor actually caused these relationships. For example, elk preferred spring feeding sites in Montana that had been moderately grazed by cattle (Grover and Thompson 1986). However, Knowles and Campbell (1982) indicated that the availability of forested cover vegetation also is an important factor for elk selection of an open feeding area. Proper livestock grazing has been shown to maintain or improve habitat for mule deer (Austin and Urness 1986).

Wildlife species diversity is strongly influenced by vegetation composition and structural heterogeneity or diversity within a habitat type (MacArthur 1964). This type of heterogeneity is a function of foliage height and cover diversity. The vertical and horizontal stratification of plants within a habitat is positively correlated with the variety of species that reside in that ecosystem. Heavy grazing can alter natural ground layer plant diversity and, therefore, impact species that feed or nest at this level. In fact, more wildlife species are dependent on the ground layer than any other vertical stratum in most communities within the Green Swamp (Figures 2-13 through 2-17). About half of Florida's species in danger of extinction use the ground stratum to obtain food and nesting resources.

Johnsgard (1973) found inverse relationships between grazing intensity and use by nesting quail. Murray (1958) reported that overgrazing diminished quail food supply. Brown (1982) documented that heavily grazed areas did not provide adequate escape and nesting cover.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)				3		3	1 12		1 18
Tree Bole (TB)						4		4	8
Shrubs/ Grasses (S/G)				1 3	2	1			1 6
Ground Surface (GS)				14 46	1 3	2 9	6	2 9	19 73
Water Surface (WS)									
Water Column (WC)									
Water Bottom (WB)									
Feeds in other habitat				6 11		1	1 1		7 13
Totals				21 63	1 5	2 18	2 16	2 12	28 118

BREEDING ZONE

Figure 2-13 Guild matrix with feeding and breeding zones for wildlife species that occur in **XERIC SCRUB** habitats in the Green Swamp. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species) in the guild (upper-right corner) are shown. See Appendix for lists of species in each guild box.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)				3		4	1 15		1 22
Tree Bole (TB)				1		4		5	10
Shrubs/ Grasses (S/G)				1 4	4	2	1	1 3	2 14
Ground Surface (GS)				12 52	4	2 11	1 12	2 11	17 90
Water Surface (WS)									
Water Column (WC)									
Water Bottom (WB)									
Feeds in other habitat				8 16		2	5 11		13 29
Totals				21 76	8	2 23	7 39	3 19	33 165

BREEDING ZONE

Figure 2-14. Guild matrix with feeding and breeding zones for wildlife species that occur in **FLATWOODS** habitats in the Green Swamp. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species) in the guild (upper-right corner) are shown. See Appendix for lists of species in each guild box.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)				3		3	1 19		1 25
Tree Bole (TB)				1		4		4	9
Shrubs/ Grasses (S/G)				1 4	4	2	1	1 4	2 15
Ground Surface (GS)				9 47	3	10	1 9	1 9	10 76
Water Surface (WS)									
Water Column (WC)									
Water Bottom (WB)									
Feeds in other habitat				9 17	1	2	5 11		14 31
Totals				19 72	8	21	7 39	2 16	28 156

BREEDING ZONE

Figure 2-15 Guild matrix with feeding and breeding zones for wildlife species that occur in **HARDWOOD HAMMOCK** habitats in the Green Swamp. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species) in the guild (upper-right corner) are shown. See Appendix for lists of species in each guild box.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)				1		4	1 16		1 21
Tree Bole (TB)		1				4		4	9
Shrubs/ Grasses (S/G)		1 2		1	4	3		3	1 13
Ground Surface (GS)		2 7		1 6	1	7	1	4 18	7 40
Water Surface (WS)						1			1
Water Column (WC)		1 5		2 6	1 4		4 10	6 13	15 38
Water Bottom (WB)									
Feeds in other habitat					1	1	2 4		2 6
Totals		4 15		3 14	1 10	20	7 31	11 38	26 128

BREEDING ZONE

Figure 2-16 Guild matrix with feeding and breeding zones for wildlife species that occur in **CYPRESS SWAMP** habitats in the Green Swamp. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species) in the guild (upper-right corner) are shown. See Appendix for lists of species in each guild box.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)				1		4	1 17		1 22
Tree Bole (TB)		1				4		4	9
Shrubs/ Grasses (S/G)		1 2			4	3		1 4	2 13
Ground Surface (GS)		2 8		1 8	1	7	3	5 22	9 50
Water Surface (WS)						1			1
Water Column (WC)		1 5		2 6	1 3		4 11	7 11	15 36
Water Bottom (WB)									
Feeds in other habitat					1	1	2 4		2 6
Totals		4 16		3 15	1 9	20	7 35	12 41	27 136

BREEDING ZONE

Figure 2-17 Guild matrix with feeding and breeding zones for wildlife species that occur in **SWAMP HARDWOOD** habitats in the Green Swamp. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species) in the guild (upper-right corner) are shown. See Appendix for lists of species in each guild box.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)								1 12	1 12
Tree Bole (TB)								3	3
Shrubs/ Grasses (S/G)				1	2				3
Ground Surface (GS)		2 8	1 1	1 5		1		1 10	5 25
Water Surface (WS)			1 8						1 8
Water Column (WC)		1 5	1	5 13	1 5		3 9	9 16	19 48
Water Bottom (WB)									
Feeds in other habitat		1					1		2
Totals		3 14	2 10	6 19	1 7	1	3 9	11 41	26 101

BREEDING ZONE

Figure 2-18 Guild matrix with feeding and breeding zones for wildlife species that occur in **FRESHWATER MARSH AND RIVER** habitats in the Green Swamp. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species) in the guild (upper-right corner) are shown. See Appendix for lists of species in each guild box.

Researchers have reported that heavy grazing was negatively correlated with shrub volume and shrub heights and bird abundance (Taylor 1986), and altered bird species composition (Mosconi and Hutto 1982). Significant differences also were found in small mammal communities between grazed and ungrazed sites in both riparian and nonriparian habitats (Johnson 1982). Platt (1985) reported that snakes and lizards were much more abundant and diverse in a natural sand prairie than in a pasture in central Kansas.

However, grazing was found to improve habitat for long-billed curlews in Idaho (Bicak et al. 1982). This is not unexpected because many birds in the sandpiper family prefer open areas with very little vegetation for nesting (Harrison 1975).

Close to 100 native vertebrate wildlife species feed or nest at or near the ground in any given upland habitat in Florida. Because each species has different vegetation height preferences, a single consistent vegetation height is not ecologically desirable. For example, Smallwood (1987) reported that kestrels generally hunted for prey in grasses and weedy forbs less than 25 centimeters in height. Harrison (1975) described average nesting sites for several Florida species including the following: turkey - depression in dead leaves usually concealed by a bush or at the base of a tree; killdeer - depression in an area cleared of vegetation; bobwhite - hollowed out tussock among grasses; Bachman's sparrow - nest on ground beneath shrubs especially saw palmetto; and hooded warbler - average nest height is 2.5 feet above the ground in a small bush or herbaceous plant. This information suggests that a heterogeneous environment that offers various nesting situations and vegetation heights would provide nesting opportunities for most species.

The physical movement of cattle through an ecosystem can have negative impacts on wildlife. Nests and eggs can be trampled (Jensen et al. 1990); burrows of fossorial animals can be destroyed; and plants can be physically damaged. Under proper grazing management, however, trampling has not been shown to be detrimental to ground nesting populations. Soil can become so compacted that plant growth may be inhibited. Trampling and grazing also have been found to be detrimental to the recovery of listed plants such as Mesa Verde Cactus (Benson 1984) and Gypsum wild buckwheat (U.S. Fish and Wildlife Service 1984). Overgrazing effects typically are more severe and long-lasting in xeric environments than in mesic environments.

Aquatic systems can be modified by cattle in several ways. Heavy grazing that causes a reduction in the amount of upland and wetland vegetation can increase sedimentation in water bodies. This vegetation filters particles out of surface water as it flows toward ponds, lakes, streams, and rivers. Heavy sediment particles settle to the bottom of these aquatic environments; decrease water depth, and can cover eggs of aquatic organisms. Lighter clay particles are suspended in the water column for long periods and can reduce light penetration to aquatic plants and diminish visibility for wading birds and predatory fish. Cattle that have direct access to aquatic systems also can cause suspension of clay particles, alter the substrate, forage on emergent vegetation, and trample on aquatic organisms' eggs and vegetation. Bue et al. (1952) found that grazing intensity was inversely related to pairs of breeding waterfowl and use of shorelines by broods in South Dakota isolated ponds. These authors recommended a stocking rate of 27 acres per cow per year and fencing out a portion of the pond shorelines.

Increased nitrification also can result in situations where cattle have free access to or occupy areas close to aquatic systems. For example, oligotrophic lakes in nutrient poor areas may be converted into eutrophic systems with an entirely different species composition. After a review of the literature, May and Davis (1982) concluded there is little question that overgrazing and excessive livestock use of streamside areas can exert negative influences on stream ecosystems. They added that these influences can be minimized with proper planning and controlled livestock use.

Tame (improved) pastures are developed to provide forages of heightened production potential and nutritive quality. This development requires removal of existing native vegetation, ditching for drainage on occasion, and planting of an improved (often exotic) forage species. Impacts of pasture development on resident wildlife populations will depend on the type of natural habitat that was converted. The greater the original amount of vegetation structure, the greater the impacts. Also, the size and shape of pastures will influence their use by wildlife. Figures 9-14 show that a large percentage of wildlife species in the Green Swamp communities are dependent on trees canopies and tree boles for feeding or nesting. Most of these species would be displaced in favor of grassland-associated wildlife species upon conversion to tame pasture. No data were found that compares wildlife use between improved pastures and native prairies. However, it is our opinion that the greater vegetation diversity in native prairies would harbor a greater variety of wildlife.

Ditching and lowering of the water table eliminates or at least reduces the amount of water in sloughs and isolated wetlands that may contain water only during periods of high rainfall. These ephemeral wetlands are important for many wildlife species.

Pasture develop causes fragmentation of the original plant and wildlife communities; the effects of which are only beginning to be studied. Creating edges potentially has as many negative as positive effects depending on the species of wildlife in question.

Given that cattle, buffalo, and bison have been a natural part of forest and grassland ecosystems for millennia, it is only natural and proper that they interact with and impact other species of animals, plants and soil. Domestication and the resulting herd management practices that were developed, however, have altered the original relationships that cattle once had with its environment. We have attempted to describe the basic direct impacts that cattle have on environment in terms of defoliation of plants, walking about the earth's surface, and competition with other herbivores; and the impact of common cattle management practices used on many ranches today. An overriding relationship became evident after reviewing the research that has been conducted on cattle-wildlife interactions: as the level of intensity in management of either the defoliation process (from light to moderate to over grazing) or the manipulation of the forage resource (form prescribed fire to mechanical roller chopping to tame pasture conversion) increases, the greater is the potential for negative impacts on wildlife to result. Tradeoffs among wildlife species often occur in response to intensification of cattle grazing and its management as well, i.e., as one species is negatively impacted another species is positively affected.

Another important fact that must be realized when considering cattle-wildlife interactions is that no ranch, regardless of size, is an island unto itself, especially in Florida. Off-site, as well as on-site, impacts occur. For example, activities on any parcel of land may impact downstream water dynamics, amount of suitable habitat for far-ranging species, or migration patterns of neotropical and temperate birds. Acceptable negative impacts to the specific site and surrounding landscape depends on predetermined goals.

Silviculture: Alteration or manipulation of vegetation in any area will impact wildlife species living there. Some animals will benefit by these changes and others will lose life sustaining requirements. Removing trees will enhance the landscape for wildlife that prefer early succession, open habitats. Such areas will become unsuitable for species that depend on mature trees for food and cover.

During a 15 year study of wildlife responses to even-aged silvicultural practices in Alabama, potential food availability was highest for deer, turkey and quail during years 3 and 4 of the study (Johnson 1986). Use generally increased for deer, however, their overall physical condition decreased following crown closure. Use decreased for quail, squirrels, raccoons and opossums while turkey and rabbit usage was generally stable. No data was collected on other species. Bird and small mammal abundance and diversity was greater in a mature longleaf pine stand than in nine-year-old slash pine plantations Harris et al. (1975).

Of 55 amphibian, reptile and mammal species observed in Douglas-fir forests in northwestern California, nine species were strongly associated with older stands and 11 species were strongly associated with younger stands (Raphael 1988). Assuming that current forestry practices would continue, the overall estimated trend is for increased abundance among species associated with open, drier habitats, and decreased abundance among species associated with moist, old-age coniferous forests. Most of the increasers are widespread species with large distributions. In contrast, the decreasers are almost all species with rather restricted total ranges, most of which are in threatened habitats.

Following harvest in flatwoods stands in north Florida, bird use shifted from being evenly dispersed to concentrating in cypress domes and edges of stands (Marion and O'Meara 1982). Amphibian and reptiles abundance post harvest was only half of that recorded in pre-harvest areas. Even selective logging can alter wildlife species composition. Red-tailed hawks were able to displace red-shouldered hawks from mature forests with crown closure < 79% (Bryant 1986).

Clearcutting in mixed oak stands in Virginia initially reduced breeding bird species diversity and abundance (Conner and Adkisson 1975). This management practice also altered species composition. Although clearcutting in north Florida flatwoods did not affect amphibian species richness, reptile richness was lower in the maximum-treatment clearcut, amphibian abundance was reduced, reptile abundance was reduced, and species composition was altered (Enge and Marion 1986).

Reported average ages of cavity trees for the endangered red-cockaded woodpecker range from 63-176 years for longleaf pine and 70-76 years for slash pine (U.S. Fish and Wildlife Service 1985).
Timber harvesting stops natural succession of aging forests. This results in forest landscapes dominated by relatively young, even-aged stands. These young forests lack the structural and functional diversity of older forests. These managed forest landscapes may be ecologically inadequate to ensure long-term forest productivity (Maser and Trappe 1984, Spies and Franklin 1988) and the perpetuation of the full array of wildlife populations (Norse et al. 1986). Many species of wildlife including flying squirrels, several species of bats, pileated woodpecker, red-cockaded woodpecker, a variety of cavity-nesting birds, and several species of amphibians are dependent on old, mature forests. Extinction of the ivory-billed woodpecker (Campehilus principais) in the United States and the endangered status of the red-cockaded woodpecker are associated with the loss of old forests (Thomas et al. 1988). Some of the forested area in the Green Swamp should be allowed to mature naturally so it can maintain some semblance of natural biotic diversity and ecosystem function.

Mining: Time constraints of this project did not allow for a literature review of the relationships between mining activities and wildlife. Much of the work on mining impacts has focused on restoration of mined areas to eventually provide some habitat value to the lands after they are mined. Mining activities usually alter the species composition of the original area. Because of the nature of the mining operations, most of the reclaimed areas are not actually "restored" to the original vegetation type and landscape design. Large lakes are created in areas that naturally supported a diverse wetland system of sloughs, creeks, and large, small, and ephemeral wetlands. Large lakes obviously provide quality habitat for species that are adapted to these systems. Maehr (1981) reported that many bird species, unusual in their presence or abundance in natural flatwoods communities in north-central Florida, were attracted to new aquatic habitats created by phosphate mining. However, lakes do not satisfy the needs of species that require a more diverse landscape.

Development: The Green Swamp is located between three of the fastest growing regions in the state, Orlando, Tamp and the Lakeland-Winter Haven area. The Disney complex is less than 5 miles from this area and has generated an explosion of development activity extending outward from Orlando. The Green Swamp has not been severally impacted by development yet, but is in jeopardy simply because of its location.

A few studies have shown how habitat quality is diminished through development. The only known investigation of urban birds in the southeastern United States was conducted in Pinellas County residential suburbs (Woolfenden and Rohwer 1969). They found that many native species were replaced by exotics when natural areas were developed and breeding pair densities increased with the maturing of the planted vegetation. Similar results were reached by Tweit and Tweit (1986) in Tucson, Arizona and Vale and Vale (1976) near Oakland, California. Some authors have reported that insectivorous birds declined, and omnivorous and grainivorous species increased as residential suburbs were built into naturally forested landscapes (Beissinger and Osborne 1982, DeGraaf and Wentworth 1981). DeGraaf (1986) and (1987) also noted that insectivorous birds were more prevalent near urban woodlots in Massachusetts. Beissinger and Osborne (1982), Goldstein et al. (1986), and DeGraaf and Wentworth (1986) described relationships between vegetation volume in residential areas and bird species richness, and recommended extensive landscaping with native plants and retaining sizeable natural forest patches. Goldstein et al. (1983) examined some of the trade-offs among wildlife, visual, and recreational amenities associated with different arrangements of a given amount of greenspace and encouraged preserving large forested clumps instead of thin borders.

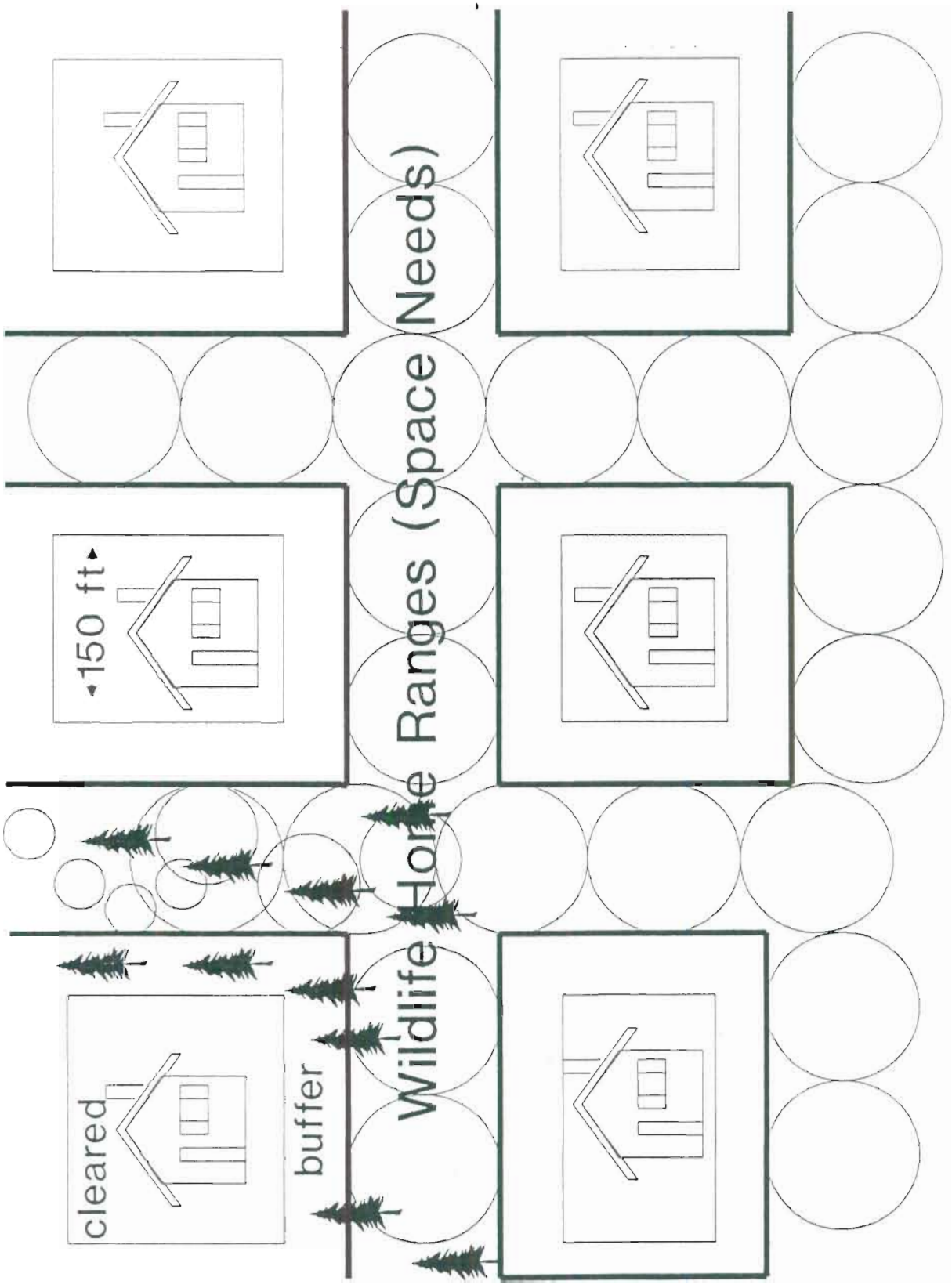
Golf courses are popular and important components of many residential development projects in Florida. Typically these elements are located close to natural landscape features such as water bodies that will enhance the recreational experience of golfers. Although we could find no data supporting the theory that golf courses have relatively little impact on natural systems or actually provide good habitat for wildlife, allowances are often provided for creating golf courses in areas where residential housing is not permitted. Two areas of potential impact that seem to be inadequately studied are chemical use and habitat alteration. Scientists at the College of Veterinary Medicine at the University of Florida have recently found that eutrophic retention ponds in developed areas had extremely high populations of Eustrongylides ignotus, a small parasitic worm that infects fish and wading birds (Pers. comm. Drs. Spaulding and Forrester). These researchers discovered that almost 100% mortality in nestling wading birds feed infected fish. This resulted in zero reproduction for colonies that fed in these ponds. There are many other contaminants and resultant conditions of aquatic environments and food chains based in these systems that could impact many wildlife species. The example of the parasitic infection of wading birds emphasizes the complexity of these systems. This problem obviously has been occurring for some time, but was discovered only recently. We cannot assume that because adverse impacts of activities have not been identified that they do not actually occur. Golf course construction converts large acreages of natural vegetation into manicured freeways with sometimes thin strips of natural vegetation in-between. The habitat values of this design are drastically different than the natural landscape. For example, lack of vegetation in the shallow areas and on the shorelines of lakes excludes use of this area by frogs, birds and a whole food chain that depend on this vegetation for food and cover.

Control of housing density seems to be a tool frequently used to minimize adverse impacts of development on wildlife habitat. Without any data upon which to make these decisions, low densities such as 1 unit per 5 acres are assumed to satisfy natural systems protection goals. An aerial survey of developed areas in and surrounding the Green Swamp provides a excellent illustration of the extent of habitat alteration that can occur on a 5 acre plot if there are no restrictions on vegetation manipulation within each plot.

One approach to evaluate the impacts of various densities on wildlife involves using spatial information (Figure 2-10) to determine which species can be accommodated in the corridors created between cleared areas (Figure 2-18). Buffer strips of natural vegetation immediately adjacent to each cleared lot are considered poor quality habitat because of the negative edge effects and disturbances received from the open canopy, developed area. The relatively in disturbed, interior corridors between houses can provide space needs for some wildlife species. Assuming cleared areas of 150 feet x 150 feet for each lot with 300 foot wide buffer strips, the core space between houses and the corresponding species richness that have space needs less than the core width can be calculated (Figure 2-19). For example, at a density

of one 1 unit per 20 acres, the usable space between houses (from buffer to buffer is about 300 feet which is wide enough to accommodate 55% of the species home range diameters. Approximately 78% of the species spatial needs will be provided in corridors produced with a density of 1 unit per 100 acres. After a density level is decided, strategies should be developed to address the spatia; requirements that cannot be accommodated within the relatively narrow corridors between houses. Several species with large range needs have special legal and ecological importance such as being threatened, endangered and endemic species.

FIGURE 2-19



Densities and Species Richness

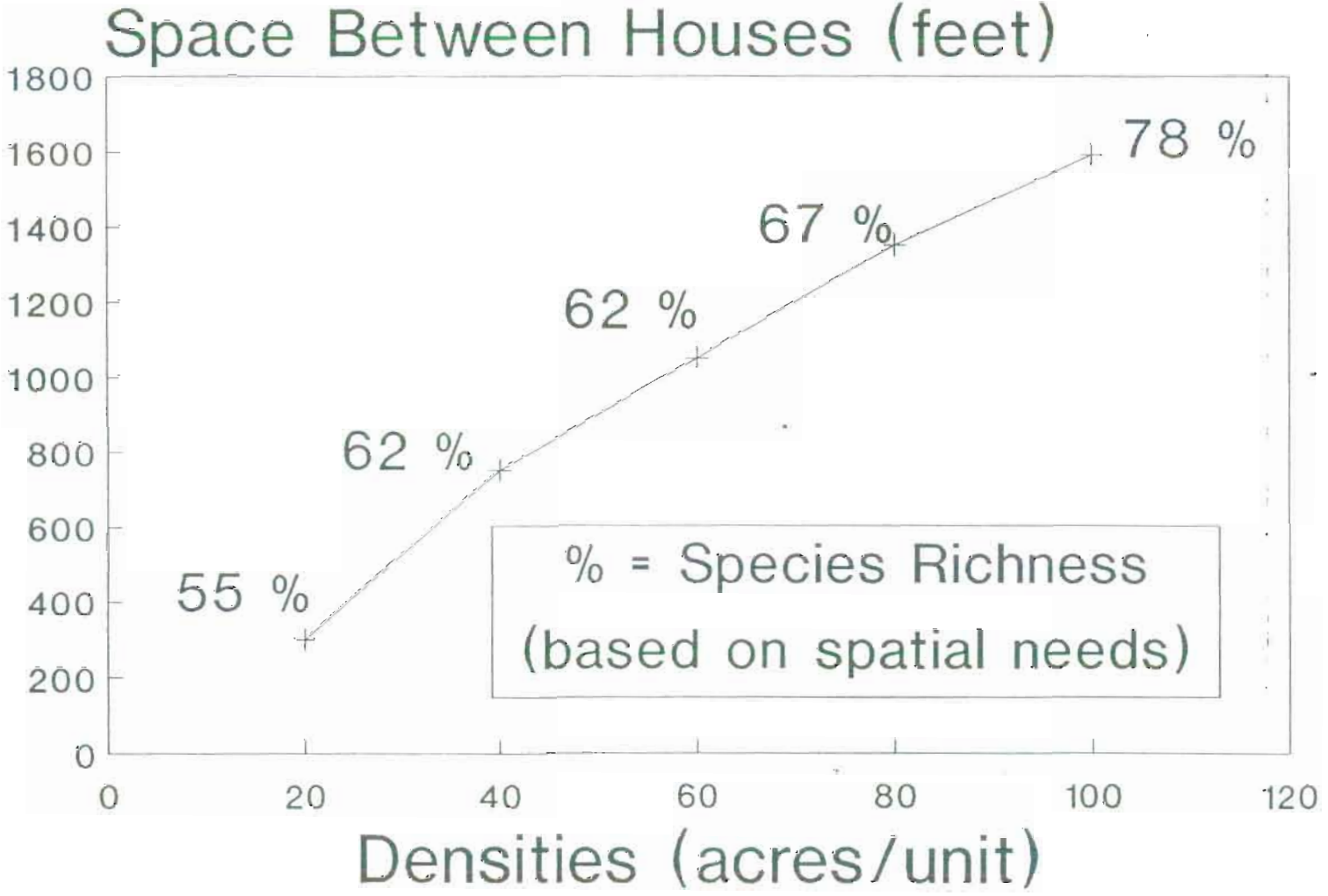


FIGURE 2-20

ACQUISITION - WHERE

Florida is a land of irreplaceable natural resources. From the wild lands and rivers of the Panhandle through the Green Swamp, to the coastal islands and estuaries of south Florida and the Keys, our state is blessed with diverse native habitats that support a wide variety of temperate and tropical flora and fauna. Florida is a state that is a vital link in the migratory path of many species.

But the state's natural heritage, the very feature responsible for Florida's explosive growth and resultant economic health, is clearly showing signs of degradation due to growth. Vital fish and wildlife breeding sites and migratory routes are being eliminated or altered, interior and coastal waters are being degraded, and once extensive and well functioning native ecosystems are being reduced in acreage and fragmented by coalescing urban centers and modern agricultural development.

Protection of Florida's natural heritage is important not only for the sake of our native plants and animals and for clean water and air; it is also important to current and future inhabitants. The state's natural resources are the basis for our quality of life, providing recreational opportunities and an overall sense of community. Unfortunately, the natural resources which drew Florida's citizens here in the first place are being altered at an alarming rate. And our residents' ties to and knowledge of their natural heritage are being lost in the process. Two alternative futures are clear.

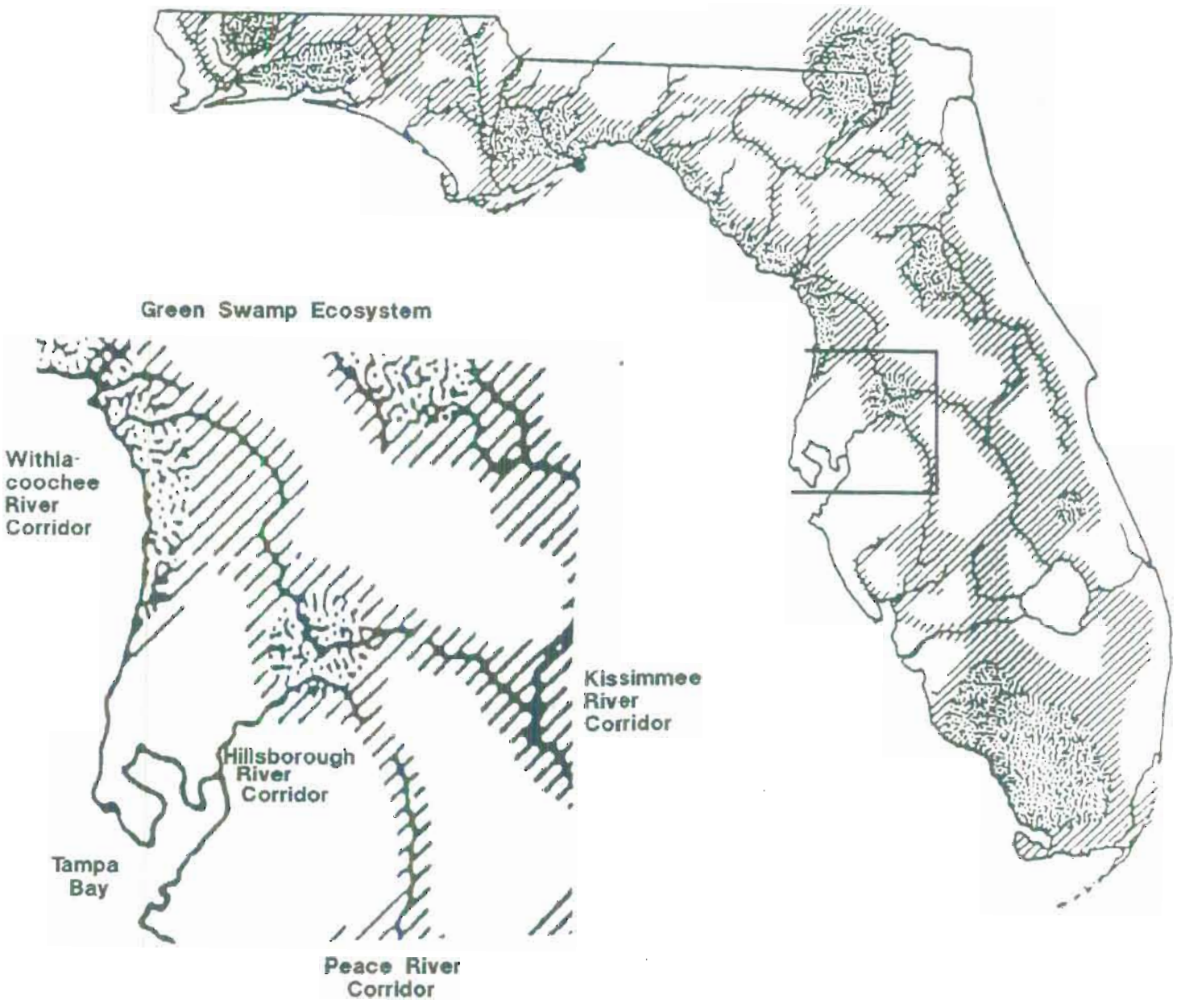
One is a future in which the status quo is maintained, where urban areas continue to sprawl across the countryside and coalesce to form giant metropolitan areas typical of the Washington D.C. to Boston megalopolis. In this future, Florida's wildlands and rural landscapes are further reduced and isolated, cutting off vital linkages between both natural systems and between people and the natural environments that drew them here in the first place.

In the alternative future, a concerted effort is made to maintain a balance and blend of the three landscapes key to human existence: wildlands, representing fundamental ties to nature; pastoral rural and agricultural lands, representing human partnerships with nature; and urban lands, focusing on kinship to other people. In this future, vital natural and human linkages are maintained. Rather than further coalescence of cities and increased isolation of wildlands, a good blend of all three landscape components remain.

Scientists and growth management professional across the state believe that a concerted effort is needed to promote the assembly of statewide, regional, and local networks of linked natural areas and other open spaces that are protected for conservation and compatible recreation activities and managed for the benefit of Florida's wildlife, its environments, and its citizens. Many feel that the assembly of a statewide network can help us reach Florida's desired future. Through the process of planning and implementing green networks at the local, regional, and statewide level, Florida's land acquisition and growth management programs can be enhanced and their integration improved. The creation of these networks will: (1) provide a spatial framework for regional and local conservation and recreation planning activities; (2) help focus and coordinate diverse public and private activities; and (3) help prevent coalescence of urban areas. Through the Growth Management process, of which the Green Swamp Task Force is a part of, communities will be able to determine and work toward their desired blend of wild, rural, and urban landscapes.

Throughout 1991 many meetings and workshops were held throughout the state involving public agencies, private citizens, and non-profit conservation organizations to discuss a statewide habitat network. Part of this on-going process was a three day workshop at the University of Florida in March of 1992 called " Corridors, Greenways & Landscape Linkages: From Concept to Reality. This workshop brought together many of the groups that had been working throughout the sate and Map 2-8 was used at that meeting. An enlargement of the Green Swamp area is provided within that map.

State of Florida
Wildlife Corridor Concept



Source: Fl. Defenders of the Environment & University of Florida Corridor Workshop, March 1992.

As envisioned, the statewide network has two components: large habitat areas, the hubs or anchors in the network, and corridors, that link natural areas. These may then be connected to man-made features and establish a tie between the city and country. The Green Swamp bioreserve is an example of one of these hubs or anchors, the corridors as shown on the Core Map, are the major corridors that will link the Green swamp to other large areas of habitat. Additional linkages, such as to the Peace River, should be considered as the planning process proceeds.

At least three distinct habitat levels exist: (1) large regional nature reserves or bioreserves, managed for preservation of entire natural systems and their functions; (2) urban and rural parks, geared toward natural resource conservation and public, nature-based recreation where compatible; and (3) habitat "islands" protected and managed for the maintenance of rare, unique and endangered species or communities, or for important physical attributes.

Wildlife corridors, are a key component of the statewide network. They provide the linkages and natural continuities, that hold the network together and allow it to function. Three different types of corridors or greenways can be envisioned in Florida: (1) extensive, rural conservation linkages, green swaths of nature delineated and managed for the protection of natural systems and biological diversity and for the maintenance of natural processes and the movement of wildlife; (2) more restricted, multifunctional, urban and suburban corridors that provide for habitat conservation and recreation; and (3) statewide, regional and local trail systems such as the Florida National Scenic Trail and the Department of Natural Resources' canoeing trails.

Significant regional hubs such as the Everglades/Big Cypress regional ecosystem, the Ocala National Forest and the Green Swamp are clearly visible on the map. Vital natural area linkages can also be noted along Florida's interior rivers, ridges and wetland systems as well as along the state's extensive coastline.

A number of existing and proposed Conservation and Recreation Lands (CARL) projects have been designed to protect entire wildlife habitat systems (e.g., Lake George and Wekiva-Ocala Connector) and to acquire extensive linear habitat features (e.g., Apalachicola River). Not only are regional Save Our River (SOR) projects important partners with statewide CARL efforts (e.g., Suwannee River), but numerous SOR-led projects are being undertaken on a system-wide, watershed basis (e.g., Corkscrew Regional Ecosystem Watershed). In addition to and often coordinated with statewide and regional efforts, local acquisition programs (e.g., Volusia, Palm Beach, and Hillsborough counties) are geared toward assembling and protecting county-wide wildlife preserve and corridor networks.

Work has also started at the regional and local levels to assess and plan for greenways and associated green networks. Planning for the Cross Florida Greenbelt State Conservation and Recreation Area, the only cross-state greenway mandated by Congress, is well underway. A management plan will go to the Governor and Cabinet in fall 1992 and the Legislature in 1993. The Cross Florida Greenbelt is to be assembled from old barge canal right-of-way lands.

The Green Swamp offers a unique opportunity to combine the hub and corridor concept. This effort is enhanced by the amount of land in the Green Swamp "core" that is already in public ownership and the foresight that the Polk County Board of Commissioners and their Green Swamp Task Force bring to the planning process of this bioreserve.

In March of 1992 the Department of Environmental Regulation (FDER) submitted an application to the CARL (Conservation and Recreational Lands) Program requesting that areas of the Green Swamp be considered for purchase as part of the state's acquisition program. This application received 6 out of 6 votes in the first round of selection review by the Land Acquisition Advisory Council (LAAC) in April of 1992. The application is now being analyzed by the Florida Natural Areas Inventory (FNAI) to establish a resource planning boundary. This assessment will be submitted to the LAAC for a second vote in

August of 1992. After review by the Department of Natural Resources (FDNR) staff and public hearings, LAAC will rank the state's purchase priorities in December of 1992.

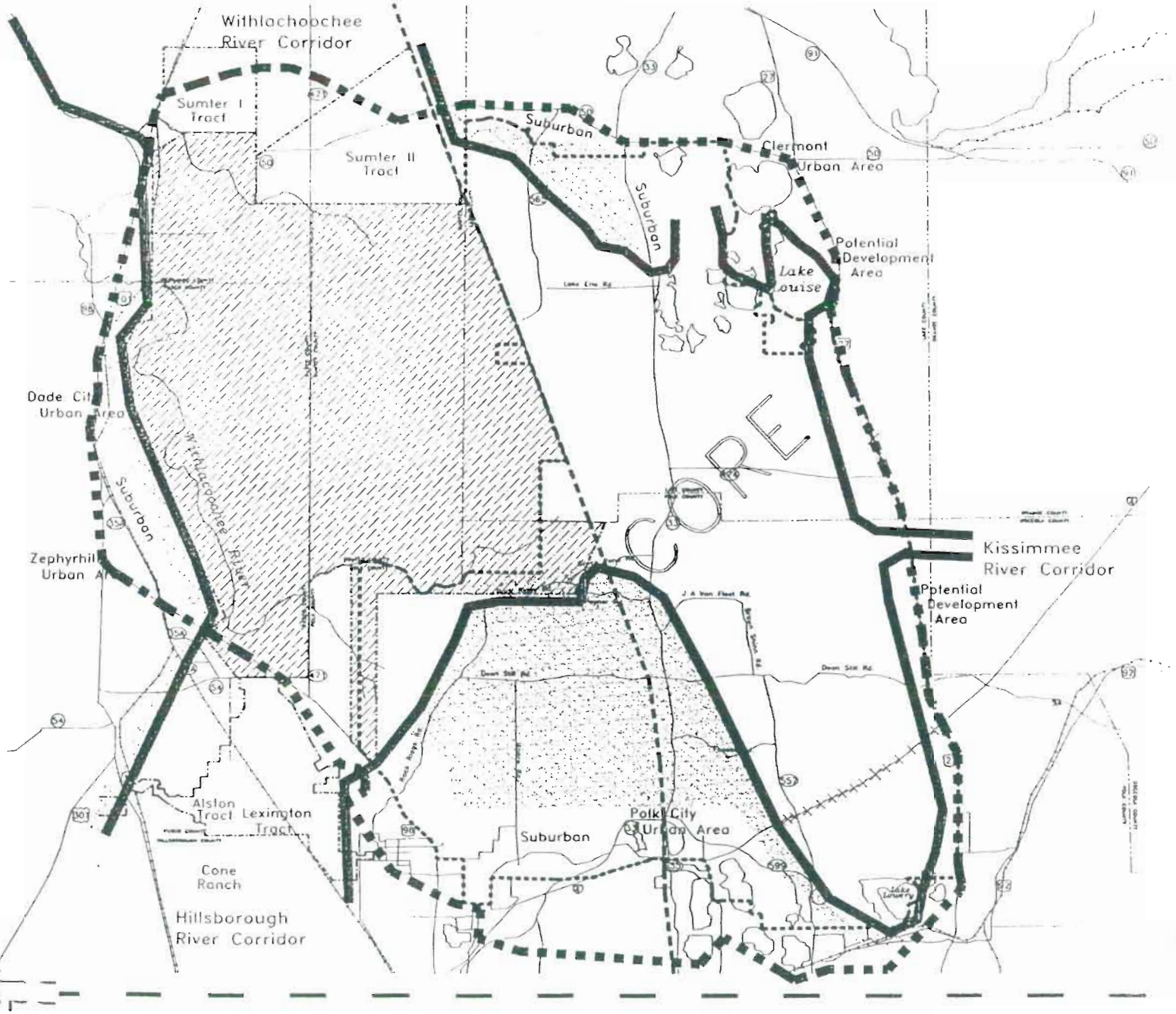
It is likely that as the Green Swamp CARL application proceeds through the review process, it will focus on increasing the public holdings in the Core Area as shown on Map 2-9. The Core Area was designated by the scientists involved in this report to:

- maintain a large portion of the area of the potentiometric high;
- protect the quality and quantity of the water associated with the five rivers of the Green Swamp, especially the Withlachoochee River, and their headwaters;
- protect an additional portion of the area where the Floridan Aquifer outcrops to ground surface;
- provide a mosaic of diverse habitats for wildlife as well as indicate wildlife corridors that will serve as linkages to large areas of existing habitat outside the area of the Green Swamp;
- recognize existing patterns of agriculture; and
- recognize existing and future growth areas of existing towns.

Also shown on Map 2-9 and Map 1-1 are parcels under consideration for purchase by the Save Our Rivers Program which is administered by the Water Management Districts. In this case the Southwest Florida Water Management District is review these parcels.

The value of Green Swamp cannot be adequately measured without examining its links or ties with Florida's other significant natural systems. The key links (or the spokes in the hub analogy) are the Lake Wales Ridge and the five rivers which radiate from the Swamp. The Withlacoochee River will flows west and north from the Swamp toward the Big Bend Gulf Coast with its miles of wilderness coastline. The Withlacoochee River also links the Green Swamp with the future Cross Florida Greenbelt and thus with the St. Johns River valley. The Hillsborough River flows west and south from the Swamp to the Tampa Bay estuary. The Hillsborough River is one of Tampa's primary sources of drinking water. The Oklawaha River flows north through its chain of lakes and wetlands before joining Silver River and one of the largest public reserves in the state, the Ocala National Forest. The Peace River flows south to the Charlotte Harbor and the southwest Florida Gulf Coast. A small tributary flows southeast toward the Kissimmee River basin which is a part of the Everglades System. The Lake Wales Ridge, which runs south into Highlands County, forms the eastern edge of the Green Swamp, is part of a significant wildlife corridor between the Swamp and the Kissimmee River basin via Davenport and Reedy Creek in Osceola County. This linkage is the most threatened because of intense development along the ridge and U.S. 27.

These linkages are the basis for Florida's network of habitats. The network originating in the Swamp is a ring of corridors with the major spoke being the Withlacoochee River which will link the Green swamp with the Cross Florida Greenbelt and the Oklawaha River. Together these form one of the state's largest and potentially most integrated habitat systems. The Peace River could connect the Green Swamp to Charlotte Harbor and the Caloosahatchee River, Lake Okeechobee, the Everglades and the Kissimmee River valley. These regional networks are further supplemented by greenway development efforts for Reedy Creek by the Disney Development Corporation; for Hillsborough River by Hillsborough County; for the Peace River by the Florida Game and Fresh Water Fish Commission; and for the Lake Wales Ridge by The Nature Conservancy and the U.S. Fish and Wildlife Service. The water management districts' land acquisition and river restoration efforts of the rivers flowing from the Green Swamp will also pay positive dividends for protecting these important linkages.


Withlachoochee River Corridor
Sumter I Tract
Sumter II Tract
Suburban
Clermont Urban Area
Suburban
Potential Development Area
Lake Louise
CORE
Dade City Urban Area
Withlacoochee River
Suburban
Zephyrhills Urban Area
Kissimmee River Corridor
Potential Development Area
Alston Tract
Lexington Tract
Suburban
Polk City Urban Area
Cone Ranch
Hillsborough River Corridor
Green Swamp Core Area
Legend
Public Owned Lands
Core Boundary
Area of Critical State Concern
Hydrologic Boundary
Culverts
Agriculture Areas
SCALE IN MILES
May, 1992

Green Swamp Wildlife Corridors

A wildlife corridor is a band of vegetation that differs from the surrounding environment (Forman and Godron 1986). Corridor dimensions are based more on function than on specific boundaries where adjacent vegetation types interface. The ability of a corridor to furnish some continuity in feeding and nesting habitats for terrestrial wildlife is usually directly related to its width. Although no formulae have been developed for determining corridor dimensions that will effectively provide wildlife requirements, corridor widths should analyze the home range diameter for a species (See Figures 2-10 through 2-12) and the movement range of species. Home range diameter should be used unless proven otherwise.

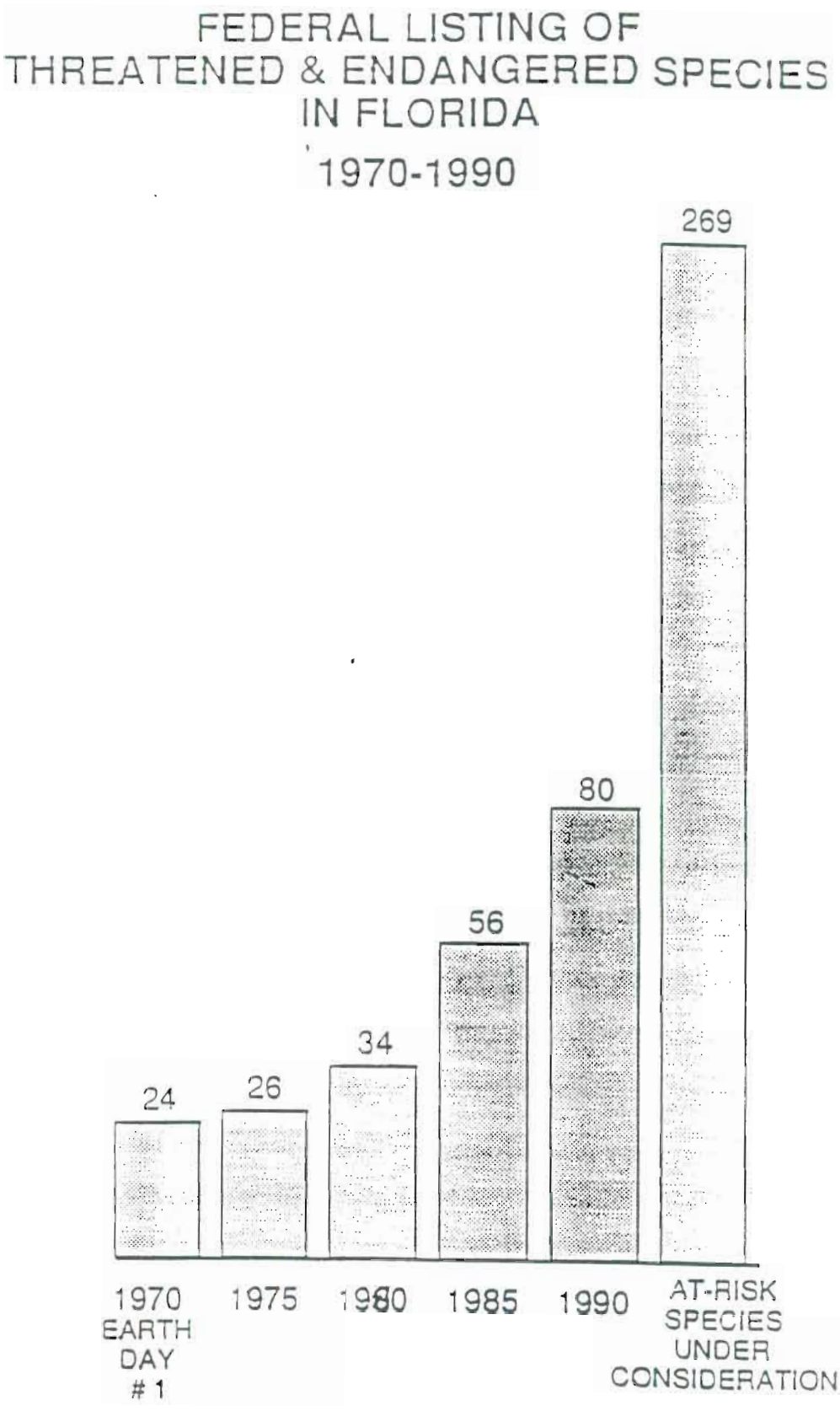
When Desoto marched through the Green Swamp area Florida possessed eleven species of native mammal larger than ten pounds in weight. Of these eleven, three are now locally or globally extinct (Monk seal, red wolf, bison), three are Federally listed as endangered (FL panther, manatee, and Key deer), three are listed as Threatened by either the state of Florida or the International Convention on Trade in Endangered Species (CITES). Only two, the white-tailed deer and the raccoon are doing well. About a dozen of Florida's terrestrial vertebrate species have been extirpated during the last 500 years.

Some would argue that it was our forefathers whose unwise actions cleared the great forests of longleaf pine and cypress and extirpated all the species such as the red wolf, ivory-billed woodpecker, and Carolina parakeet. As damaging as those activities were, they pale by comparison to today's human impact. Consider that ten species were lost during nearly 500 years of history, that averages out to a species every fifty years. Today's rate of "listing" and extermination is much greater than this (Figure 2-19). Also consider that most of the species were lost prior to development of conservation philosophy or agency programming. Compare this to the rate of loss today, a time when many agencies and non-governmental organizations are working feverishly to forestall further losses.

In a former time when much of Florida was wild and when it was official government policy to exterminate large predators such as panthers, decades of open hunting and bounty incentives failed to achieve the goal. Today, when so little of Florida is wild, it remains to be seen if even the most aggressive conservation programs can save the species. Clearly, the challenge exists.

Previous sections of this report document the vegetation and wildlife associations that are likely to occur within the confines of the Green Swamp area. These works represent building blocks that are necessary for any regional conservation plan; necessary but not sufficient. The rapid rate of demise of the Florida black bear in the Green Swamp area suggests that as development continues to encroach and fragment the habitat into disjunct pieces, no area will support a viable population of these or other large mammals species. Landscape linkages or habitat corridors that interconnect the already established conservation areas will be necessary in order to save Florida's remaining large mammals and/or provide any hope for reestablishing native species such as the red wolf.

Figure 2- 21 Endangered Species



In the absence of an integrated statewide habitat system, the fauna and flora that were characteristic of pre-settlement Florida became endangered while common species continue their increase (source: U. S. Fish and Wildlife Service).

Field investigations during the course of this study focused on identification of habitat linkages that could be acquired by fee-simple, by easement, or other means in an effort to interconnect the Green Swamp system with surrounding large conservation areas or major conservation corridors. Because of the powerful protections already afforded to wetlands, it seems logical that conservation corridors that occur along wetlands will seem least obtrusive and most likely to succeed in the long term. Thus, for the most part, the habitat linkages identified follow wetlands as closely as possible.

Direct habitat linkages into the major drainage areas are identified. In certain cases, little land acquisition may be necessary while in at least one case, an upland acquisition is proposed. The five river systems to which the Green Swamp should be directly and physically interconnected are the Hillsborough and Withlacoochee to the west, the Peace River and the Reedy Creek–Kissimmee River System to the south, and the Oklawaha to the northeast.

Because the Hillsborough River linkage is so obvious and because the wisdom and logistic details of making this linkage are already proceeding, it will not be treated any further here. The remaining four river system linkages are treated in the order presented.

The Withlacoochee River Linkage

Because of the direct manner in which the water and the stream channel of the Withlacoochee interconnect the Green Swamp with the Gulf Coast at Yankeetown, the most appropriate linkage may seem self-evident. There are certain bottlenecks, however, that make a total reliance on this system tenuous.

In the first place, the present regime of regulated water flow does not allow for natural hydroperiod fluctuations. This means that the native fauna can not and does not have full opportunity to move up and down the river course during flood stage, a time when flooding triggers the dispersal movement of aquatic species. Similarly, native plant species that are water dispersed are hampered because their fruits and seeds that fall on the floodplain floor away from the channel are not picked up and carried by the current. In the absence of the natural hydroperiod, native vegetation associations delimited by floods are either blurred or totally lost. This also affects the occurrence and dispersal of animals.

Perhaps more important than all the above, in the absence of a natural flooding regime, human settlement encroaches overly close to the river channel and the combination of structures such as piers, weirs, docks, bridge abutments, boat houses, and chain link fences may totally impede the movement of native fauna and flora along the river course.

A natural hydroperiod regime should be re-established on the Withlacoochee River in order to restore the natural 50-year floodplain. An upland linkage in the area of the Ridge Manor subdivision in the northwest corner of the Green Swamp is necessary. At this location, the bulk of the floodplain lies to the north of the river and logic would have it that this is where the habitat corridor should be located. However, human development is intense there, and it seems that an upland corridor to the south of the subdivision is much more feasible.

The fact that the Withlacoochee State Forest occurs as three disjunct tracts represents a prime example of imprudent conservation programming. This is especially true for native fauna. Not only are none of the three tracts large enough to support a viable population of black bears or panthers in and of themselves, the lack of a continuous holding and the existence of intervening human settlement increases management difficulty and cost. How much easier and cheaper would it be to implement badly needed management such as prescribed burning if a large contiguous tract were created? An aggressive acquisition initiative aimed at interconnecting the three disjunct tracts of the Withlacoochee State Forest

must be given one of the highest priorities if ever a viable population of black bears and other large mammals are to be re-established in the Green Swamp area.

The prospect of interconnecting the Withlacoochee basin with the Half Moon Ranch and the Ross Prairie section of the Cross-Florida Greenbelt park offers very high promise. Not only do very short distances exist between the existing series of natural areas that run due northward from Hernando to Marion counties, several of the intervening areas are already listed as category five, high priority acquisitions on the Southwest Florida WMD SOR/P-2000 five year plan. Acquisition of a north-south habitat linkage that would interconnect the Croom section of the Withlacoochee State Forest with the Cross-Florida Greenbelt in southern Marion County should be pursued.

The Peace River Linkage

Flowing due south from the Green Swamp, the Peace River represents a major linkage opportunity that can be accomplished with modest planning and action. First, restoration and creation of a continuous riverine corridor is already being pursued as a joint venture of the Florida Game and Fish Commission and cooperating phosphate corporations. Second, with only minor road modifications to Interstate 4, and a very small amount of habitat acquisition, a continuous and functioning riverine corridor could be created.

The importance of modifying Interstate 4 to facilitate the north-south movement of fauna and flora can not be over emphasized. Given the current density of traffic on I-4, and the rate of strip development that is occurring along it, this major east-west thoroughfare stands to become one of the truly great biological barriers separating the entire southern half of the Florida peninsula from the north. Unless movement of native fauna and flora is facilitated beneath this roadway, the consequences will be devastating to scores of species.

Simultaneous with the establishment of movement underpasses beneath I-4, habitat lying south of I-4 and extending to the Teneroc property could be acquired. Other possible connections in this area should be pursued.

East - West Linkage of Green Swamp with the Reedy Creek and Kissimme River System

Plans and current efforts to restore natural drainage of the Kissimmee River represents one of the most progressive environmental restoration projects in North America today. When conserved and restored, the Kissimmee River will once again function as the principal north-south corridor for movement of fauna and flora of the Everglades region. Movement opportunities from the Kissimmee northward into Reedy Creek will continue to exist. Davenport Creek, lying immediately east of the Lake Wales scarp in intimately associated with Reedy Creek and thus the Kissimmee farther to the south.

Because of the close geographical location between Davenport Creek on the east side of U.S. 27, and Green Swamp to the west, a continuous habitat connection that links the two major swamp systems must be designated and protected. An east-west strip of native high pine/scrub and abandoned or decadent citrus with dimensions of about three miles long and one mile wide can be created with modest cost or imposition. An ideal landscape location for such an east-west corridor occurs about one mile south of U.S. Highway 192. Such a strip will include the southern shore of Lake Davenport.

In order to ensconce the Davenport Creek-to-Reedy Creek linkage, one or more underpasses beneath Interstate 4 will need to be constructed. The strip of land lying between the two parallel east-west roads, SR 532 and SR 54 seems ideal for the facilitation of linkage. A strip of habitat that continues southeastward from this point on I-4 to Reedy Creek should be acquired.

Analysis of natural vegetation and topographic maps revealed that another linkage from the north-east corner of the Green Swamp eastward into the Lake Okahumpa--Lake Denham--Lake Harris--Lake Apopka chain is also important. Preliminary analysis suggests that this linkage should occupy the land occurring between the Sunshine State Parkway and SR 44 running west from Leesburg. This east-west linkage would be located about 30 miles north of the Davenport Creek linkage.

Green Swamp - Oklawaha River System Linkage

Palatlakaha Creek runs from the Lake Panasoffkee region of the Green Swamp in a east-northeast direction crossing beneath the Sunshine State Parkway and then into the Oklawaha River system. Because there is currently much emphasis being placed upon restoration of the Oklawaha River and creation of the Cross-Florida Greenbelt Park and Conservation Area, this linkage from the Greenswamp to the Oklawaha seems desirable and important.

It is highly recommended that a wildlife corridor--greenbelt conservation area be established in order to connect this major west-central resource area (the Greenswamp) with the Oklawaha basin.

MANAGEMENT PLAN

A management and protection plan that will effectively preserve the wildlife integrity of the Green Swamp should address the following issues: habitat fragmentation, decrease in overall landscape diversity, reduction in habitat quality, impacts of adjacent land use, impacts of public recreation, impacts of cattle grazing, and impacts of silviculture. Until a plan is formalized and a preservation area delineated, a moratorium on land uses that may adversely affect wildlife viability in the Swamp would assure that remaining critical habitat areas will not be lost.

Many of the habitats in the Swamp already have been fragmented or reduced in size. Roads and several other land uses are interfering with wildlife movements. The corridor linkages to other important habitats have been partially severed and constricted. Important wildlife habitat areas need to be delineated and protected from the adverse impacts of future development and other land uses. A broad, holistic perspective is more biologically sound and provides greater access to a diversity of habitats than a site by site approach. The most serious problem confronting Florida's wildlife is fragmentation of natural habitat areas into small, isolated parcels that are not large enough to sustain viable populations. Growth management decisions must focus on maintaining the biotic integrity of systems by designing areas that will perpetuate functional communities and not merely token remnants.

Management concerns should not be directed only toward endangered plants and animals. This approach has been proven to only help maintain species at endangered levels and not to recover species from endangered status. Many other species not legally listed as threatened or endangered are in just as much jeopardy of extinction as listed species and continue suffer from lack of consideration. Buffers for wildlife should be incorporated into all wetland systems. This will provide travel corridors for some animals and also protect valuable habitat resources.

A primary objective for any public lands in this area should be the protection of the natural integrity of the Swamp. Park development and accompanying human activities should be prohibited unless scientific evidence supports such decisions. Studies reviewed in this report suggested that outdoor, nonconsumptive recreation can be detrimental to wildlife if people are not properly managed. (Figure 2-20)

The short time frame for this study did not allow a thorough assessment of the wildlife resources in the Swamp. The most accurate method of determining current baseline data on wildlife species would be through systematic species' surveys. The need for this is exemplified by the fact that very few of the listed species that are assumed to occur in the Swamp have been documented. The cursory surveys that are conducted during DRI proposal preparation would be unlikely to document inconspicuous species such as the gopher frog and indigo snake. A systematic survey schedule for all classes of wildlife in different community types would take at least one year. Data obtained from these surveys would greatly reduce the assumptions upon which decisions determining the fate of the Green Swamp's wildlife resources will be based.

The impacts of recreation on wildlife are not generally recognized. More specific information on the effects of various recreational activities on wildlife are needed to provide the basis of prudent multiple use decisions. Several studies have documented flushing distances of visible wildlife in open habitats. But very little is known about the effects of development and use of passive recreational facilities on wildlife that are not as obvious in a forested environment. An ideal study design to investigate this relationship would include collecting baseline data on 1) independent variables such as habitat characteristics and human activities, and 2) wildlife species composition, diversity, and density prior to park development. Periodic follow-ups will reveal any relationships between changes in the independent and dependent variables. Specific wildlife habitat values of small "Conservation Areas" on development sites is unknown. A study designed to determine the benefits of various set asides would help developers and development

review teams to plan more efficient uses of land. This could be accomplished by comparing wildlife survey data obtained in various set asides with independent set aside variables such size, habitat type, insularity, and quality of adjacent areas.

Highways and roads are major obstacles to wildlife movement and are primary causes of mortality for some species. The construction of underpasses has been proposed many times as a method to reduce these problems. However, no studies have determined the effectiveness of various underpass designs. This could be investigated by selecting several types of underpasses and conducting wildlife surveys at the highway underpasses. The different types of underpass designs could be analyzed as separate treatments in an analysis of the data.

Several gaps in information need to be addressed. Important foraging and nesting areas should be monitored to determine patterns of use so that effective protection and management plans can be developed. Impacts of different levels of off-site land uses off-site need to be determined to provide the basis for BMPs. An integrated approach of acquisition, regulation, community education, and land owner ethics will assure the perpetuation of
the natural heritage of the Green Swamp.

Setting Goals

The first and essential step in developing a management and protection plan for wildlife is to determine the purpose of the management activities. A variety of political units such as the Florida Department of Community Affairs, various counties, regional planning councils, and regulatory agencies such as water management districts have the responsibility of determining the future of natural systems in the Green Swamp. To be effective in this regard, clear goals are necessary. Goal statements of this plan should be specific and include criteria for objectively measuring or evaluating success. A goal such as "to protect wildlife habitat" is too vague to provide a solid basis upon which to build a logical, scientifically-sound approach, and to allow objective evaluation. A more meaningful and responsible goal would be "to maintain native wildlife richness." Within this goal, criteria for measuring success could be specified; for example, the presence of a full complement of species or indicator species at 5-year intervals. Lesser goals will fall short of preserving the natural integrity or function of the system. Agencies with statutory authorization limited to wetland systems might establish a goal "to maintain viable populations of all wetland-dependent species."

Because wildlife is a mobile resource, it is not feasible to maintain viable populations on every acre in this diverse system. A plan that will effectively preserve the natural integrity of the Green Swamp should be focused on the entire swamp and surrounding areas and not at a smaller scale. Goals need to be related to environmental systems and not restricted to individual parcels of property within the system. Setting aside small, token habitats on specific sites will not adequately protect a resource that moves throughout and requires an entire landscape. Protected habitats must be part of larger, planned conservation reserves.

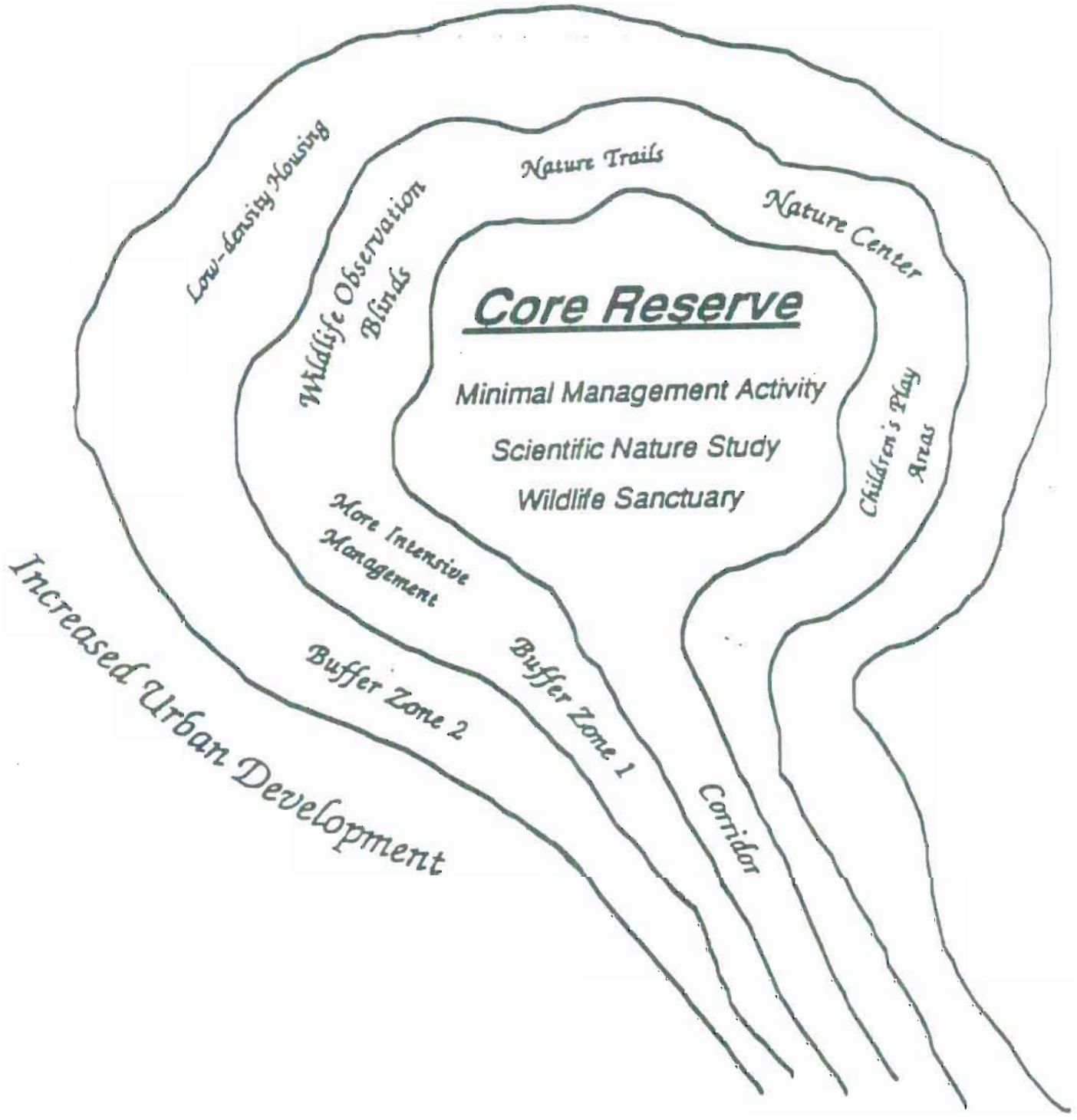
The ideal strategy that would provide the quality and quantity of environmental conditions necessary for perpetuation of wildlife resources and natural systems and also incorporate the needs of other land uses that may detrimentally impact these resources is to establish boundaries for 1) a Core Area, 2) corridors that connect this area to off-site wildlife areas, and 3) multiple use lands outside of the Core Area (Map 2-8).

Wildlife Preservation Area

The most important component of a wildlife management and protection plan for the Green Swamp is to maintain a large contiguous area of the most important habitats within this system in as much of a natural

condition as possible. The designated preservation area should be large enough to support viable populations of far ranging species such as the black bear. Within this area, certain management practices will be necessary to maintain vegetation communities at the desired successional stage that will preserve the natural biological diversity of this system. These methods should be implemented by trying to simulate natural dynamics of these systems. For example, fires caused by lightening strikes historically controlled the encroachment of hardwoods into pine flatwoods and helped to naturally maintain the diversity and openness of scrub communities. However, periodic wild fires now are prevented from spreading across the landscape and providing these functions because of the many human-made fire barriers that currently exist. To maintain the integrity of these systems we must replace some of their natural dynamics. Creating artificial landscape elements such as food plots for game species should not be practiced in the wildlife preservation area. Acquisition for these purposes should concentrate on the potential wildlife areas shown on FGFWFC maps that analyze current information. These are shown on Maps 2-2 through 2-7.

Figure 2-22 Management Diagram



An idealized zoning scheme around an urban or suburban nature preserve that provides for the full range of human uses and enhanced nature protection. From Adams and Dove 1989.

Evaluation of Success

The nonscientific community sometimes develops misconceptions about the status of wildlife communities. Florida and the Green Swamp are home to a variety of species. Some of these, are generalists and quite well adapted to any abrupt changes that may occur in their environment. Others are extremely sensitive to the slightest modifications. A great number of easily observed species in an area does not necessarily mean that the ecosystem is healthy and not experiencing problems. The wading bird parasite problem mentioned earlier in this report is an excellent example. Sensitive species that are most adversely affected by development and other human activities are not as obvious. Cursory surveys will not reveal their presence.

Wildlife and not plant establishment or occurrence should be used as a measurement of success for the implementation of a plan to protect wildlife. Criteria for measuring success should be specific; for example, the presence of a full complement of species or indicator species at 5-year intervals. The problem with policies such as 'no-net-loss of wetlands' is that no meaningful criteria have been established to measure the success of recommended procedures.

Once an area is designated for wildlife management a plan must be written and permanently funded to further the preserves goals. The following are issues that should be addressed by the plan:

Fire

A great amount of literature exists describing the benefits of fire to various wildlife species. Fire is a natural event in grasslands and pine forests, especially in Florida. Periodic fire usually causes little direct mortality of vertebrate wildlife species (Doerr et al. 1970, Komarek 1969); however, Brynard (1971) found that infrequent, intense wild fires can kill all types of wildlife including such huge animals as elephants. Impacts associated with fire are related to alteration (improvement) of food items and maintenance of a more-opened habitat. An assessment of fire needs for different habitats within the preservation area should be made and a prescribed fire plan developed and implemented.

Mechanical Brush Control - Roller Chopping

In areas where fire is potentially dangerous because of smoke hazards or damage to adjacent residential areas, vegetation can sometimes be managed by roller chopping. Chopping potentially impacts wildlife in two general ways: direct mortality, reduced cover, and alteration of plant species composition and structure (cover).

Published information on direct mortality is very limited. Susceptible animals would be slow-moving species or nestlings incapable of flight. Gopher tortoise burrows are destroyed by chopping, but few are directly killed and most dig out of the burrows soon after treatment (Tanner and Terry 1981). Severe negative impacts of burrow destruction are associated with the numerous species that are dependent on gopher tortoise burrows for shelter. Also, long-term impacts on the displaced tortoises are not known.

Wildlife responses to chopping-induced changes in vegetation species composition and structure are similar to those described associated with fire. However, vegetation responses, especially structural changes, are much more rapid due to the crushing action of the choppers. Most past research dealt with economically important wildlife species such as white-tailed deer. Since deer require cover screen, total elimination of woody plants can cause abandonment of the area (Inglis and McMahan 1974). Box and Powell (1965) reported rodent numbers to be higher on chopped area than on control areas in south Texas, but Fitzgerald (1990) found bird use of chopped areas to be almost non-existent for 6 to 9 months after chopping on south Florida flatwoods and the species composition to change from midstory species to grassland species of those birds returning.

Restoration of Natural Systems

There are many acres of disturbed or altered lands within the Green Swamp. Some of these such as roads and residential developments are relatively permanent land uses, while others such as improved pastures, mined lands, and citrus groves can be easily restored to natural conditions. Restoration procedures range from very passive approaches relying on natural processes to revegetate an area to extremely intense and costly techniques involving grading and preparing the soil, and planting desired species. The main advantage of the latter approach is that it expedites the process of the restored area reaching the desired level of plant maturity and successional stage of the community.

Effective restoration of all of the functions of natural systems requires more than just planting desired vegetation. A landscape perspective is fundamental to designing a successful restoration project. Adjacent habitats and off-site influences such as hydrologic and surface water flows should be taken into consideration. Two references recommended as guidelines for restoration projects specifically designed for mined lands are Brown and Best (1988) and King et al. (1985). The principles reviewed in these publications also can be applied to other restoration needs.

Compatible Activities

All human-related activities that are not specifically designed to manage the habitat to benefit wildlife should be assumed to cause negative impacts on wildlife. Potential effects of activities such as non-consumptive recreation (hiking, bird watching, etc.) should be evaluated and decisions should be based on scientific information. Further development of roads and utility easements should be prevented. The purpose of the preservation area should be to maintain natural conditions. A strategy focused on minimizing negative impacts of various activities will cause degradation of systems and the accomplishment of something less than viable populations of species and the natural integrity of the Green Swamp.

Multiple Use Areas

Various human-related land uses that are not totally compatible with efforts to preserve natural systems should be separated from the preservation area. Activities conducted outside of the preservation area would not have to be as restrictive as they would if a management and protection plan to maintain natural systems were implemented with all lands zoned for similar uses.

Within areas zoned for multiple use, factors such as noise, domestic pets, pollutants, cowbird parasitism, increased densities of natural predators, and competition from disturbance-tolerant species also may negatively impact wildlife in the adjacent preservation area (Whitcomb et al. 1976; Gates and Gysel 1978; Wilcove et al. 1986). Wilcove et al. (1986) suggested that the deleterious effects of increased nest predation may extend 300 to 600 meters inward from a forest edge.

Studies of nature preserve boundaries support the need for zones of decreasing use outside reserve boundaries to reduce the detrimental effects of these activities (Unesco 1974; Dasmann 1988; Schonewald-Cox 1988). Janzen (1986) stated that managers can expect serious negative impacts (including problems related to heavy use by humans and domestic animals) anywhere within 5 km of a reserve boundary. Temple (1986) recommended a smaller buffer of 100 meters based on bird data. The main focus of a management strategy for the multiple use area that will contribute to the overall purpose of maintaining the natural integrity of the Green Swamp should be to conduct activities with the greatest potential negative impacts farther away from the preservation area boundary.

Recreation

The consequences of recreational activities on natural systems should be considered before decisions are made on whether and at what level this land use will be implemented. Passive recreational facilities such as nature trails have less impact than more intense land uses. These trails should be designed so they do not provide access to sensitive areas. Trails on the perimeters of the preservation area can provide quality recreational experiences while avoiding disturbances into core sensitive areas. Parking lots and more intense land uses should be located the most peripheral areas. Educational programs should be developed to explain to visitors the ecological values of natural systems and impacts of various activities including recreation.

Cattle Ranching & Other Agriculture

In general, agricultural activities are less detrimental to natural systems than more intense land uses such as residential development. However, some sort of scale should be used for a fair comparison. For example, 1,000 acres of improved pasture would be less similar to a natural system than a 1,000 acre plot developed at 1 house per 50 acres with strict vegetation removal ordinances. Agricultural practices in moderate amounts should be preferred over more intense land uses for areas adjacent to the preservation area. Economic incentives to maintain areas in agriculture production may reduce development pressure on these lands. Total conversion of all multiple use areas to improved pastures and citrus would not be desirable from a wildlife perspective. Chemical runoff and negative edge effects, as described earlier, will penetrate into the preservation area. Model ranches should be identified, managed and studied to provide the combination of science and education that will assure community acceptance and examples of agricultural practices that achieve conservation goals.

Silviculture

Best management practices should be adopted for various vegetation communities in the Green Swamp. Unlike the current BMPs that only addressed wildlife needs incidently to water quality and quantity issues, new BMPs should provide specific guidelines for timber harvesting practices based on wildlife data such as minimum width of leave strips tolerated by different species. Standards should be established for clearing vegetation within certain distances from the preservation area boundary to minimize negative edge effects penetrating into the preservation area. Economic incentives and model harvesting situations also should be established similar to those recommended for agricultural land uses.

Mining

Comprehensive plans for potentially mined areas should include wildlife considerations. Such plans should provide a landscape, long-range view of mining operations and the areas to be impacted. This approach will help to prevent isolation of natural areas and also aid in the design of successful restoration plans. Mining operations also should be set back from the preservation area boundary.

Development

Proactive comprehensive planning approaches will prevent additional adverse development impacts from occurring in the Green Swamp. Responding to individual DRI's and negotiating reasonable compromises on a site by site basis will not achieve the level of management necessary to protect the biotic integrity of the larger system. The focus should be on the entire Swamp. A complete management program that will provide the best protection for the wildlife resources of the Green Swamp, and also avoid negative impacts and costly mistakes will execute the following recommendations:

1. Apply buffers (development set-backs) to all wetlands.
2. Develop a landscape ordinance that requires the use of plants indigenous to communities in the Swamp and restricts the removal of understory vegetation so that developed areas will blend into the natural areas in the preserve.
3. Develop standards for storm water control ponds that include the use of native emergent vegetation, littoral zones, and native vegetation along the shore so that these ponds also will serve an ecological function.
4. Develop educational programs and additional incentives that will encourage pet owners to keep their cats and dogs confined to their property.
5. Develop educational programs that will help to instill a land ethic, and an appreciation and understanding of the natural integrity of the Green Swamp.
6. Design a study that will evaluate the long term effectiveness of this management and protection strategy in preserving natural biological diversity.
7. Design a study that will evaluate the relationship between various development densities and wildlife diversity and abundance.
8. Restrict development along U.S. 27. This area provides the only connection between the Green Swamp basin eastward to habitat areas into the Kissimmee drainage system in Osceola County. The original scrub habitat along this ridge is unique to this area of the state and can be reverted into its natural condition unless it is converted into residential or commercial development.

Conservation Areas and Corridors

Although the term wildlife corridor is used in many DRI proposals and Comprehensive Plans, the concept behind the term is poorly understood. Planners and developers often refer to 10 foot wide green areas between houses as corridors and conservation areas. These narrow strips only provide food and cover requirements for species such as blue jays, cardinals, doves, and mockingbirds that are commonly found in developed areas. These token corridors support very few if any native wildlife that are sensitive to development and in greater need of conservation efforts. In fact, these areas have been referred to as "ecological traps" because of the abnormally high predation and cowbird parasitism that occurs when the strips are to small (Gates and Gysel 1978, Wilcove et al. 1986). The minor ecological importance of these areas within developments should be recognized so that their purpose is not confused with the purpose of the larger preservation area of the Green Swamp.

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ECONOMIC OVERVIEW

Generally, the notion of "economy" refers to the activity of people in the day-to-day provision of material needs, as well as to the daily activity of people in seeking various other wants. A concern with the "natural resource and environmental economy" of the Green Swamp, then, suggests the need to focus on the role of the natural system and natural environment of the Green Swamp in affecting, first, the ability of people to "make-a-living". Second, the role of the Green Swamp in affecting the degree to which people are able to take actions to satisfy other human wants, many of which are not necessary to existence, also needs to be understood.

Some people live within the natural environment of the Green Swamp, and use natural resources in the area for producing things needed and wanted, and, as such, the natural environment and the natural resources in the Green Swamp directly influence that local human economy, e.g., providing low cost homesites, or facilitating ranching and farming activities. Others live near the Green Swamp, and also depend to some extent on the area, e.g., for recreation services, or for the recharge water entering the ground in the area. Still others live more distant, but still rely on the natural environment and natural resources of the area albeit in less direct ways, e.g., in enjoying flood water detention, or benefits from pressurizing of the Floridan aquifer. Even in more indirect ways, citizens of the entire State may have some stake in the Green Swamp, e.g., as an area for wildlife habitat. (There may even be people out of state that may feel some affinity to the Green Swamp, especially with respect to the wildlife habitat provided by the area).

In these terms, it is the impact of human activity on the environment and the natural resources of the Green Swamp, and the counter-influence of the environment and the natural resources of the Green Swamp on the economy, that is of concern to and is being addressed by the Green Swamp Task Force. Clearly the Task Force is faced with a difficult task because of the wide variety of interests (local, regional, state) in the area, and the diversity of services provided by the Green Swamp.

The 1974 "Area of Critical State Concern (ACSC)" designation (see Kiker and Lynne, 1981, p. 152) suggests that Florida citizens have recognized for some time that the Green Swamp may play a key role in the local, regional and state economy. At that time, the area was viewed as contributing to the economy primarily in three ways, 1) providing recharge water to the Floridan aquifer, and serving to help pressurize the aquifer, 2) providing wetland services, and 3) serving as a flood detention area, and thus serving to dampen flood damages downstream in the rivers originating in the area. Concern was being expressed at the time that other economic activity in the area, e.g., housing development, might damage the (listed) natural services to the economy.

Little action has been taken since the ACSC designation in 1974 to influence economic related behavior in the area. A flourish of interest has created a conflict over just how the Green Swamp should figure into the economy suggests a renewed concern. Because of the renewed interest, it is useful to briefly review past natural resource and environmental economic studies of the area in order to see where we have been, with the hope of improving understanding of the intricate relationship of the economy and the environmental/natural resources of the area, and
thus provide some direction for the future.

Past Studies of the Green Swamp Environmental and Natural Resources - Linkage with the Economy

Kiker and Lynne (1981) conducted a generalized economic study of the Green Swamp in the late 1970's. The study focused on current and potential land uses in the area, and projected the likely level of direct (primary) economic activity in the area from varying scenarios of future development. Specifically, the study examined land use changes involving more housing development in the region. Additionally, the study estimated the likely impacts on groundwater recharge from the projected human, economic activity.

The study focused on the linkages of the economy with water quantity resources, and did not address the myriad of other linkages with the environmental and natural resources, such as with water quality, or wildlife.

Generally, the study proposed various future economic scenarios and calculated the value flowing from the land to the human economy when used in the particular pattern of use. The base condition was taken as people enjoying $11.8M (million) from agricultural activities, and $1.3M from housing related use activities, or annual net returns to land of $13.1M. Base land use was estimated at 48,000 acres of citrus; 120,300 acres of pasture; 4,400 acres in housing; and 132,000 acres in wetlands.

Various future scenarios were then examined, including 1) 100 percent citrus irrigation, 2) all uplands in housing, 4) housing only along highways, 5) housing along highways and a recharge requirement of at least 1,961,700 acre inches, and 6) housing along highways and a recharge requirement of 2,061,700 acre inches.

Importantly, in order to provide perspective on the matter of the Green Swamp economy, the most intense land use scenario considered (all uplands in housing except citrus acreage, scenario number 2) raised net returns to land to $27.9M per year (Kiker and Lynne, 1981, p. 153), or only an annual increase of $14.8M over the base condition. Citrus acreage remained at $48,000 acres; pasture was reduced to 87,300 acres; housing was increased from 4,400 to 54,100 acres; and wetland acreage was not changed from the base of 132,000 acres. It was assumed for this scenario, and throughout the study that building in wetlands would simply not prove to be a sound environmental and natural resource economic decision, even though it may be financially possible.

Considering the total 545,331 acres, the return per acre is increased by only $27 per acre, on average. This rather modest increase in annual returns came with an additional 600,000 people living in the area.

The difficult question faced by the Task Force is one of deciding whether the losses in natural services from the Green Swamp with such development has more value than $27 per acre. The impact on the environmental and natural resources of the area could be substantial from an additional 600,000 people with only modest gains to the regional and state economy.

The other economic study of the Green Swamp was conducted by Environmental Science and Engineering (1985). The study assessed the economic benefits and costs of using the Green Swamp for flood control by building flood control structures in the area. The study was somewhat unique as such studies go, however, in that all types of benefits and costs were considered, including (ESE, 1981, p. xii)

1. Those exchanged in well-functioning markets, and quantifiable (most agricultural crops are typical examples).

2. Those quantifiable and measurable goods/inputs exchanged in less than perfect markets (e.g., public water supply).

3. Those quantifiable and measurable goods/inputs that are not normally exchanged in any type of market, such as recreation benefit flows from natural areas.

4. Those unquantifiable and unmeasurable benefits and costs, for which dollar values are nearly impossible to acquire because of the difficulty in quantitative description. A good example is the benefit flow from a scenic view. Also included are such "option values" some people gain simply from knowing there are

wilderness areas, even though they may never visit these areas, or may not even desire to visit them.

Importantly, the study found very small dollar benefits from flood control enhancement using the Green Swamp (Types 1-3), but described substantial nonmoney related benefits from not developing the area for flood control (Type 4). The study noted how the Green Swamp area is one of the few major ecosystems in Florida still relatively intact. The area could play a definite important future role in the regional economy (because of its location among three major population areas) by providing for recreational use, wildlife habitat and open green space (ESE, 1981, p. xvii).

Current Landowners May Prefer Transferable Development Rights

While the evidence supporting intensive housing and related development in the Green Swamp area is weak based on overall economic impact in the region and state, clearly individual landowners and developers could benefit from such development. The important social question becomes the extent to which such individuals are to be reimbursed for not being able to intensely develop land. The issue really hinges upon how economic value of land is created and reduced by government (collective) actions of various kinds.

The value of land largely fluctuates up and down in response to market forces, at least on the surface. More fundamentally, however, the value of land is determined at base by the set of laws, rules, and regulations (and possibly the customs, habits, conventions of people) affecting how the land markets work. Thus, a law requiring that infrastructure (e.g., roads, schools, water supply and sewers) be in place before land can be developed affects land value very directly. In fact, the public infrastructure investment is often at the base of the private values accruing to land owners and developers, as well as the benefits enjoyed by users of the developed land. With intensive infrastructure development on the part of the public, private land values increase. (Witness, for example, the gains to private landowners owning land near exits and intersections of the interstate highway system throughout the U.S.). Without infrastructure development on the part of the public sector, private land values will be lower.

The question of what is lost in the Green Swamp area by current landowners and developers, then, hinges upon the extent to which the public feels justified in investing heavily in infrastructure to make the area more habitable to people. Building roads, providing fire and police services, developing schools and other public services in the area will be costly. Without such investments, however, little value is taken away from the private sector because the value does not currently exist.

In other words, the low property values in the Green Swamp reflect its location, the carrying capacity or economic productivity of the land, and the general absence of public infrastructure. All three factors are subject change. Although location does not change, surrounding development values or pressures do change. Surrounding development pressure changes the perception or acceptability of the Green Swamps location. Carrying capacity can change through substantial modifications to drainage patterns, groundwater levels etc. Public infrastructure can change through provision of roads, utilities, and schools. Property values will remain low without substantial infusions of public or private investment. Public investment may be the single largest component of change.

There will be exceptions. Some individual landowners could indeed lose substantial amounts of money from being unable to develop in areas that already have adequate infrastructure (e.g., along already established major highways). For such cases, the Task Force might consider recommending the development of markets in Transferable Development Rights. While not without its problems, such a market process generally facilitates current landowners and developers to realize some monetary gain from not developing land in the Green Swamp. At the same time, individuals buying the development

rights and transferring such rights to other areas in the region gain from being able to develop other land areas more intensely.

Conclusions

The Kiker and Lynne (1981) finding of small increases in direct economic benefits from development in the Green Swamp is significant to the Task Force. The study suggests that the direct contribution to the regional and state economy from intensive housing development would be relatively small. It may well be that keeping the area mainly in its current support role to the surrounding economy (in the sense of the currently provided recharge and aquifer pressurizing function, providing wetlands services, and providing for wildlife habitat) could well be the highest and best use for the area.

The Environmental Science and Engineering (1985) study seems to suggest the same conclusion. The fact that the area is one of the few intact ecosystems still remaining in Florida alone raises its value, i.e., resources gain in value due to scarcity of the unique services produced by an area. It appears the Green Swamp may provide the most service to the economy by remaining essentially as is into the indefinite future.

This conclusion does not obviate the need to consider the rights of current landowners in the area to reasonable use of their land. This does not necessarily imply a right to intensively develop the land. While overall regional benefits from development in the area would likely be small, clearly individual developers could realize substantial gains. The question that must be resolved in such cases is whether there has really been a taking of value, in that much of the private value is created from providing public infrastructure in the first place. To the extent the public would create the value in the first place, it is not all clear the private developer should be reimbursed for something that does not exist.

Yet, there may be some loss in value for certain kinds of land regulations. For such cases, the Task Force might consider the notion of Transferable Development Rights. While not without difficulty, the concept of allowing landowners in the Green Swamp to sell development rights to other areas benefits everyone concerned. Those outside the area wanting more intensive development can buy the rights, while those inside the area can realize some financial gain even though the land use regulations stop future intense development.

Overall, the Task Force is faced with a very difficult set of questions pertaining to whether the Green Swamp will be more valuable to the local, regional, and state economy if left essentially as is, or if more economic value will be produced by intense development in the area. There are opportunities lost under either option. The general task is to weigh the opportunities under each scenario, and choose the path of least opportunity loss, measured in both dollar and nonmoney valued ways, which implicitly means the path of greatest gain. The general message of this economic analysis is that opportunity costs, or losses, do need to be weighed, and the lowest cost path pursued.

FORESTRY

Silviculture within the Green Swamp

Timber harvesting has occurred in the Green Swamp since the early 1900's, if not before. Virtually all of the timber has been cut over at least once (Terwilliger and Ewel, 1986).

From a forest management prospective, the designated area of critical concern changes from north to south. Forest types, soil types, topography, abundance of forests, and economic considerations, are all factors which affect forest management priorities and decisions in the overall area.

Lands in the swamp's northern end are generally capable of producing a greater volume of wood. The dominant species harvested is slash pine. These lands are much closer to the processors, making the timber growing on them more valuable from an economic viewpoint. More landowners in this area probably consider timber or forestry as a primary management objective than those farther south.

As you proceed south, forest management for timber production takes on a much lower priority for most landowners. In Polk County, most of the land on which forestry is practiced is being managed mainly for another agricultural crop, such as cattle or citrus. The standing timber is viewed as "money in the bank" to supply needed cash flow when prices of other commodities are down. There are, however, a few southern landowners that manage their timber as the sole or primary crop.

With the exception of land within the Withlacoochee State Forest, forest type is not adequately defined and mapped, (Figure 3-2 Withlacoochee State Forest Tables & Map 3-1 Richloam/Withlacoochee State Forest Map). Satellite imagery gives good general information, but there is a definite need for ground checks and surveys to more accurately measure forest resources. Similarly, with the exception of the Withlacoochee State Forest, there is no data available on the species or amount of timber harvested within the Green Swamp area.

The primary commercially harvested trees are baldcypress (Taxodium distichum), pondcypress (Taxodium distichum var. nutans), slash pine (Pinus elliottii), and some longleaf pine (Pinus palustris). Baldcypress and pondcypress have the ability to survive and grow in very wet soils consisting of mucks, clays, or the finer sands where moisture is abundant and fairly permanent.

Differentiation between the two varieties is sometimes quite difficult. Baldcypress is normally recognized by its feather-like leaf configuration, while pondcypress has scale-like leaves that are twisted and lie closely appressed to the twig. Baldcypress is normally found along creeks, streams, and rivers where water is flowing, while pondcypress occurs in swamps with very little stream-like water movement.

Common tree species associated with cypress include the gums, maple, bays, and occasionally pines. As you progress into deeper water, cypress is often the single tree species found, due to its ability to survive in standing water.

Baldcypress is a southern species ranging naturally as far west as eastern Texas, northerly along the Mississippi Valley to Arkansas, up the east coast as far as southern Delaware, and as far south as extreme south Florida.

Pondcypress has a more limited range with its northerly boundary reaching from southeastern Virginia through mid-Georgia and southern Alabama to southeastern Louisiana. It is also found as far south as extreme south Florida. Slash and longleaf pine are found on the higher sandy sites, typically in association with gallberry and saw palmetto.

The majority of the pineland in the Polk County portion of the Green Swamp is probably viewed by the landowner or lessee as native range for cattle. The stands are predominately slash pine (with some longleaf). The stands are burned regularly to improve forage production. Natural regeneration is encouraged by this practice. Chopping, another pasture maintenance practice, also encourages the natural regeneration of pine. Often the landowner will apply or remove these practices, as needed to encourage the establishment or re-establishment of pines. The citrus killing freezes of recent years have resulted in some conversion of former citrus lands to planted pines. Most of these conversions have been implemented to enable the landowner to maintain an agricultural assessment on his property. Most, but not all, of the planted pines in the Polk County portion of the Green Swamp are found on these sites. This is not the case for lands north of the Polk/Lake County line.

The Division of Forestry

The Florida Division of Forestry, Department of Agriculture and Consumer Services programs relative to the Green Swamp are divided primarily into two areas. One area is concerned with management of forest resources, the other involves open burning and wildland fire control.

The Division has county contractual agreements to provide a professional/graduate forester to assist landowners with forest management matters. Within the Green Swamp this most often involves assistance with planting and harvesting. Requests for this type of assistance are not numerous. Private consulting foresters also work in this area. Specific recommendations are based on the landowners objectives. Timber management is not a primary objective of most Green Swamp landowners. It is a reserve or secondary source of income.

Some of the landowners in this area were raised in the Green Swamp area. Through years of passed-down information and practical experiences, they have obtained a respect for the land and knowledge about natural responses to management activities. While they do not rely heavily on the advice of professional foresters, they do occasionally require and seek out that advice.

The Division promotes voluntary compliance with Silviculture Best Management Practices. There are no state or county regulations which restrict logging activities in the Green Swamp other than trespass and timber theft statutes. The water management districts require permits for certain types of construction and operation of surface water management systems.

The subject of wildland fire in Green Swamp is one of increasing concern because of the urbanization of previously undeveloped land. Florida's ecosystem is dependent on periodic fire to maintain the existence of many endemic herbaceous species. Exclusion of fire leads to understory dominance by shrubs resulting in a decrease in the number of flowering grasses and other herbs. It also causes the build up, from year to year, of potential fuels. This increases the severity and difficulty of controlling wildfires.

Increasing urbanization restricts the ability to conduct prescribed fire because of the smoke and fire threat. It is important to note that in 1990 the state legislature enacted legislation which protects a property owner from liability due to damage from a properly conducted prescribed burn. (Florida statute 590.026) (see Figure 3-1 Land Management Liability Attachment) A management plan for the Green Swamp should include a burn plan which appropriately allows for conducting periodic prescribed burns.

Figure 3-1 LAND MANAGEMENT LIABILITY

590.026 Prescribed burning; requirements; liability.

(3) Definitions. As used in this section:

(a) "prescribed burning" means the controlled application of fire to naturally occurring vegetative fuels under specified environmental conditions and following appropriate precautionary measures, which causes the fire to be continued to a predetermined area and accomplish the planned land management objectives.

(b) "Certified prescribed burn manager" means an individual who successfully completes the certification program of the Division of Forestry of the Department of Agriculture and Consumer Services.

(c) "Prescription" means a written plan for starting and controlling a prescribed burn.

(4) Rules.

The Division of Forestry of the Department of Agriculture and Consumer Service shall promulgate rules for the use of prescribed burning.

(5) Requirements; liability

(a) Prescribed burning conducted under the provisions of this section shall:

[1] Be accomplished only when at least one certified prescribed burn manager is present on site while the burn is being conducted.

[2] Require that a written prescription be prepared prior to receiving authorization to burn from the Division of Forestry.

[3] Be considered in the public interest and shall not constitute a public or private nuisance when conducted pursuant to state air pollution statutes and rules applicable to prescribed burning.

[4] Be considered a property right of the property owner if naturally occurring vegetative fuel are used and when conducted pursuant to the requirements of this subsection.

(b) No property owner or his agent, conducting a prescribed burn pursuant to the requirements of this subsection, shall be liable for damage or injury caused by fire or resulting smoke, unless negligence is proven.

(6) Duties of agencies.

(a) The Department of Community Affairs, the Division of Forestry of the Department of Agriculture and Consumer Services, and the Office of the State Fire Marshal shall prepare a report to be submitted to appropriate legislative committees by February 1, 1991, that shall identify actions required to minimize the threat of wildfire in areas where new development is proposed in or adjacent to wild lands.

(b) The Office of Environmental Education of the Department of Education shall incorporate, where feasible and appropriate, the issues of prescribed burning into their educational materials.

FIGURE 3-2

Table 1

In the Richloam Section, Withlacoochee State Forest (fig.1) forested lands are categorized and distributed as follows...

Pine	27,143	acres
Bottomland Hardwoods	2,515	acres
Cypress-Gum	16,260	acres
Non Forested	1,731	acres

Table 2

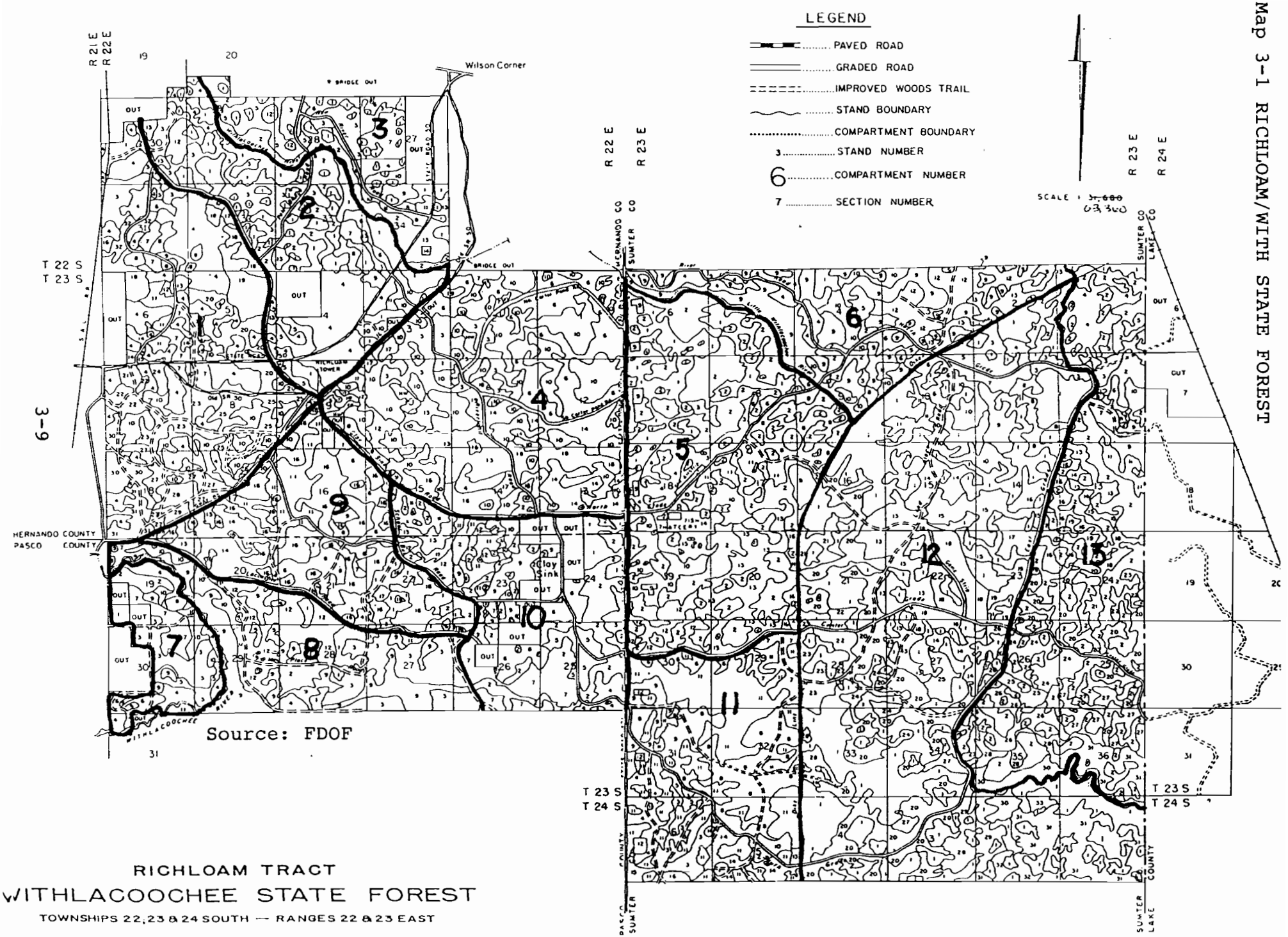
Withlacoochee State Forest
Richloam Section
Timber Volumes 1991

Cypress Pulpwood	216,314	cords
Cypress Sawtimber	143,556,000	bd. ft.
Pine Pulpwood (all species)	167,948	cords
Pine Sawtimber (all species)	123,033,000	bd. ft.

Table 3

Withlacoochee State Forest
Richloam Section
Timber and Pulpwood Sales July 1986 - June 1991

Sawtimber	11,550.30	thous. bd. ft.
Pulpwood	15,280.50	cords
Receipts	$ 1,855,045.00	
Sale Area	5,192.00	acres



Source: FDOF

RICHLOAM TRACT

WITHLACOOCHEE STATE FOREST

TOWNSHIPS 22, 23 & 24 SOUTH — RANGES 22 & 23 EAST

4/4/86 By: D B Reilly

Harvesting Techniques

Timber harvesting is typically accomplished by one of the following cutting methods:

> Clearcutting Harvesting of all merchantable trees within a specified area in one operation.
>
> Seed Tree Removal of the mature timber in one cutting, except for a limited number of trees left singly or in small groups as a source of seed.
>
> Shelterwood Removal of the mature timber in a series of cuttings which extend over a relatively short portion of the rotation period. Serves to encourage the establishment of essentially even-aged reproduction under the partial shelter of seed trees.

The harvesting is accomplished with rubber-tired hydraulic feller-bunchers which clip off each tree and stack them in small piles which are then hauled to a loading area by the same machine or a similar machine called a skidder.

K. Brandt and K. Ewel, 1989, report that "Both rubber-tired and tracked vehicles can ruin productive wetland soils by compaction. Increased soil bulk density impedes root penetration, reduces aeration, and restricts the movement of air and water in the soil, although it is not clear how much Florida's sandy soils may be affected. Advance regeneration is crushed by machines, and cypress seeds may not germinate as well in compacted soils where drainage has been impeded. Machines skin the bark off stumps, and damage remaining trees, making them vulnerable to invasions by insects and fungi." (Brandt and Ewel, 1989)

The following quotation of K. Brandt and K. Ewel addresses the issue of cypress regeneration following harvesting:

> The major consideration in logging is regeneration. Although there is disagreement about the likelihood of natural regeneration after timber harvest, it is clear that a seed source must be left on or adjacent to a site, that severe fires following harvest can prevent regeneration, and that profound changes in hydroperiod, water levels, soil aeration and understory vegetation can hinder seed germination and seedling survival.
>
> Given the precise sequence of water levels needed for seed soaking, seed germination, and seedling establishment, it is unlikely that regeneration from seeds deposited before harvesting will occur immediately after harvest.
>
> Regeneration via coppice appears dependable, but it is not well understood. If sprouting is desired, trees should be cut so that the tops of the stumps are above the mean high water level, although sprouting appears to decrease if stumps are too high. Optimum tree age and season of cutting, vulnerability of trees grown from coppice to windthrow and disease (particularly peckiness), and the quality of timber produced by sprouts must be ascertained before dependence on coppice for cypress regeneration can be recommended for sustained-yield timber production. One advantage of successful reproduction by coppice may be early production of seeds from sprouts.
>
> Although an economic analysis of the profitability of planting cypress is beyond the scope of this paper, it seems safe to say that hastening (or ensuring) the establishment of a new cypress stand by planting might be advisable to derive the best returns from forest lands. Seedlings should be tall enough to escape inundation after outplanting; 1-year-old seedlings may be adequate for

smaller, shallower swamps. Cattle should be excluded from regenerating areas. Where nutria and rabbits are abundant, planting is risky, and trapping and/or application of repellents may be necessary.

Clearcutting is attractive because it requires less labor (selection of seed trees is not required) and only one cut is necessary during each rotation (no second cut is needed to remove seed trees). If an isolated swamp, such as a cypress dome, is to be harvested, then seed trees must be left or coppice production must be dependable. If a larger swamp is to be cut, a viable alternative might be to harvest in small blocks to ensure good seed distribution from trees on the edges of the clearcuts.

The traditional seed-tree system, in which seed trees are left scattered throughout a large cutover area, risks damage to seed trees during the initial harvest and to the new stand when the seed trees are harvested. The latter risk can be eliminated if seed trees are not removed, making this technique a practical alternative. In mixed swamps where cypress regeneration is desired, cypress should not be selectively cut, because cypress seedlings and saplings are likely to be outcompeted by more shade-tolerant hardwoods. Cypress and many desirable shade-intolerant hardwoods are more likely to regenerate in such forests if small blocks are clearcut.

With a system of clearcutting small blocks, the distinction between clearcutting and seed-tree cutting becomes blurred. Such a system will preserve a source of seed and maximize the amount of light reaching the floor of the swamp. Controlling the growth of understory vegetation may still be necessary to ensure cypress regeneration.

The question of thinning is difficult to address because there has not been sufficient research to demonstrate its effectiveness. Thinning baldcypress stands increases the growth of remaining trees, but not significantly. Economic feasibility and potential for damaging the remaining trees during thinning operations are the major considerations in deciding whether thinning is advantageous.

In large stands of high-quality timber where it is economically feasible, the May Brothers' system of building levees and flooding the areas to be harvested could be modified to enhance regeneration. Seed trees should be left uncut and standing water maintained inside the levees during the winter after harvest to allow seeds to soak. In spring, the water level could be drawn down to the surface to allow germination.

Although the use of large machinery appears attractive, especially for harvesting large swamps, the long-term costs of impairment of regeneration and reduced site quality can be significant. Degree of soil compaction and its effect on regeneration are important issues. Harvesting timber in small blocks and cutting with chain saws instead of feller-bunchers may prove less costly in the long run. (Brandt & Ewel, 1989)

Surficial Hydrology and Forestry

An issue of major concern within the Green Swamp is the effect of lowered water levels on vegetation. There are examples throughout the Green Swamp of changes in vegetation from wetland species to species not commonly found in wet areas. The cause for this appears to be an overall lowering of water levels. A period of drought has preceeded this report, however lower water levels may be a combination of complex hydrologic changes. This issue is also discussed in the wetland section of Chapter One.

Examples of how lowered water levels affect change include cypress areas which have been logged and cypress stands which have burned with intense wildfires. Depending on available seed source, they

reseed with pine and other herbaceous species not usually associated with wetland areas. Continuation of this trend has the potential of significantly changing vegetation types in the Green Swamp.

The likelihood of intense wildfire will be increased because of the heavy accumulation of herbaceous vegetation which provides heavy buildup of available fuels. This could be a major problem in the proximity of major roads and housing developments.

Best Management Practices (BMPs)

It has been documented that certain forestry practices on sensitive sites impact water quality. The Best Management Practices Manual discusses these impacts, the management practices that may cause them, and the management techniques used to prevent or minimize them.

The manual provides a brief discussion of the silviculture/water relationship in Florida as it is understood, and offers recommendations that, if followed, will protect surface water quality and conserve site productivity. It describes the method being used to match Best Management Practices with various forest conditions in Florida, the Best Management Practices themselves, the method to be used to evaluate both compliance and Best Management Practice effectiveness, and the available sources of technical assistance.

In 1972, the United State Congress passed the Federal Water Pollution Control Act Amendments (P.L. 92-500), establishing both national water quality goals and setting the course for a massive federal, state and local planning effort to achieve them. These nationwide goals were to achieve water of swimmable and fishable quality by 1983, and to eliminate pollution discharge using best available technology by 1985.

The Act addressed all known forms of water pollution and provided a mechanism by which each could be controlled. Examples of these pollution forms and the Section addressing them include:

Section 404 - Dredge and Fill discharges.
Section 201 - Sewage Treatment Plant discharges
Section 208 - Nonpoint Pollution discharges

The latter category includes the impacts of most land management operations, and is therefore of keen interest to the forestry community. A nonpoint source may be defined as water which enters a after-course in a diffuse manner, and is induced by storm events. The water does not flow through a discrete conveyance, such as a pipe, and cannot readily be turned on and off. Contaminants in this flow are called nonpoint source pollutants.

Section 208 calls for the assessment of nonpoint pollution and their degree of severity. Controlling this type of pollution is to complement the effort to control Point sources of pollution.

Unlike point source pollution, however, nonpoint pollution is difficult to quantify and will be difficult to control. For this reason, the Environmental Protection Agency (EPA) and the Florida Department of Environmental Regulation (DER) have agreed that certain management measures that prevent generation of pollution should be encouraged.

In the sense that these preventive management practices are to be the best known means to protect the water resource, they are considered Best Management Practices, or 'BMPs'. Since they are also designed to conserve the soil and associated nutrients, they also contribute to good overall forest management.

Application of BMP's is proposed be evaluated on a biennial basis by staff from the Florida Division of Forestry. If forestry practitioners abide by them, the program will remain non-regulatory. However, if

compliance checks indicate a lack of cooperation by practitioners, the Environmental Protection Agency has indicated that a permitting program may be instituted.

During 1992 a review panel made up of industry representatives, citizens, environmentalists and agency representatives is meeting in Tallahassee to evaluate the success and compliance of the current BMP program. This group may update and/or revise these checks.

Forestry and Air Pollution

Present global temperatures are the highest since mankind has been keeping records. The rate of global warming in the past two decades is higher that at any earlier recorded time. (Hansen, 1988)

The rate of average global warming is three times higher over the past 20 years than had been predicted by climatologists. Carbon dioxide (CO2) in the atmosphere acts like the glass in a greenhouse. The sun's rays penetrate readily, hit the earth, and are reflected as longer-wave heat. Carbon dioxide bounces the heat waves back toward earth, trapping heat that would otherwise radiate into space. Other greenhouse gasses do likewise, but carbon dioxide is estimated to cause about half of the global warming phenomenon.

Scientists estimate the level of atmospheric CO2 could double in a relatively few years, if present trends continue. If that happens, average temperatures in portions of the United States could rise by 6 - 12 degrees Fahrenheit (3.3 - 6.6 degrees Celsius) in a matter of a few decades. This could result in rising sea levels that would be of particular concern in coastal states.

Thrifty growing trees use CO2 at the rate of about 48 pounds per year - approximately 10 tons per acre per year. Put another way, for every ton of new wood that grows, about 1.47 a tons of carbon dioxide are removed from the air and 10.7 tone of life-giving oxygen is produced. This phenomenon is of value to people everywhere but is of a particular cleansing effect to localized populations.

AGRICULTURE

Reliable historical records of agricultural uses site specific to the area now designated as the Green Swamp Area of Critical State Concern are not readily available. However, aerial and ground surveillance of the area and information available from landowners indicates that agriculture has existed in the area since it was settled. Because the identified area contains (as do many other areas in Central Florida) substantial areas of swamp, sandy pine/palmetto flatwoods, and higher sandy ridges it lends itself to broad diversification in agricultural use. There are no less than thirty different soil map units identified in the study area in the Soil Survey of Polk County, Florida prepared by the Soil Conservation Service of the United states Department of Agriculture. The predominant agricultural uses of the area include forestry (covered separately in this report, cattle, sod production, hay, other agronomic crops and, to a lesser extent, citrus, vegetables, ornamental and landscape plants, and aquaculture.

The broadest uses for the purposes of this segment of study are beef cattle production and associated agricultural enterprises. Enterprises associated with beef cattle production include hay production, sod harvesting, and seed. Most of the cattle operations include both native range sites and improved pastures with the productivity of significant acreage of improved pasture upgraded with seepage irrigation during the 1950's and 1960's. Seepage irrigation systems are not intended for drainage and instead use well water; water is not intended to leave the property as it would in drainage systems. Sod harvesting and haymaking operations are associated with the improved pasture portions of the cattle operations. Sod harvesting would not generally be carried out on the same acreage year after year. Harvest of warm season perennial grass hay is a common practice for many of the cattlemen in the area. Actual acreage harvested for either crop would vary from year to year and is uncertain.

Relatively large acreage of agronomic crops such as field corn have been grown in the study area in the past, however, in recent years agronomic crop production has been focused on small grains for winter pasture and is found in the improved pasture areas.

Considerable acreage on the higher ground and sandy ridges (particularly in the eastern portions of the study area) has been devoted to citrus production. Freeze damage during the 1980's limited citrus development and caused some citrus acreage to be converted to alternative uses, however, another year to two without serious freeze damage could trigger more replanting of citrus in areas previously planted to citrus.

Vegetable production in the study area is not only seasonal but variable from year to year and dependent on a very uncertain market for profitability. Crops grown in the area may include cucumbers, squash, peppers, okra, melons, corn, strawberries, tomatoes and others. There is little evidence of recent vegetable production in the study area observed during recent aerial surveillance.

Production of landscape plants is carried out in the study area but acreage used is uncertain and would be minimal compared to other crops.

Aquaculture is also found in the study area but, like the nursery industry, acreage involved is minimal. Aquaculture has, however, been investigated by several property owners in the area.

MINING

Three types of mining occur in the Green Swamp. They are sand, limerock, and peat mining. Sand and limerock are used primarily for construction materials. Peat is used in horticultural activities. Map 3-2 shows area mines.

Sand mined in the Green Swamp is used for ready-mix concrete. In general, deposits of commercial grade sand run through the middle of the state from Leesburg through Clermont, the Green Swamp, Lake Wales, to La Belle. The material is marketed from Georgia to the Keys. Transport is by truck.

The process of removing the sand is by hydraulic dredge which recirculates the water. In the past this water was discharged. The sand is piped to the processing facility in a water slurry. A typical sand mine excavates an average of six acres a year. Sand mining occurs in the surficial aquifer. Pit depths may reach 60 feet.

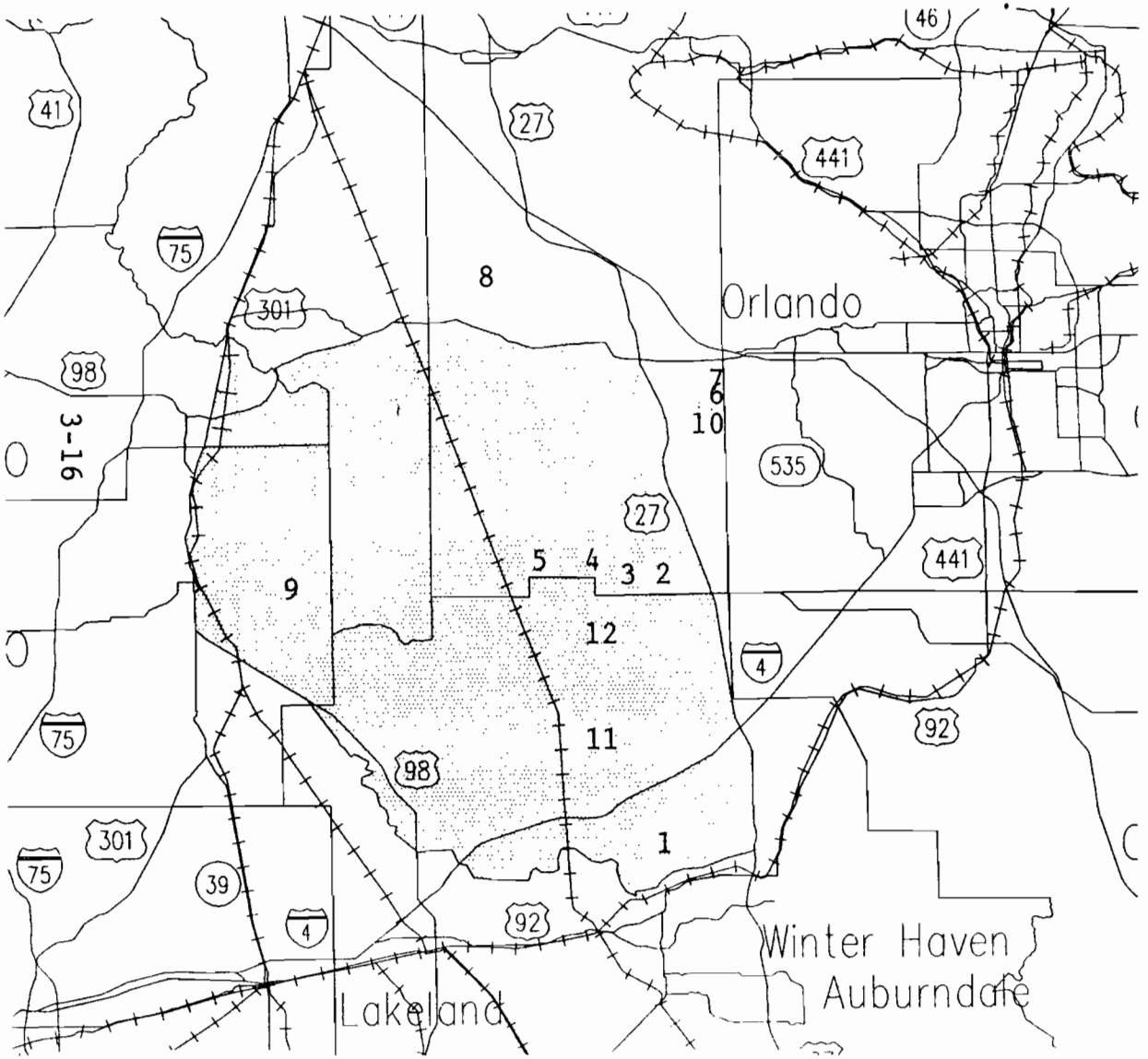
Limerock mining occurs in the upper levels of the Floridan Aquifer. Besides being used in construction materials and concrete, the dolomite in limerock is used in cattle and chicken production and ceramics. Limerock is mined in the western portion of the Green Swamp where it is found near the surface. The material is excavated by draglines from pits that may reach 60 feet in depth. It is usually transported by truck.

Peat mining in the Green Swamp is planned to be phased out as a result of concerns that were apparent in the comprehensive planning process.

Mining is regulated through permitting programs of local governments, Water Management Districts, DER and DNR. Local government regulation is related to the activity as a land use. It is mostly concerned with traffic and adjacent land owners. The industry is required to submit annual reports and mines are inspected annually. Water Management Districts regulate the site's surface water and groundwater withdrawals used in processing. In the area of withdrawals the District's take into consideration that a portion of this water is returned to the aquifer. The District's monitor mines with flow meters in the pipelines and with rain gauges. DER is concerned with mining as an industrial waste and potential air quality concern. If wetlands are to be impacted an combination dredge and fill permit is require by the U.S. Army Cops of Engineers and DER. DNR regulates the reclamation process that follows mining. This is usually in the form of side dressings consisting of sloping banks as vegetated littoral zones.

The environmental concerns relating to mining are potential impacts to the water quality and quantity of the area. Turbidity is a water quality concern, as is the concern that mine cuts can be a direct release point of contamination of the water supply. Water quantity concerns are related to the pumping of groundwater and how this affects the surrounding natural vegetation especially the hydroperiod needed for cypress forests.

MAP OF MINES IN THE GREEN SWAMP AREA



1 - Standard Sand
2 - Lake Sand Plant/Florida Rock
3 - C & C Peat
4 - Rinker Materials Inc. (sand)
5 - Jahna Industries Inc. (sand)
6 - Florida Crushed Stone Co. (sand)
7 - Jahna Industries Inc. (sand)
8 - Jahna Industries Inc. (sand)
9 - Overstreet/IMC Mine (limerock)
10 - Silver Sand/Tarmac Inc.
11 - Standard Sand/Polk City
12 - Vulcan ICA (sand)

MAP 3-2

DEVELOPMENT

Historically, the Green Swamp has not faced the development activity characteristic of much of Florida. Other lands have been better located in relation to existing population centers, transportation routes, and economic resources. Other lands have been easier to develop with fewer site limitations. The Green Swamp had no beaches, navigable water ways, substantial areas of uplands or direct access to markets. Even today, a Florida map displays few roads, communities or other non-agricultural, man related impacts within the Green Swamp.

Population growth and economic activity has increased in Orange, Lake and Polk Counties, in part, as a result of the development of Disney World and the adjacent commercial developments. The adjacent areas of the Green Swamp immediately attracted the attention of more marginal land speculators who tended to seek out low priced land beyond the immediate development fringe. In some cases the lands involved were developable properties with substantial carrying capacity, which had property values reflecting rural location. In numerous other cases, the properties involved were lands with substantial development limitations and property values which reflected that fact. These lands were often popular with land sales operations which are now more tightly regulated. The original designation of the Green Swamp Area of Critical State Concern, was in part a response to this situation.

In the two decades since designation of the ACSC surrounding areas have continued to grow. Development activity, particularly at the edges of the Green Swamp, has increased. Two types of development activity are evident.

Lower density single family development is occurring in substantial amounts on marginal, low value land. This type development can be seen in the vicinity of U..S. 98 in Polk County. Cheap land, often with a seasonal high water table, is subdivided for lower cost housing units. Aerial overflights performed during the course of this study amply documented numerous inundated yards during the rainy season. Most of these dwelling units have mounded septic systems which typically fail during the rainy season. Many of these dwelling units are used rental mobile homes serving as a form of affordable housing. These dwelling units are often distant from public services and infrastructure needed by residents of affordable housing units.

Other low density single family development is occurring. Large lot, higher value development does occur, although not in the numbers as lower value units. Large lot rural developments attract those individuals who are attracted to a more rural lifestyle, but who do not wish to have substantial acreage. Although these individuals are more able to afford the higher development costs associated with marginal lands, they are often unaware of environmental problems such as seasonal failures of mounded septic systems, the areas flooding potential, or how further alterations of natural drainage patterns can affect neighboring properties.

The other development activity occurring within, or adjacent to the Green Swamp includes major developments, planned unit developments, and Developments of Regional Impact. Map 3-3 & Figure 3-3 depict developments proposed within and in close proximity to the Green Swamp. Some of these developments are legitimate proposals to meet perceived market needs in the immediate vicinity. Other developments are highly speculative proposals which focus on areas of very low land values, and attempt to create additional value through regulatory approvals.

These developments are proposed, in part, to the response to continuing development activity in the Orlando area, Lakeland, and eastern Lake County. Several of these developments are very large. Lexington Park, a new town proposed north of Lakeland is a 10,000 acre site for a community of 40,000 residents. Southlake, in Lake County, is an approved DRI for 8,000 single family residential units. Many

of the other planned unit developments are for smaller single family subdivisions. Several developments are resort oriented. These include All Seasons Resort and Orlando Vacation Resort.

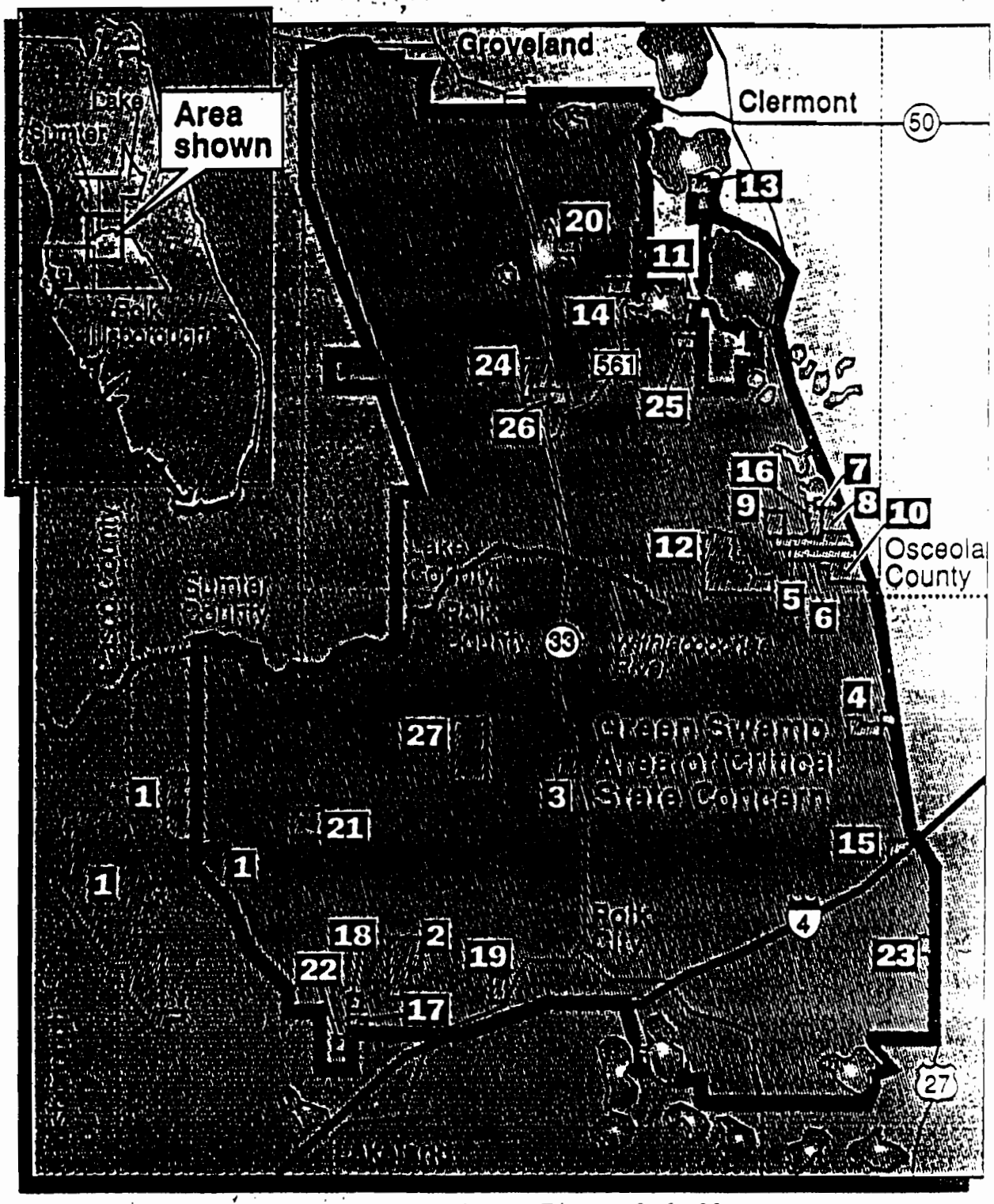
As with any area of lower value property in the vicinity of areas of substantial development activity, the Green Swamp will continue to attract development proposals. Some will reflect pressures for the extension of development of immediately adjacent urban areas. Many may be more speculative proposals for lower value, environmentally sensitive lands. These proposals will have a more difficult regulatory climate consistent with Florida's growth management activities. Under the current system, much of the actual development which could occur, will be a continuation of the low density residential development which is so common at this time. The appropriateness of existing land development regulations in addressing the real environmental constraints and values within the Green Swamp must be a priority. All land development activity can be expected to meet the minimum development regulations enforced within the jurisdiction.

Previous to the printing of this report two projects, Corinthian Park and Westridge, had completed the appeal process with the Department of Community Affairs. Corinthian Park, which is located in Lake County, had it's administrative hearing pursuant to Chapter 120. Among the issues resolved were changes in densities and concerns about groundwater contamination by septic tanks. Westridge, located in the U.S. 27 corridor of Polk County, satisfied concerns expressed by the Department prior to going to hearing. Among issues resolved were changes in septic tank design.

Several additional projects within Polk County have been, or are expected to be, appealed by the Department. Issues raised include those previously mentioned, as well as, flooding potential, urban sprawl, and notification procedures.

Development in the Green Swamp

In May 1990, the state Department of Community Affairs assigned a person fulltime to monitor developments in the Green Swamp. Since then, the department has learned of the following developments that have been either approved by local government or proposed in the area of critical state concern, which covers only about half the swamp.



Source: St. Petersburg Times 9-1-91

Figure 3-3 Table of Large Scale Developments

LARGE SCALE DEVELOPMENTS

1. Lexington Park is a proposed DRI for 20,000 dwelling units for a potential population of 40,000. It is also proposed to have 8,876,250 square feet of commercial and industrial space. Following denial of the project by CFRPC in November 1991 the two smaller, northeastern parcels were auctioned.

2. Scandinavia USA, previously called The Trails, has been approved by Polk County. This project proposes 1,061 dwelling units and 54,000 square feet of commercial space on 1,020 acres. It is located north of Old Polk City Road. Six single family residences have been built.

3.* Buck Hill proposes 55 residential units on a total of 212.7 acres west of state Road 33, north of Dean Still Road.

4. Westridge was approved for 448 residential units on 221.5 acres west of U.S. Highway 27. The development is in the process of being platted.

5. All Season's Resort is located in Lake County and was approved for 438 RV lots on 63 acres. The project is built-out.

6. Orlando Vacation Resort is approved for 233 vacation residences on 55 acres. The project is built-out.

7. Lake Groves Utilities is on 85 acres and is approved for public utilities that include a fire and police station. This development will not be completed until the Greater Groves subdivision is built.

8. Greater Groves is a project that consists of 455 single family, residential units and 150,000 square feet of commercial space on 223 acres. The project is platted and construction is underway.

9. Corinthian Park is a project of 80 single family, residential units on 108 acres.

10. Southlake is an approved DRI consisting of 8,000 residential units with 200,000 square feet of commercial space on 617 acres. The project has not begun development.

11. Lake Nellie Oaks is a project approved for 26 residential units on 61 acres. The project has not begun development.

12. Roy Ranch is a 900 acre project originally approved for 900 units. The developer as reapplied with a reduction in density to 795 units and 50,000 square feet of commercial space.

13. Gem O' the Hills is a 95 acre project of which 35 are submerged. This is an approved PUD for 195 residential units and associated amenities. This PUD has not started development.

14. Lake Giona Shores is a 35 single family, residential subdivision approved but not recorded. The 35 units are to be locate on 27 acres.

15. Seidman Property is a 32 acre property rezoned in 1991 for an outlet mall. This project has not been developed.

16. Lake Ridge is a 143 acre project proposed for 346 residential units. It has approval for Phase I, which has 37 lots recorded.

17. Sherwood Forest is a 116.9 acre project approved for 213 residential units.

18. Glen Ridge Phases 1 & 2 is a proposed project of 163 residential units on 59 acres. Phase I has been platted and approximately 75% developed.

19. Country Trails is a 246 acre project proposing 273 units in four phases. This project is platted.

20. Pine Island Estates is a 13 acre project proposing 7 residential lots on 13 acres. This project has been approved but not platted or developed.

21. Saddlewood Estates Phase I is a project proposed for 116 residential units on 149 acres. The project is unconstructed.

22.* Hunter's Ridge is a proposed project for 49 residential units on 18.7 acres. The project has not been developed.

23. Ridge Haven (La Casa Del Sol) is a project platted for 309 residential units on 140 acres.

24. Green Grove Estates is a project consisting of 118 single family, residential units on 700 acres. This project has not been constructed.

25. Lavender Hills is a project that has been approved but not platted for 20 residential units on 10 acres.

26. Donald Bronson Trust is a 240 acre project proposing 42 units on lot a minimum of 5 acres.

27.* Paradise Country Estates is a project proposing 360 residential units on 1,284 acres. This project has not been developed.

Additional Projects:

Evans Acres is a recorded subdivision of 1,280 acres. This subdivision originally has 92 lots however, it has been subdivided into 172 lots.

* Deer Trails North II is a 77.7 acre project proposing 64 residential units. No development has taken place.

Double Diamond is a 24 acre project, located east of Ct. Rd. 33 just south of the Lake County line. It is proposing 17 units, however no construction has taken place.

* Lake Lettuce Estates I is a 24.6 acre project proposing 35 dwelling units. No construction has taken place.

Nottingham is a 34.2 acre project of 84 residential units of which most are built. It is located near Polk City.

* Manors of Nottingham is a 25.5 acre project proposing 54 most are built. residential units. Some lots have structures.

* Nottingham Trails is an unconstructed 37.9 acre project proposing 60 dwelling units.

Sunshine Groves is a 110 acre residential subdivision containing 232 lots located 2 miles east of Polk City.

Timberidge is a residential development located off Old Polk City Road a half mile west of Moore Road. It is planned for 292 residential units on 144 acres.

* Turkey Creek is a 170 acre project proposing 57 units. It is located north of Dean Still Road, west of Ct. Rd. 33.

The Woods Ranching and Farming Tracts is 668 acres and is platted for 205 residential units with 136 developed.

* Yearling Trace is a 544 acre project north of Fussel Road, east of Ct. Rd. 33 that proposes 108 residential units.

* Indicates projects under appeal by The Department of Community Affairs at the time of print

ACQUISITION - HOW

Summary of Land Acquisition Program Funding Sources

Funding for the acquisition of conservation and recreation lands is available through several state, federal, and local governmental programs, as well as through the many nonprofit land conservation organizations. These programs differ in their primary purposes, but share substantially similar program goals and objectives (see Figure 3-4 Funding Sources and Figure 3-5 Comparison of Objectives of Acquisition Programs).

The Florida Statewide Land Acquisition Plan (FSLAP) Technical Report included an extensive review of the numerous programs in existence as of 1986. New programs established since then include: the Florida Recreational Trails Program (including the Rails to Trails component); the inholding and additions programs of the Florida Game and Fresh Water Fish Commission, the Division of Recreation and Parks, and the Division of Forestry; the Florida Communities Trust Program; and several local acquisition programs. Although primarily focused on water quality and quantity studies and remedial actions, the Surface Water Improvement and Management (SWIM) Program is another post-1986 program that may also serve as a source of funds for the acquisition of conservation lands.

Some programs which were described in the 1986 FSLAP Technical Report have expended all of their funds and thus are no longer viable programs (e.g., Environmentally Endangered Lands [EEL] Program). The Save Our Coast Program has a small amount of funds remaining, but most of these funds are committed under option contracts or purchase agreements. Figure 3-6 provides an historical synopsis of the state's primary land acquisition programs, while the FSLAP Technical Report includes brief descriptions of these programs.

The following represents a concise summary of Florida's major acquisition programs that could potentially provide funding for land acquisition within Polk County. This summary is organized according to the level of government that has primary administrative responsibility. For easy comparison, Figure 3-4 includes a synoptic overview of the major features of most of the state's acquisition programs. A summary of local government programs is also provided in this section to illustrate the various funding mechanisms currently being utilized.

Federal Programs

Florida receives federal Land and Water Conservation Fund (LWCF) allocations for conservation and recreation acquisition via the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the National Park Service. During the 1980s the average annual LWCF appropriation to these agencies for Florida acquisition projects was $10 million. LWCF also funds local government projects through a state administered program.

Figure 3-4

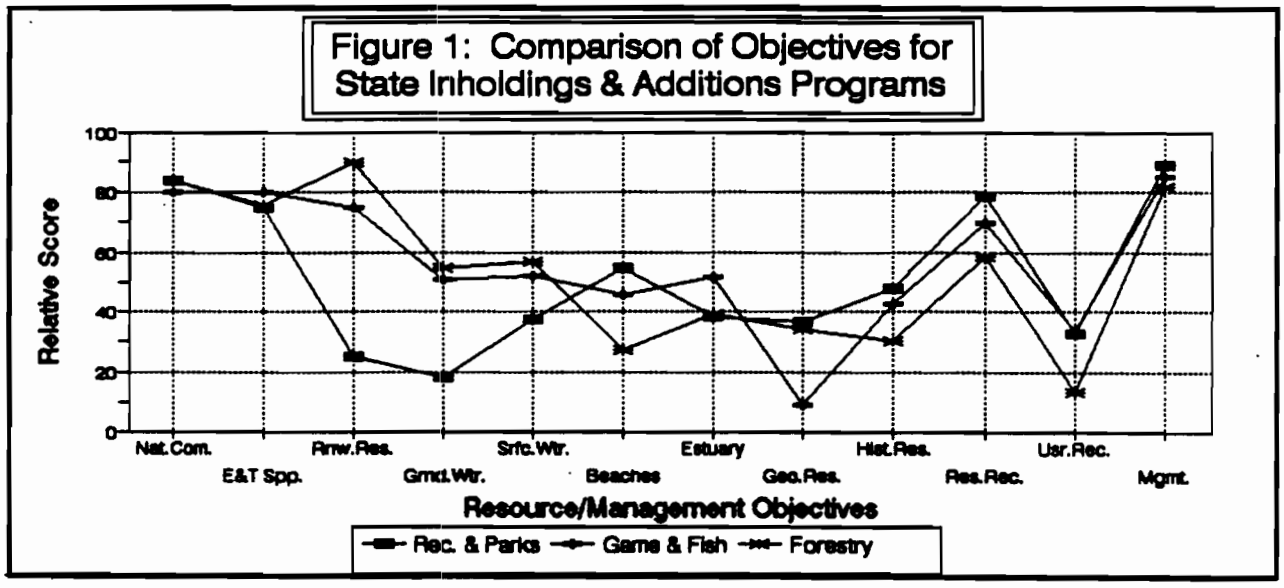
Comparison of State Acquisition Programs

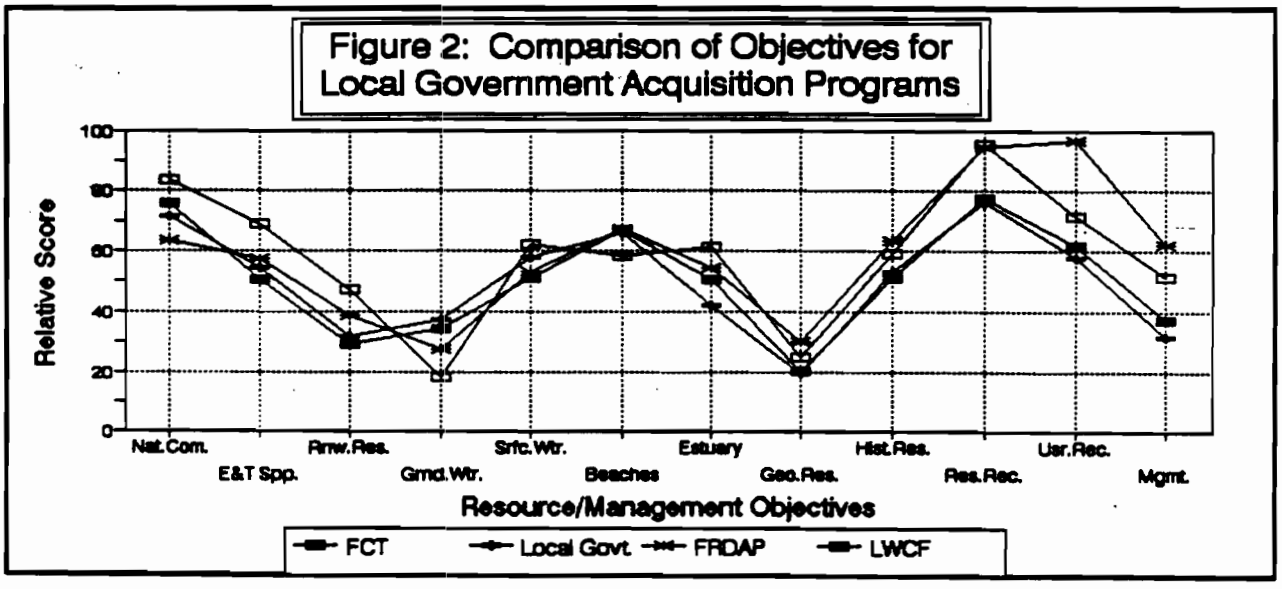
PROGRAM	AGENCY	FOCUS
CARL	DNR	Acquisition of environmental, recreational, and archaeological & historic lands and sites -- including statewide or regionally significant parks, forests, wildlife management areas, etc.
LATF		- Acquisition of outdoor recreational lands and sites managed by DNR's Division of Recreation and Parks (DRP). - Additions and inholdings to DRP managed lands.
FRDAP		Grants to local governments for land acquisition and development to provide outdoor recreational opportunities to the public.
LWCF		
Recreational Trails		- Acquisition of abandoned railroad ROW for multi-use recreational trails. - Acquisition of abandoned railroad ROW and Florida National Scenic Trail.
589.07, F.S.	DOF	- Acquisition of forestry tower sites, work centers, and additions & inholdings to state forests. - Additions and inholdings to DOF managed lands. - Acquisition of lands in furtherance of outdoor recreation and natural resources conservation.
372.12, F.S.	GFC	Acquisition of habitats for threatened species, inholdings critical to the management of existing GFC-controlled lands, public access to existing public fish and wildlife resource lands for fish and wildlife oriented outdoor recreation.
372.074, F.S.		- Additions and inholdings to GFC managed lands. - Acquisition and management of lands for the conservation of fish and wildlife.
SOR	DER & WMDs	Acquisition of fee or other interest in lands necessary for water management, water supply and the conservation and protection of water resources.
FCT	DCA	Assist local governments in implementing conservation, recreation & open space, and coastal elements of comprehensive plans -- including but not limited to: redevelopment projects, resource enhancement projects, urban restoration projects, and site reservations.

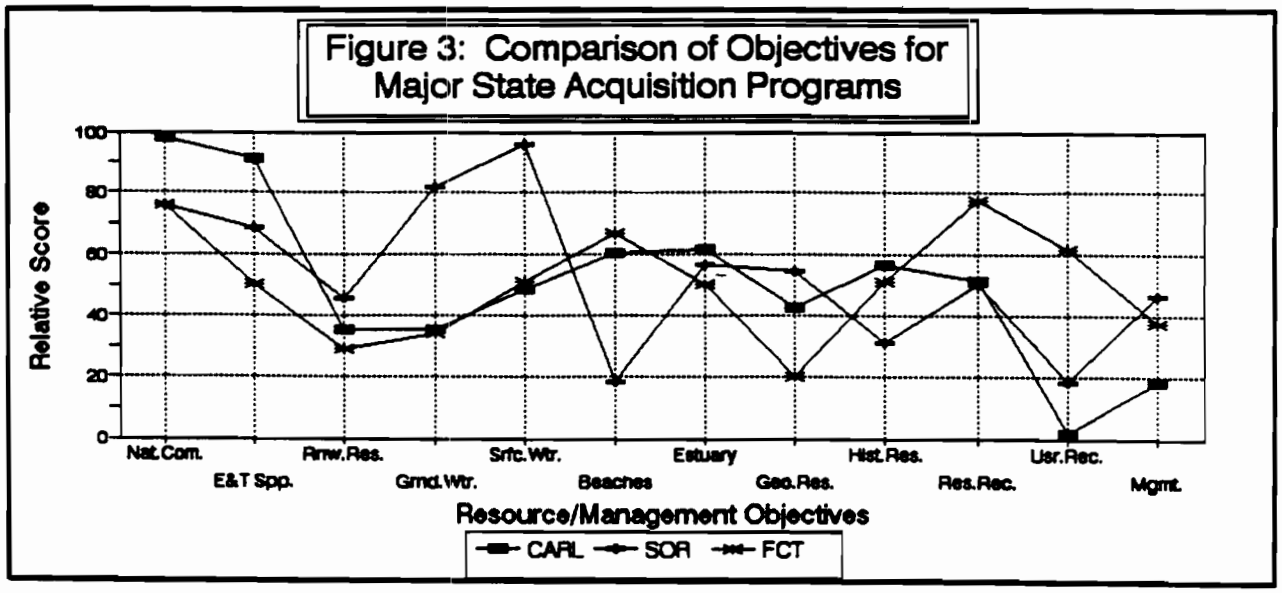
FUNDING SOURCES
- Documentary stamp taxes (DOC stamps) and phosphate severance tax: $50 million average projected total per year from FY 1989-90 through FY 1994-95 (through CARL Trust Fund). - P-2000 Bonds: $150 million per year (additional acquisition criteria apply through P-2000 Trust Fund).
- DOC stamps: $1 million to $1.5 million per year during 1980's (LATF funding not allocated in 1990; alternative funding under P-2000 -- see below). - P-2000 Bonds: $8.7 million per year (restricted to inholdings & additions).
- DOC stamps: $3.5 million per year (through LATF).
- Federal: 1989-90 - $582,318; 1990-91 - $900,000 to $1 million.
- 1987: Infrastructure Trust Fund = $3 million; 1989: LATF = $1 million (Rails to Trails). - 1990-92: P-2000 Bonds = $3.9 million per year.
- Proceeds, in part, from forestry operations and sale of obsolete tower sites (through Incidental Trust Fund): $70,000 per year. - P-2000 Bonds: $8.7 million per year (restricted to inholdings & additions). - Up to 10% of funds derived from State Forest operations.
- Federal funds through Pittman-Roberts Wildlife Restoration Act, and state funds through sale of management area permits and other special permits: Combined = $300,000 per year.
- P-2000 Bonds: $8.7 million per year (restricted to inholdings & additions). - Donations, grants, and development of regional impact (DRI) wildlife mitigation contributions (via Fish and Wildlife Habitat Trust Fund) and legislative appropriations.
- DOC stamps: $42 million average projected total per year from FY 1989-90 through FY 1994-95 (through Water Management Lands Trust Fund). - P-2000 Bonds: $90 million per year (additional acquisition criteria apply through P-2000 Trust Fund; also, P-2000 funds may be used to acquire lands under SWIM Program).
- Funds derived from operation, sale, lease or other disposition of lands, water areas, and related resources & facilities acquired or constructed under enabling legislation (through Florida Communities Trust Fund). - % of funds from sale of environmental license plates (through Florida Communities Trust Fund). - P-2000 Bonds: $30 million per year (additional acquisition criteria apply through P-2000 Trust Fund).

Source: LAPIC June 1991

FIGURE 3-5







Source: LAPIC June 1991

FIGURE 3-6

HISTORY OF FLORIDA'S MAJOR LAND ACQUISITION PROGRAMS FOR CONSERVATION AND RECREATION PURPOSES

YEAR	PROGRAM/ACTION	FUNDING SOURCE	AMOUNT[1]
Pre-1963	No programs	Line-item appropriations for specific projects	< $2MM total pre-1963
1963	Outdoor Recreation & Conservation = Land Acquisition Trust Fund (LATF)	5% tax on outdoor recreation clothing & equipment	$1.5MM/yr
1968	LATF funding base switched & recreation bonds sold	- Documentary Stamps - Gen. Obligation Bonds	-$1MM/yr[2] - $20MM
1972	Land Conservation Act = Environmentally Endangered Lands (EEL) & Outdoor Recreation bond programs	- EEL Bonds - Recreation Bonds (Debt service for both programs funded in 1990 by Infrastructure Fund)	-$200MM -$40MM
1979	Conservation & Recreation Lands (CARL) Act	Severance taxes on mineral extractions (primarily phosphate)	$15MM/yr to $40MM/yr
1981	Save Our Coast bond program	Debt service funded by % of LATF proceeds	$275MM
	Water Management Lands Trust Fund = Save Our Rivers	Documentary Stamps	$30MM/yr to $40MM/yr
1987	CARL funding base switched & CARL bonds authorized	- Documentary Stamps - Phosphate Severance - Bonding authority	-$40MM/yr -$10MM/yr -$35MM[3]
1990	Preservation 2000 Act = funding for several programs	Debt service funded by Documentary Stamps via LATF bonding authority	$300MM/yr for 10 years

Source: LAPIC June 1991

NOTES:

[1] Values represent average annual appropriations or estimates of amounts to be generated via bonding to acquire recreation and conservation lands.

[2] Based on disbursements for FYs 1968-81, minus 1968 & 1972 bond funds.

[3] CARL bonding authority allows up to = $200 million; only $35 million has been utilized thus far.

The Federally administered portion of LWCF is primarily used to acquire inholdings and additions for federally managed lands, although new federal proposals are funded as well. LWCF projects receive funds through specific appropriations by the U.S. Congress. Recent LWCF projects in Florida include: Pinhook Swamp addition to the Osceola National Forest; Silver Glen Springs addition to the Ocala National Forest; additions to Key Deer, Crocodile Lakes, and Lower Suwannee National Wildlife Refuges, and to Everglades National Park and Big Cypress National Preserve; and acquisitions within the recently approved Timucuan Ecological and Historical Preserve and the Florida Panther National Wildlife Refuge.

The U.S. Fish and Wildlife Service recently approved a project for the Lake Wales Ridge that includes several tracts of land in Polk County. This project was identified recently as their number one project in the entire United States. Thus, federal funding should be anticipated in the next few years.

State Programs

The State of Florida administers several programs that acquire lands for conservation and recreation purposes. Most of these are primarily focused on acquiring lands for management by state agencies, although acquisition for local governmental purposes are common.

Developed in 1979 to replace the $200 million Environmentally Endangered Lands (EEL) bond program, Conservation and Recreational Lands Program (CARL) has developed into America's premier state land Acquisition program. From 1980 to 1990 more than 181,000 acres were protected under CARL at an approximate cost of nearly $356 million. Funding in recent years has primarily originated from documentary stamp taxes ($40-45 million annually) and from severance taxes on phosphate mining ($10 million annually). With an augmented Preservation 2000 (P2000) income of $150 million per year, CARL funding could amount to more that $200 million annually for 1990-1999 if P2000 continues to be funded.

Although the CARL program is rather broad in scope, it is especially oriented to acquiring natural areas of statewide or regional significance. These may include: recreational lands; forests; wildlife management areas; and historic, archaeological and geological sites. Although Lake Arbuckle is the only CARL acquisition in Polk County thus far, the state is currently negotiating two other projects within the County: Catfish Creek and Saddleblanket Lake Scrub. The 1992 Carl Priority list also includes two other projects in Polk County; Lake Wales Ridge Ecosystem and Horse Creek Scrub.

Although the CARL Program is notable for developing projects in conjunction with other entities, it has received criticism for joint acquisition procedures that are so complicated that potential cooperators may be discouraged from participating. The Bureau of Land Acquisition within Florida's Department of Natural Resources (DNR) attributes much of this criticism to the large number of requests for cooperative acquisitions combined with the limited funding available for these projects. In fact, the number of requests for cooperative acquisition agreements between the CARL Program and other entities increased to such a degree that DNR implemented policies and procedures to established priorities for acquiring cooperative projects.

The 1990 Florida Legislature enacted the Florida Preservation 2000 (P2000) Act to augment funding for existing land acquisition programs, and as the primary funding source for several new programs. The new programs include: the Florida Communities Trust; the Florida Recreational Trails; the Surface Water Improvement and Management (SWIM); and the inholdings and additions programs of the Division of Recreation and Parks, the Florida Game and Fresh Water Commission, and the Division of Forestry. As envisioned, P2000 is a bonding program that would raise $300 million annually over the next ten years. According to the formula now employed, each series of P2000 bond funds would be distributed as follows:

50.0%- Conservation and Recreation Lands Trust Fund (CARL);
30.0%- Water Management Districts (SOR & SWIM);
10.0%- Florida Communities Trust;
2.9%- Div. Recreation & Parks (inholdings and additions);
2.9%- Game and Fish Commission (inholdings and additions);
2.9%- Div. Forestry (inholdings and additions); and
1.3%- Florida Rails to Trails and National Scenic Trail.

At present, P2000 funding is contingent on annual appropriations of bond debt service by the Legislature because no dedicated funding source was included in the bill. Instead, P2000 bonds were intended to be funded by annual increases in documentary stamp tax revenues. The anticipated increase in these revenues did not occur in 1991, which resulted in intense competition for limited general revenues. In response to this situation, the 1991 Legislature amended the P2000 Act to declare"... its intent to identify, no later than May 1992, a permanent source of funds to dedicate for the implementation of the Florida Preservation 2000 Act and to discontinue the issuance of bonds upon identifying and dedicating that source" [ss. 259.101(2), Florida Statutes]. Future funding for this program is in jeopardy. At the time of printing (June 1992), the 1992 Legislature is in special session resolving budget issues.

The Florida Legislature created the Water Management Lands Trust Fund in 1981 to promote the acquisition and restoration of lands significant to the protection of water resources. This trust fund is better known as the Save Our Rivers (SOR) Program.

Funded by a percentage of the documentary stamp tax, this program distributed nearly $45 million to Florida's five regional water management districts (WMDs) in 1989. P2000 provides approximately $90 million per year in additional acquisition monies to fund SOR projects, as well as land acquisitions necessary for implementation of the Surface Water Improvement and Management (SWIM) Program. Southwest Florida Water Management District (SWFWMD) receives 25% of these funds or approximately $33.75 annually if the Preservation 2000 program continues at current funding levels.

From 1981 through 1990, the SWFWMD has invested $62.6 million to purchase over 55,000 acres of water management lands. Notable examples of water resources protected to some degree through SOR acquisition are: Hillsborough River, Withlacoochee River, Green Swamp Riverine Corridor, Flying Eagle Ranch, Carlton Tract, Potts Preserve. At the time of printing of this report, SWFWMD is in the final phases of purchasing the 25,000 acre Agri-timber Tract which fills in the hole in Pasco County shown on Map 1-1. Local governments contributed over $800,000 to help acquire water management lands. Some of these projects were co-operative acquisitions involving federal, state, local, and non-profit organizations.

The Land Acquisition Trust Fund Program (LATF) was developed within DNR during the 1960's primarily to fund acquisitions of inholdings and additions to state parks, recreation ares, and special feature sites. However, LATF also acquires new state and local parks and recreation areas. Lake Kissimmee State Park was an LATF acquisition in Polk County.

Funded by a percentage of documentary stamp tax revenues, this program averaged $1 million per year in park land purchases during the 1980s. LATF allocations for this purpose were not made in 1990 or 1991, primarily because of new P2000 funding. If P2000 continues to be funded, DNR's Division of Recreation and Parks could receive approximately $8.7 million annually. However, these funds may be used to acquire only inholdings and additions to lands managed by the Division (see Figure 3-5 Comparisons of State Acquisition Programs). Similarly, P2000 provides approximately $8.7 million annually to each of the state's two other primary management agencies (i.e., Division of Forestry, and Florida Game and Fresh Water Fish Commission) to acquire inholdings and additions to lands that they manage. Each of these agencies has developed policies and procedures to identify parcels to be acquired with P2000 funds. In most cases, the lands being acquired will be valued at less than $500,000.

Larger acquisitions and lands that do not qualify as inholdings or additions primarily will be directed to CARL, SOR, and other programs.

Although authorized under S. 589.07, Florida Statutes, to use a portion of the proceeds of State Forests to acquire lands, the Division of Forestry seldom received appropriations from the legislature for such purposes. Therefore, P2000 funding greatly increases Forestry's ability to acquire inholdings and additions.

The Florida Game and Fresh Water Fish Commission (FG&FWFC) has five programs in addition to their P2000 inholdings and additions program. These five programs generally are not restricted to acquiring only inholdings and additions, although inholdings and additions to GFC-managed lands are often a priority. Federal funds received under the Pittman-Roberts Wildlife Restoration Act and 30% of the proceeds from the sale of special wildlife permits may be used to acquire lands for the protection of wildlife resources. Combined, these two programs raise about $300,000 annually. Other GFC acquisition programs include mitigation parks, conservation easements, and the newly created Fish and Wildlife Habitat Trust Fund (see Figure 3-5 Comparison of Objectives of Land Acquisition Programs).

Various regulatory programs now require mitigation for the destruction of wetlands or critical wildlife habitat. Water management districts, local governments, the Florida Department of Environmental Regulation, and the U.S. Corps of Engineers may require the protection and/or creation of wetlands in order to offset the effects of wetlands destruction. In some cases mitigation for wetlands loss is accomplished through the off-site acquisition of protective buffers to naturally functioning wetlands. Similarly, the U.S. Fish and Wildlife Service and the Florida Game and Fresh Water Fish Commission (GFC) may require a set-aside of uplands, conservation easements, or the acquisition of equivalent off-site properties through an "incidental take permit" for the destruction of endangered or threatened species or their habitat.

Florida's Development of Regional Impact review and permitting process now requires specific comment on these issues. Local governments are encouraged to require developers to either reserve important habitats on-site or contribute funds to acquire similar lands off-site to mitigate for ecological impacts. In addition or ancillary to habitat mitigation, at least 16 counties and 33 cities use development impact fees to fund park acquisition and/or management.

As a result of the above, "mitigation parks" or "mitigation banks" have been established in the Withlacoochee Regional Planning Council (RPC) and the Northeast Florida RPC, and another is being planned for the East Central Florida RPC. The Trust for Public Lands and the Nature Conservancy have been instrumental in assisting the GFC and the RPC's in the development of mitigation parks. Additionally, the Fish and Wildlife Habitat Trust Fund was legislatively established in 1990 within the GFC largely to facilitate off-site mitigation programs.

The Florida Department of Transportation (FDOT) under the Right of Way Acquisition Program cooperates with other state and local agencies to acquire lands for conservation and recreation purposes in three ways. First, FDOT may acquire replacement property for property acquired for a transportation project as a means of mitigating environmental impacts. FDOT may use condemnation in this capacity. However, their eminent domain power is limited statutorily and is strictly construed against the condemning authority. Therefore, mitigation by this means is difficult and, because FDOT must pay all attorney fees and court costs in eminent domain proceedings, is considered an extremely expensive method of acquiring lands for conservation purposes.

Second, FDOT may facilitate the acquisition of conservation lands through severance damages. These are damages which are caused to the remaining property as a result of severing a portion of the property from the original parent tract. Severance damages often result from loss or diminution of ingress or

egress or change in shape, size or configuration of the remaining property. In some cases, FDOT has cooperated with other agencies to acquire, for conservation purposes, remainder lands which have been damaged as a result of a transportation project (e.g., Big Cypress Addition).

Third, FDOT has acquired portions of abandoned rail corridors with the intent to bank this property for future transportation needs. In some instances, a corridor may be leased back or sold to other agencies for interim or permanent use as bicycle trails or for other recreational uses. In this regard, Section 260.0161, Florida Statutes, requires FDOT and DNR to coordinate their evaluation for acquisition of potential abandoned rail rights of ways.

Established by the 1963 Florida Legislature, FRDAP is a local government grant program administered by DNR's Division of Recreation and Parks. FRDAP provides matching funds to eligible local governments on a competitive basis for the development of outdoor recreation facilities and the acquisition of lands for outdoor recreation purposes. Funded by a percentage of documentary stamp tax revenues, this program averages $2 - 3 million annually for park development and land purchases.

Established in 1965 by the federal government, the LWCF Local Assistance Program is equivalent to the FRDAP, since it is administered by the same staff and operates under equivalent administrative procedures. Funding for the LWCF grants program is generally around $800,000 to $1 million annually.

Established in 1989 by the Florida Legislature and reenacted in 1991, the Florida Communities Trust (FCT) was created to help local governments fund activities and projects to implement the conservation, recreation and open space, and coastal elements of local comprehensive plans, or to otherwise help local governments to conserve natural resources and resolve land use conflicts.

The FCT receives revenues from: (1) the operation, management, sale, lease, or other disposition of land, water areas, related resources, and facilities acquired or constructed under FCT; (2) 25% of the proceeds from the sale of Florida panther license plates; (3) donations, grants, loans, and other aid; and (4) 10% of P2000 bond funds. At this time, the primary funding source for FCT is the $30 million that will be distributed annually from P2000 if that program continues to be funded and if the distribution formula is retained.

P2000 funds allocated to the FCT may be used to make grants and loans to local governments for the "...acquisition of lands in furtherance of outdoor recreation and natural resources conservation" [ss. 380.510(7), Florida Statutes]. Half of FTC's P2000 revenues must be matched by local governments on a dollar-for-dollar basis. Local governments may use federal grants or loans, private donations, or environmental mitigation funds for part or all of the required matching funds. P2000 also specifically allows the FCT to purchase lands on the CARL, LATF, or Save Our Coast (SOC) priority lists.

Although P2000 lands acquired under the FCT program must first be vested in the Board of Trustees of the Internal Improvement Trust Fund (i.e., Governor and Cabinet), unlike CARL, title to FCT lands may subsequently be transferred to a local government, nonprofit organization, or other entities. Transfers of this nature, however, must include "...such covenants, reverter clauses, or other restrictions as are sufficient to protect the interest of the people of Florida" [380.510(3)(b), Florida Statutes].

The Florida Recreational Trails Act of 1979 established within DNR's Division of Recreation and Parks a program to "...provide the means and procedures for establishing and expanding a network of recreational and scenic trails..." [ss. 260.012(1), Florida Statutes]. Recreational trails are intended to encourage horseback riding, hiking, bicycling, canoeing, and jogging. In 1987 the legislature amended the Act to establish the Florida Rails to Trails Program for the purposes of acquiring and developing abandoned railroad rights-of-way for public recreational trail use. The Rails to Trails Program received a $3.175 million appropriation in 1987 and an additional $1.0 million appropriation in 1989. P2000 provides approximately

$3.9 million annually for this program and "...to assist in the acquisition of the Florida National Scenic Trail..." [259.101(3)(g), Florida Statutes].

Subsection 260.0161(2), Florida Statues, requires DNR and FDOT to coordinate their annual acquisition lists for rail abandonments. This is accomplished via a Memorandum of Agreement which directs the agencies to jointly develop annual acquisition lists, thus avoiding competition for the same rights-of-way. Rails to Trails acquisitions thus far include: (1) Gainesville to Hawthorne, (2) Gulf Junction to Inverness, (3) Inverness to Owensboro, and (4) Polk City to Mabel.

Local Government Programs

In addition to state administered local assistance programs (see Figure 3-7), at least fourteen counties and one city are currently engaged in land acquisition programs specifically for conservation and recreation purposes. An additional four counties have acquisition programs pending (See Figure 3-8). Funding for county land acquisition programs is derived from a variety of sources available to local governments in Florida. The most common revenues utilized are bonds and ad valorem (property) taxes, or some combination of the two, with voter-approved referenda constituting the most popular source. Other revenue sources include: local option sales taxes; extraordinary millage; and impact and mitigation fees (see Mitigation..., Figure 3-4 Land Acquisition Funding Sources). The level of funding for these county land acquisition programs varies, ranging from $2.5 million to $100 million. Currently active programs include the following:

Brevard County adopted $30 million program in 1984 for acquisition of lands adjacent to the beach and inland waterway. In 1990, voters approved an additional $55 million bond issue supported by a 0.25 mill ad valorem tax for 20 years. These funds may only be used for "environmentally endangered lands." Joint CARL projects are anticipated, as three projects on the 1991 CARL priority list are within Brevard County.

Broward County approved a $75 million capital improvement program in 1988 for acquiring environmentally sensitive lands. Some of these funds were used to match SOR and CARL funds.

Dade County voters approved a referendum to fund the acquisition, restoration, and management of environmentally endangered lands. An extraordinary 0.75 mill ad valorem tax was approved for a two-year period to fund their program which will generate an estimated $90 million in 1991-92. The county hopes to obtain matching funds from CARL, SOR, and other programs. Dade also plans to establish a permanent management trust fund of several million dollars, using the interest earned on this account to manage and restore lands acquired.

Flagler County adopted a $20 million bond issue in 1988, supported by a 1/3 mill ad valorem tax. The county has purchased recreation sites and developed joint land acquisition projects with the SJRWMD.

Hillsborough County adopted a $21 million bond issue in 1987 financed by a 0.25 mill ad valorem tax for 20 years. The issue was extended to $100 million in 1990. Hillsborough funds may be used "...for lands which have environmentally unique, irreplaceable, and valued ecological resources." Hillsborough has already received matching funds from CARL and anticipates additional matching funds from CARL, SOR, and other programs.

Lee County voters approved a 0.25 mill increase in ad valorem taxes to raise approximately $2.5 million annually for acquiring environmentally sensitive lands. Lee is currently cooperating with SFWMD and CARL to acquire lands in the Corkscrew Swamp watershed.

Manatee County does not have an ongoing program, but has raised $25 million locally for matching CARL purchases.

Marion County adopted a $20 million bond issue in 1988, supported by a 0.5 mill ad valorem tax for 30 years. The funds may be used for environmentally sensitive lands, recreation areas, and water recharge areas. Local funds were recently used to help acquire Rainbow River, and plans are underway for additional CARL and SOR matches.

Martin County approved a $20 million bond issue in 1989, financed y a 0.625 mill increase in ad valorem taxes for 20 years. The funds may be used as follows: $12.5 million for open space, $5 million for community parks, and $2.5 million for contingency funds. Martin County has developed joint projects with CARL, SOR, and SOC programs.

Monroe County implemented in 1987 the Monroe County Land Authority, a land acquisition program sanctioned by the legislature under Chapter 380, Florida Statutes. The legislation provides a special resort tax and a special state park surcharge to fund land acquisitions for several purposes, including the protection of natural resources.

Palm Beach County approved a $100 million bond is in March 1991 to acquire and protect up to 14 sites containing endangered and threatened species and important natural communities. Palm Beach County hopes to receive matching funds from CARL and other programs for several of these sites.

Pinellas County adopted a local option sales tax in 1990. Included in the package was $65 million for land acquisition for 15 sites over a 10 year period. These sites were selected for environmental, recreational, and other unique features.

Seminole County voters approved a $20 million bond issue backed by a 0.25 mill ad valorem tax increase in November 1990. They plan to acquire park sites and jointly fund CARL and SOR projects.

Volusia County adopted a $20 million bond issue in 1986, supported by a 0.25 mill ad valorem tax for 30 years. Volusia has developed cooperative projects with SOC, SOR, CARL, National Park Service, and area cities. Volusia's funds may be used for parks, recreation areas, water recharge areas, and "endangered lands."

City of Boca Raton also has a land acquisition program that consists of a $12 million bond issued from a .250 mill of ad valorem tax.

FIGURE 3-7

ACTIVE COUNTY LAND ACQUISITION PROGRAMS

County	Revenue Amount	Revenue Source	Proposed Land Use	Potential Partners
Brevard	$55 million bond issue	.250 millage ad valorem tax	Environmentally endangered lands	CARL
Broward	$75 million (substantially spent)	.250 millage ad valorem tax	Parks and open spaces	SOC, CARL
Dade	$90 million ad valorem	2 year .75 millage ad valorem tax	Acquisition and restoration of environmentally sensitive lands	CARL, SOR, SOE
Flagler	$7.8 million bond issue	.330 millage ad valorem tax	Recreation and water recharge	WMD, CARL
Hillsborough	$100 million bond issue	.250 millage ad valorem tax	Environmentally unique and irreplaceable lands	CARL, WMD
Lee	$2.5 million annual appropriation	Ad valorem taxes	Endangered uplands	CARL
Manatee	$25 million bond issue	Raised locally	Conservation lands	CARL
Marion	$20 million bond issue	.500 millage ad valorem tax	Environmentally sensitive lands, recreation areas, and water recharge areas	CARL
Martin	$20 million bond issue	.625 millage ad valorem tax	Open space, parks and contingency	CARL
Monroe	$1 million annually	Resort tax and State Park surcharge	Critical areas of Concern approx. 50% for Key West - 50% for the county	SOC, CARL, FCT
Palm Beach	$100 million bond issue	.250 millage ad valorem tax	Native ecosystems	CARL
Pinellas	$68 million ($5 million for a specific RTT site)	$.01 local sales tax	Environmentally unique land and recreation sites	CARL, RTT
Seminole	$20 million	.250 millage ad valorem tax	Conservation and park lands	CARL, WMD
Volusia	$20 million bond issue (majority of this has been spent)	.250 millage ad valorem tax	Parks, recreation, water recharge areas and endangered lands	SOC, SOR, CARL, NPS and local cities
City	Revenue Amount	Revenue Source	Proposed Land Use	Potential Partners
Boca Raton	$12 million bond issue	.250 millage ad valorem tax	Environmentally sensitive lands	CARL, FCT

Abbreviations:

CARL	Conservation and Recreation Lands
FCT	Florida Community Trust
NPS	National Park Service
RTT	Rails to Trails
SOC	Save our Coasts
SOE	Save our Everglades
SOR	Save our Rivers
WMD	Water Management Districts

FIGURE 3-8

PENDING LAND ACQUISITION PROGRAMS

County	Revenue Amount	Revenue Source	Proposed Land Use	Potential Partners
Citrus	9 million	$.05 sales tax for 3 years	Conservation lands	WMD, CARL
Collier	40 million bond issue	.250 millage ad valorem tax	Conservation lands	FCT, WMD, CARL, SOR, NPS
Indian River	28 million	.5 millage ad valorem tax	Conservation lands	FCT,CARL,WMD, USFWS
Orange	115.5 million	Portion of 3 year $.01 sales tax	Conservation lands & parks	SOR, CARL, FCT

Nonprofit Organizations

Private nonprofit organizations at both the state and local levels are very active in conservation and open space land acquisition and management in Florida.

The Florida Chapter of the Nature Conservancy has protected more than 450,000 acres of environmentally sensitive lands throughout the state since its inception in 1960. The Nature Conservancy currently manages 21 preserves in Florida. The Trust for Public Lands, since its founding in 1973, has been working to protect downtown parks, historic sites, rural wildlife habitat, and coastal wetlands throughout Florida. The Southeast Regional office of the Trust for Public Lands, based in Tallahassee, has protected over 78,000 acres in Florida. Both the Trust for Public lands and the Nature Conservancy have worked with state agencies, water management districts, and local governments to pre-acquire land for public ownership. The Audubon Society and the Sierra Club also own and manage several nature preserves in Florida.

At least thirteen local land trusts are currently operating in Florida (see Figure 3-9). Land trusts are community-based nonprofit organizations that manage and protect cherished local landscapes. Local land trusts are one of the most dynamic and effective sectors of local conservation movements. While the land trust movement in Florida is relatively young, land trusts will play an increasingly important role in working with local governments to develop land acquisition programs and in the implementation of the Florida Communities Trust Program. Florida's local land trusts recently organized into the Florida Land Trust Association to increase their effectiveness at both the local and state levels.

Comparision of Evaluation and Selection Procedures

Several methods exist for determining which lands to acquire. In general, these may be separated into two categories: point systems and gestalt selection. Point systems are often used in an attempt to avoid biases of the evaluator or to reduce the potential for "political gerrymandering" of acquisition priorities. However, unless point assignment factors are explicitly defined, biases and politics still can influence the scoring and, therefore, the acquisition priorities. Establishing criteria for assigning points can be largely a subjective matter. For example, if points are given for occurrences of endangered species, does a migratory species which spends only a few days on a site count as much as a breeding population? Similarly, would a site with one eagle's nest count as much as another site with two or three nests? To discriminate these kinds of situations requires a point system that is extremely complicated and overbearing.

Point systems also run into trouble when one tries to compare very different resources which may have equivalent importance values. For example, is a small isolated parcel of scrub with several endangered plants more important than a large tract of cypress swamp that provides habitat for black bears? How do you compare (i.e., establish point values) for groundwater recharge and outdoor recreation? Thus, the assignment of point values for the different types of resources is very subjective in most cases. In addition, unique occurrences may score poorly under a point system, scoring well in only one or two categories, but still be worthy of purchase.

In spite of these failings, once a point system is established it is the least subjective and most defensible method. Point systems are used by the FRDAP, the LWCF Local Assistance program, and the Florida Communities Trust Program. SWFWMD's evaluation process represents the pinnacle of point systems. They employ a geographical information system (GIS) that calculates weighted values for various resource considerations and plots these weighted areas, or various combinations of them, onto a map to identify potential acquisition areas and to establish priorities. Changing the weighting factors for the different resources and concerns changes the outcome which allows subjectivity to enter the process.

Figure 3-8

Florida's Local Land Trusts

Name of Land Trust	County
Alachua Conservation Trust	Alachua
Apalachee Land Conservancy	Leon
Barrier Island Land Trust	Franklin
Calusa Land Trust	Lee
Florida Keys Land and Sea Trust	Monroe
Indian River Land Trust	Indian River
Land Preservation Trust of Palm Beach Co.	Palm Beach
Land Trust of Dade County	Dade
Lemon Bay Conservancy	Lee & Sarasota
Osceola Land Trust	Osceola
Southwest Florida Land Preservation Trust	Collier
Swamps, Incorporated	Hillsborough
Volusia Land Trust	Volusia

Source: LAPIC June 1991

The gestalt system is more difficult to define because it is much more subjective. Under this system resource professionals are asked to compare projects and place them in priority order based upon their general knowledge about the projects or their general "feeling" of which resources are more or less important. Accountability is maintained to some degree through the requirement that each participant prepare written statements describing the resources within their area of expertise. This can be a very time consuming task that lengthens the selection process.

In an attempt to balance the particular biases of any individual, the decision makers are selected from diverse backgrounds representing the major resource categories, and they collectively select projects and establish priorities by voting. The CARL program utilizes this process to select projects and establish priorities. The six agency heads that compose the Land Acquisition Advisory Council independently rank projects in priority order; the scores for each project are totaled; and the lowest total score becomes the first priority, while the highest score becomes the last.

Reduction of subjectivity is also attempted via the use of comprehensive plans to identify the most important factors for consideration. For example, nine categories of resources are described in the Florida Statewide Land Acquisition Plan. Under each category are a list of general acquisition objectives. Modifications to these objectives were recently proposed by the Land Acquisition Programs Integration Committee.

Components of a Site/Ranking Criteria

Several different ranking criteria are used in the various state and local acquisition programs around the state. While different, many of these systems have similar components. The following is an example of the types of criteria that are usually part of these sytems:

Vulnerability: Vulnerability: This criteria addresses the likelihood of events which might degrade or destroy the site.

Rarity: This criteria incorporates the rarity of each of the site's community types, the rarity of the species it provides habitat for, and the uniqueness of the site's special features, such as geological formations or champion trees. Rarity must be viewed on several scales: county, state, and global.

Connectedness: The criteria concerns how the site links to related elements of the landscape. Does it lie within or constitute a link between segments of an actual or potential wildlife corridor, a green space zone, or a trail system? Is it an inholding or a buffer for another natural area? How do the habitats relate to those nearby?

Completeness: This is basically an index of the site's ecological quality. Are the ecological communities representative examples with a full complement of species? How diverse are the habitats? The flora? The fauna? Has the site been degraded? To what degree? Are the "missing" species gone forever or is the basic integrity of the system still intact enough that there is a realistic potential for reintroductions?

Manageability: This is an assessment of long-term viability. Is the site big enough? Would the preservation and maintenance of its species be compatible with present and future neighboring land uses? Are degraded habitats in restorable condition? Would it be practical to do prescribed burning in fire-maintained habitats? Would there be problems with trespassers or neighbors?

Nature-Oriented Human Use Potential: This concerns the site's inherent suitability for human activities dependent upon non-destructive use of natural features. Is it a documented research site or especially appropriate for scientific studies? Does it have a variety of habitats and transition zones through which a nature trial could be routed? Is it a beautiful place that would be aesthetically enjoyable for the public?

How difficult would it be to construct and maintain trails and other facilities for passive recreation without damaging the environment?

Scoring Criteria:

Vulnerability

1. Slated for development or prime real estate currently up for sale. No significant regulatory protection.

2. Owner likely to sell or develop, but action not imminent. No significant regulatory protection. Located in high-growth area. Good development site.

3. Owner has no sale or development plans. Heirs may be inclined to sell. Borderline case as to regulatory protection. Located in low-growth area. Marginal development site.

4. Respected by conservation-minded landowner. Some regulatory protection. Very low development potential.

5. Preservation guaranteed by deed restriction, easement, or established regulatory authority.

Completeness

1. Outstanding habitat. Diverse species, communities, and natural successional stages, including a number of rarities. Large enough to maintain long-term disturbance/succession matrix. Sizeable gene pools due to size and\or links to similar habitat areas. Potential for retention or reintroduction of full-normal flora and fauna, including range predators.

2. Excellent habitat. Diverse species, communities, and successional stages. Practically all appropriate species except rarities and large predators present and thriving. Excellent potential for reintroduction of most missing species.

3. Good habitat. Good diversity of species or communities. Slight degradation. Probably capable of maintaining populations of most typical species.

4. Fair habitat. Moderate species and communities diversity. Degraded, but restorable. Might be capable of supporting populations of relatively tolerant species.

5. Poor habitat. Low species and community diversity. Seriously degraded. Too small and/or isolated to maintain normal flora and fauna.

Rarity

1. Rare community type. Extraordinary example of a natural community. Diverse array of superb habitats, several of them scarce. Extensive tract of old growth. Many rare species, including a number FNAI ranks 1 or 2 on state scale. Critical habitat for a globally endangered species (GI). Unique geological or wildlife site. State or nationally significant.

2. Excellent examples of natural communities, some of them scarce. A number of rare species, but none dependent upon this site for survival. Several species FNAI ranks 1 or 2 on state scale. No significant occurrence for a globally endangered (GI) species or community. Important geological or wildlife site. One of the best sites of its kind in area.

3. Good examples of natural communities. Habitat types well represented statewide, but scarce in county. A few rare species, but not many ranked 2 on FNAI's state scale and none ranked

higher. Geological features or wildlife sites of moderate value. Some old growth, but no large tracts or stands of "living museum" quality.

4. Typical community types still represented by extensive acreages in the county. A few uncommon species, but no significant occurrences of anything ranked higher than 3 on FNAI's state scale. No major geological features or wildlife sties. No mature forests or outstanding examples of natural communities.

5. Common community types in poor to average condition. Habitat types widespread throughout county. No rare animals or plants. No significant occurrences of anything ranked higher than 4 on FNAI's state scale. No significant geological features or wildlife sites. No trees of extraordinary size or age.

Connectedness

1. Directly contiguous with large areas of natural habitat along extensive boundaries. Critical situation for interconnecting natural areas or trail systems.

2. Not broadly joined to large areas of natural habitat, but close or connected by significant existing or potentially restorable habitat corridors. Good situation for connection of natural areas or trail systems.

3. Isolated from natural habitats of significant size by an expanse of marginally suitable habitat. Narrow connecting corridors. Useful situation for interconnection of natural areas or trail systems.

4. Isolated from natural habitats of significant size by a moderate expanse of unsuitable habitat. No significant connecting corridors. Not situated strategically for interconnection of natural areas or trail systems.

5. Small size tract, isolated from natural habitats of significant size by a large expanse of unsuitable habitat or a virtually impenetrable barrier (from standpoint of organisms inhabiting site). No significant connecting corridors. Not situated strategically for interconnection of natural areas or trail systems.

Manageability

1. Habitat types in excellent condition. Fire maintained habitats in good condition. Inherently well buffered from most external impacts. Location minimizes problems with trespassers, neighbors and facilities management access.

2. Habitats in good condition, but requiring a fire restoration phase or extensive one-time cleanup. Effective buffering from most external impacts possible. Location and surrounding land uses reasonably convenient for management.

3. Could be maintained in or restored to good condition, but would require vigilant management. Location and/or historic use suggests chronic problems with trespassers and/or neighbors. Special programs such as exotic plant removal or hydrological restoration required. Difficult location for management.

4. Location and/or extent of degradation would make management difficult and expensive. Questionable whether protection/restoration programs would be successful.

5. Too small and/or degraded for maintenance or reestablishment of normal ecosystem processes, such as periodic burning or flooding. Highly vulnerable to uncontrolled external impacts.

Purchase Concerns

In addition to resource values, acquisition concerns are equally important. For example, the most important resources may occur on lands that have owners who are unwilling sellers. In these cases, public ownership may be impossible unless you are willing to condemn property for conservation purposes. Similarly, if two tracts have similar resource values, the one which is less expensive probably should be acquired before the other. However, one must be careful not to allow the acquisition concerns to supersede the resource concerns. Just because a property is available at a bargain price does not mean you should spend limited acquisition funds to acquire it. A "non-bargain" purchase may be much more important when one compares resource values.

The CARL program utilizes several mechanisms to resolve to some degree the conflicts between resource and acquisition concerns. During the first stage of evaluation, a resource planning boundary is developed for each project. Ownership considerations are largely deferred until the project design stage of evaluation. Similarly, acquisition priorities are based primarily on resource concerns, although special consideration is given to bargain purchase opportunities. Projects are placed into acquisition categories, and funds are allocated to each category. The highest ranked projects within each category, which should correlated with resource value to a large degree, are acquired first. A project ranked low in the priority purchase category may encourage the owner to reduce the price in order to rank higher in a bargain purchase category.

One of the most important factors to consider when developing an acquisition program is the separation of duties and powers. The CARL program separates responsibilities among three entities: the Land Acquisition Advisory Council, the Division of State Lands, and the Governor and Cabinet. The Land Acquisition Advisory Council is responsible for selecting, designing, and ranking projects in priority order. The Division of State Lands is responsible for negotiating the acquisition of parcels, to the greatest degree in the order of priority established by the Council. The Governor and Cabinet have veto power over the other two entities in that they can remove projects from the priority list or refuse to release funds to acquire a parcel. The Governor and Cabinet also review and approve policies and procedures under which the other two entities operate. Similar separations of powers and responsibilities have been adopted by most local governments that have acquisition programs. A primary reason for separating responsibilities is to enhance the credibility of the program through the acquisition of properties with the most important resources -- the resource experts identify what should be acquired, the acquisition experts get the best price and conditions, and the politicians ensure that purchases are made in the public interest.

Acquisition in Polk County and Lake County

Given the concentration of environmentally threatened lands found in Polk, the county has been the focus of several acquisition programs. Federal and state programs are ranking the Lake Wales Ridge scrub habitats high on their priority lists. The county government has also begun to consider several funding mechanisms to purchase land in the Green Swamp, along the ridge systems, and along the Kissimmee and Peace River basins. The requirements of the adopted Polk County Comprehensive Plan indicate that some environmentally sensitive and/or park will be acquired.

At the time of the printing of this report, Polk County is deliberating the possibility of placing a referendum on a fall 1992 ballot. This referendum would ask voters to approve a 1 cent increase in the local option sales tax for three years. The annual revenue would be approximately $33 million. The county is

examining a proposal which would equally appropriate the money to land acquisition, jail construction and infrastructure improvements.

The local option sales tax "sunsets" in November of 1992, unless the legislature approves an extension. The Polk referendum would have to take place this fall to exercise this funding mechanism.

Polk County is in the process of convening a Local Land Acquisition Advisory Committee charged with the responsibility of identifying and prioritizing specific sites for protection. Committee members have been selected and contacted to participate. Approval is pending by the Commission. Setting up a Local Land Acquisition Advisory Committee is and essential step in the referendum process. Discerning voters want to know where the money will be spent and how that selection was made.

However, the county has not presented a package for how the dollars allocated to infrastructure improvements and jail construction will be spent. Tying these three unrelated issues together could result in an unsuccessful referendum. Voters that support one issue, may vote against it because it is linked to an issue they oppose.

An historically winning format for a land preservation referendum places funding for land protection on the ballot alone - not tied to other county needs. Another option for Polk County is to raise the ad valorem tax 1/4 millage, as debt service for a $20 Million bond, and allocate the full amount to purchase environmentally sensitive land. By utilizing bonds, the county would not be rushed to address this issue by the fall of 92, an important consideration given Polk's current economic stresses. Additionally, the payments would be spread over an extended period of time (twenty years) and would be enjoy the low interest rates currently available on general obligation bonds.

Lake County currently provides matching funds to other acquisition programs through their Pollution Control Department. Extension of this program would facilitate land acquisition within the Green Swamp area of the County.

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INTRODUCTION

The resources of the Green Swamp are subject to regulation by a number of entities at the local, regional, state, and federal levels of government. Five counties--Lake, Polk, Pasco, Hernando, and Sumter--and several cities have comprehensive planning and land use regulatory authority over the Green Swamp. A portion of the Green Swamp was designated an Area of Critical State Concern in 1974. The designation imposed specific planning and regulatory requirements on Polk and Lake counties regarding protection of the hydrologic functions of the Green Swamp. Local government comprehensive plans are being reviewed by the regional planning councils and the Florida Department of Community Affairs. The comprehensive plans must be implemented through development regulations. Certain large-scale developments (Developments of Regional Impact or DRIs) are subject to special review by local governments, the regional planning councils, the Department of Community Affairs and, if appealed, the Governor and Cabinet.

Environmental quality is regulated through a variety of permitting programs. The discharge of domestic and industrial waste through point sources is primarily regulated by the Florida Department of Environmental Regulation and the U.S. Environmental Protection Agency (EPA). The St. Johns River Water Management District and the Southwest Florida Water Management District regulate the construction and operation of surface water management systems. Phosphate mining is regulated by the Florida Department of Environmental Regulation (DER) while other types of mining, such as sand mining, are regulated by the water management districts. The DER stormwater rule is also implemented by the water management districts. The effects of surface water management systems on wetlands and wildlife are considered by the water management districts. In addition, the water management districts, DER, the U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency regulate activities in wetlands under varying jurisdictional and permitting criteria. The effects of wetlands development on wildlife is considered by both state and federal agencies, with the assistance of the Florida Game and Fresh Water Fish Commission and the U.S. Fish and Wildlife Service. Special protection for endangered and threatened species and their habitat is provided for by state and federal laws. The effect of consumptive water use on both ground and surface waters and associated resources is regulated exclusively by the water management districts.

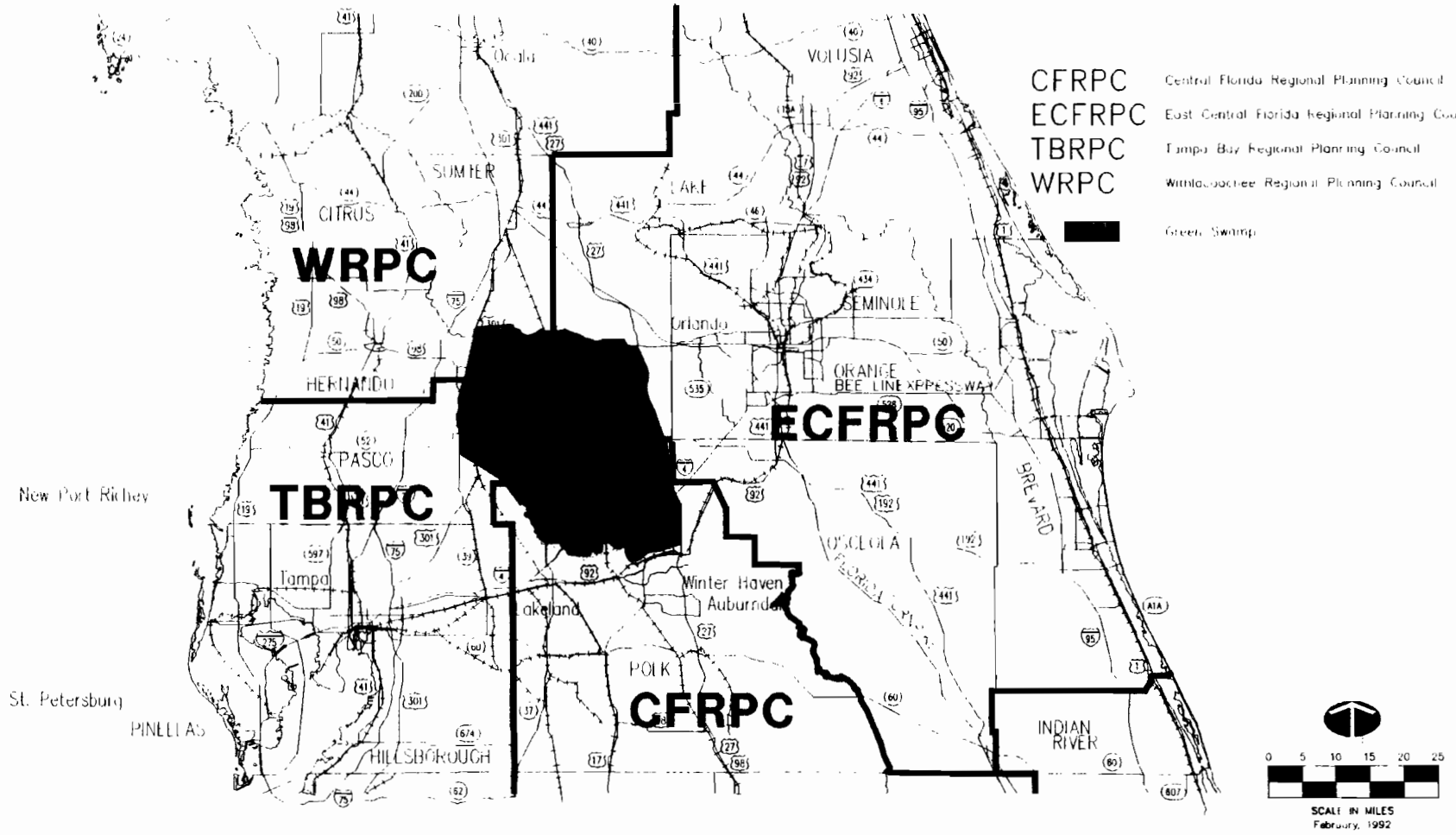
The planning and regulatory system is thus extraordinarily complex. The purpose of this section is to briefly describe the most important programs and assess their potential for protecting the resources of the Green Swamp. This evaluation will provide a basis for recommending ways to implement the management recommendations contained in other chapters of this report.

LAND USE PLANNING AND REGULATIONS

Political Jurisdictions

Map 4-1 depicts the political jurisdictions within the Green Swamp. Polk, Lake, Sumter, Hernando, and Pasco counties have regulatory authority over portions of the Green Swamp. The following municipalities are located on the perimeter of, or are partially within, the Green Swamp: Lakeland, Haines City, Clermont, Groveland, Mascotte, and Dade City. Polk City is the only community to lie entirely within the Green Swamp. At the time of this writing Polk and Lake counties have the most significant impacts on the Green Swamp, and their regulatory programs are examined in detail in this report. Analysis of the other local governments' regulatory programs has been excluded from this report due to time constraints. However, the regulatory structure and growth management disposition of these cities should be examined in the future.

Regional Planning Council Jurisdictions within the Green Swamp



History of State Planning

The first major set of growth management laws were passed in Florida in 1972 following a severe drought. At that time, the Environmental Land and Water Management Act (Chapter 380, F.S.), the Water Resources Act (Chapter 373, F.S.), the State Comprehensive Planning Act (Chapter 23, F.S.), and the Land Conservation Act (Chapter 259, F.S.) were passed. These acts addressed, respectively, state and regional concerns in local development decisions of greater than local impact, an improved system to manage the state's water resources, the development of a comprehensive state plan to guide actions at all levels of government, and a new program to acquire environmentally endangered lands.

Concurrent with the passing of these laws, the Environmental Land Management Study Committee was established to conduct a thorough study of the status and effectiveness of local planning and land development regulation in Florida. The committee's recommendations to the Legislature included numerous local planning law reforms which were enacted as the Local Government Comprehensive Planning Act of 1975, (Chapter 163, F.S.). This Act mandated that all local governments prepare, adopt, and implement local comprehensive plans.

Although a significant first step and far reaching attempt to manage growth, this new system was not adequate to meet the demands of the high level of growth that was continuing in the state. This was primarily due to shortcomings in the legislation which limited the state's ability to fully implement and enforce its provisions. It was clear by the late 1970's that the growth management system was in need of revision.

In 1982, Governor Graham established the second Environmental Land Management Study Committee to undertake a complete critique of the state's growth management system and make recommendations for new laws, new funding, and new administrative efforts that would result in an adequately funded integrated policy framework. The committee's recommendations, delivered in 1984, resulted in the passing of the State Regional Planning Act. This Act called for the development of a state plan for presentation to the 1985 Legislature. The 1985 Legislature approved the proposed state plan and also made major changes to the Local Government Comprehensive Planning Act of 1975. The Legislature renamed it the Local Government Comprehensive Planning and Land Development Regulation Act[1] (Chapter 163 Part II), and substantially strengthened the requirements for local plans and their implementation.

This new system of growth management, as established by the 1985 Legislature, called for an integrated policy framework that required consistency among a set of state, regional and local plans, and the implementation of local regulations that were consistent with the local plans. The Department of Community Affairs, the state land planning agency, was charged with the responsibility of developing a schedule for reviewing local government plans and assuring their consistency with the state's policies and guidelines.

State and Regional Planning Requirements

Chapter 163 Part II requires that local governments devise comprehensive planning programs to guide and control future development. Comprehensive plans are long range policy documents which provide guidance for local government regulatory activities. Local government comprehensive plans must address a number of required elements, most of which have some bearing on the nature and intensity of development in the Green Swamp. Local governments must incorporate state and regional goals and objectives into their local comprehensive plans and land development regulations. The Department of

1. FLA. STAT. §§ 163.3161 - 163.3243 (1991).

Community Affairs and the regional planning councils review and assist in development of plans and regulations by local governments within the Green Swamp. Comprehensive plan elements must be consistent with guidelines in regional and state comprehensive plans.[2] Local government developmental approvals must be consistent with adopted and approved local government comprehensive plans. An in depth examination of each comprehensive plan element is beyond the scope of this report. This discussion will thus focus on several elements which are critical to the control of development affecting the Green Swamp, including the future land use, conservation, recreation and open space, and intergovernmental coordination elements of each local government's comprehensive plan.

The Department of Community Affairs (DCA) is responsible for insuring that local governments and regional councils abide by the policy guidelines of the state comprehensive plan[3] and Chapter 163 Part II. Rule 9J-5 was adopted by DCA and establishes minimum criteria for local comprehensive plans.[4] Rule 9J-5 requires that local government comprehensive plans include future land use, conservation, recreation and open space, and intergovernmental coordination elements. The state comprehensive plan provides additional policy guidelines for water resources, natural systems, recreational lands, and land use.[5]

Future Land Use Elements

Chapter 163 Part II requires that the future land use element designate the future distribution, location, and extent of private and public land uses.[6] Local government future land use elements must show generalized land uses and natural resources on existing land use maps.[7] The maps must include natural resources such as shores, rivers, lakes, floodplains, wetlands, minerals, and soils.[8] The elements must include general densities or intensities of use for gross land areas within each use category.[9] The element must also include an analysis of the availability of services and facilities to serve existing uses, the character and magnitude of existing undeveloped land to determine its suitability for use, the amount of land needed to accommodate the projected population, and the suitability of development and redevelopment of flood-prone areas.[10]

Future land use elements must include objectives which protect natural and historic resources, discourage urban sprawl, and encourage use of innovative land development regulations such as planned unit developments.[11] In addition, the elements must include policies to ensure: 1) development approval

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2. *Id.* § 163.3177(10)(a).

3. *Id.* § 163.3167(2), ch. 187.

4. FLA. ADMIN. CODE ch. 9J-5 (Sept., 1991).

5. FLA. STAT. §§ 187.201(8),(10),(16) (1991).

6. *Id.* § 163.3177(6)(a).

7. FLA. ADMIN. CODE Rule 9J-5.006(1)(a),(b) (Oct., 1990).

8. *Id.*

9. *Id.* § 9J-5.006(1)(c).

10. *Id.* § 9J-5.006(2).

11. *Id.* § 9J-5.006(3)(b).

is conditioned upon the availability of adequate levels of service, 2) management of drainage and stormwater, and 3) protection of environmentally sensitive lands.[12] The elements must also include a future land use map which shows natural resources and the proposed distribution, extent, and location of generalized land uses.[13]

Future land use elements are important to the future of an environmentally sensitive area such as the Green Swamp because they dictate the types and intensities of development which will be allowed in any given area. The future land use element should designate appropriate levels of development within and adjacent to the Green Swamp.

Conservation Elements

The conservation element must provide for the "conservation, use, and protection of natural resources in the area, including ... water, water recharge areas, wetlands, waterwells ... soils ... shores, floodplains, rivers ... lakes ... forests, fisheries and wildlife ... and other natural and environmental resources."[14] Local government conservation elements must identify and analyze rivers, wetlands, floodplains, fisheries, wildlife, and vegetative communities including forests.[15] Local governments must then create goals and policies to protect these natural resources.[16] These goals and policies must: 1) conserve and protect native vegetative communities, including forests, from destruction by development activities, 2) conserve and protect existing soils, fisheries, wildlife habitats, rivers, lakes, floodplains, wetlands, freshwater beaches and shores, and their natural functions, 3) protect waterwells and water recharge areas, 4) encourage cooperation with other local governments to conserve "unique vegetative communities located within more than one local jurisdiction," and 5) designate environmentally sensitive lands for protection.[17]

The Florida Game and Fresh Water Fish Commission (GFC) has created a model conservation element for local governments to use for guidance.[18] The document includes selected provisions from the State Comprehensive Plan and the State Land Development Plan which relate to fish and wildlife resources. In addition, the GFC recommends a number of policies, many of which could, if adopted and implemented by local governments, provide significant protection in the Green Swamp. Many of the GFC recommendations are consistent with recommendations contained in this report, including the following provisions:

- Conserve forests, wetlands, fish ... and wildlife to maintain their environmental, economic, aesthetic, and recreational values.
- Develop and implement a comprehensive planning, management and acquisition program to ensure the integrity of Florida's river systems.

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12. *Id.* § 9J-5.006(3)(c).

13. *Id.* § 9J-5.006(4).

14. FLA. STAT. § 163.3177(6)(d) (1991).

15. FLA. ADMIN. CODE Rule 9J-5.013(1) (Oct., 1990).

16. *Id.* § 9J-5.013(2).

17. *Id.* § 9J-5.013(2).

18. Florida Game and Fresh Water Fish Commission, Model Local Government Comprehensive Plan Conservation Element (August, 1987).

- Emphasize the acquisition and maintenance of ecologically intact systems in all land and water planning, management and regulation.
- Prevent water management and development projects that may alter or disrupt the natural function of significant natural systems.
- [Develop a] critical habitat map ... to delineate specific locations of sensitive natural resources ... [including] high quality and/or unique natural plant communities (ie., ... longleaf pine, wiregrass, ... xeric oak and sand pine scrubs) ... and corridor areas such as strips of undeveloped habitat separating existing conservation reserves, or transitional zones along major floodplains.
- Maintain the local government's current complement of wildlife species [and natural plant communities] through preservation of diverse and viable habitats.
- Encourage and promote the protection of viable tracts of sensitive or high quality natural plant communities within developments.
- Require detailed inventories and assessments of the impacts of development on environmentally significant systems.
- Maintain upland buffers along the local government's waterways to provide wildlife habitat and corridors, prevent erosion, retard runoff and preserve natural aesthetics.
- Protect, restore, or create wetland areas to provide wildlife habitat, prevent water quality degradation, aid water storage and recharge the aquifer.
- Incorporate upland preservation in and around preserved wetlands to provide habitat diversity, enhance edge effect, and promote wildlife conservation.
- Promote the long-term maintenance of natural systems through such instruments as deed restrictions, covenants, easements, transfer of development rights, mitigation banks, zoning and acquisition.
- Promote the establishment of wildlife corridors in order to help maintain regional species viability and diversity.[19]

Local government conservation elements are extremely important to the future of the Green Swamp, because they establish policies and criteria for delineation and protection of environmentally sensitive areas.

Recreation and Open Space Elements

The recreation and open space element must provide for a comprehensive system of public and private sites for recreation, including natural reservations, parks, and open spaces.[20] Rule 9J-5 directs local governments to assess existing recreation and open space sites and to project future needs in this area.[21] Local governments must create policies which ensure that future public and private development

19. *Id.*

20. FLA. STAT. § 163.3177(6)(e) (1991).

21. *Id.* § 9J-5.014(2).

provides adequate open space and recreation lands to accommodate existing and future recreation demands.[22]

Rule 9J-5 directs local governments to "ensure public access to identified recreation sites ... "[23] This provision is directed toward "recreation" sites, and should not be interpreted to mean that all public lands should be open to intense public use. Areas defined as conservation or environmentally sensitive may require special criteria limiting the intensity and types of public use in order to preserve the natural character of these areas. Recreation and open space elements are important to the Green Swamp, because they provide the basis for determining appropriate levels of use for recreation areas and open space.

Intergovernmental Coordination Elements

Generally, the intergovernmental element must provide for coordination of planning and operation between 1) the local government and various agencies, and 2) between the local government and other local governments. Specifically, the local government must identify and resolve incompatible goals, objectives, policies and development proposed in local government comprehensive plans and determine and respond to the needs for coordination processes and procedures with adjacent local governments, and regional and state agencies. It is important to realize that the element requires neighboring local governments to cooperate in planning to ensure that the objectives of each comprehensive plan are met.

The intergovernmental coordination element must establish a system for coordination of the adopted comprehensive plan with the comprehensive plans of adjacent municipalities, counties, the region, and the state comprehensive plan.[24] This element must also show how the adopted comprehensive plan will affect these surrounding jurisdictions.[25] Local government intergovernmental coordination elements must identify and resolve incompatible policies and development within a particular comprehensive plan and provide for coordination between overlapping and adjacent jurisdictions.

Rule 9J-5 specifically requires jurisdictions within an ACSC to analyze the comprehensive plan's coordination with the rules, principles for guiding development, and development regulations in any designated [ACSC] ...[26]

Local governments must also review the "relationship of proposed development of the area to the existing comprehensive plans of adjacent local governments."[27]

The intergovernmental element is extremely important to the success of the Growth Management Act and the ACSC program in protecting a complex, interconnected, environmentally sensitive area like the Green Swamp, which extends across local government jurisdictional lines.

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22. *Id.* § 9J-5.014(3).

23. *Id.* § 9J-5.014(3)(b)1.

24. FLA. STAT. § 163.3177(6)(h) (1991).

25. *Id.*

26. FLA. ADMIN. CODE Rule 9J-5.015(2)(d) (Oct., 1990).

27. FLA. ADMIN. CODE Rule 9J-5.015(3)(c)5 (Oct., 1990).

Comprehensive Regional Policy Plans

The Green Swamp generally falls within the jurisdiction of four regional planning councils. The East Central Florida Regional Planning Council has jurisdiction over Lake County. The Tampa Bay Regional Planning Council has jurisdiction over Pasco and Hillsborough County. The Withlacoochee Regional Planning Council has jurisdiction over Sumter and Hernando County. The Central Florida Regional Planning Council has jurisdiction over Polk County. The designated Green Swamp Area of Critical State Concern is within only the Central Florida and East Central Florida Regional Planning Council.

Each Planning Council has adopted a Comprehensive Regional Policy Plan (CRPP) pursuant to the State and Regional Planning Act of 1984. The legislation mandated preparation of State and Regional plans as policy documents to guide further growth and development in Florida. The intent was to provide clear policy statements to guide governmental actions which will moderate the problems of rapid growth, and which will protect identified regional resources.

All of the CRPP's contain general policies which can be applied to the Green Swamp. These policies address the protection of water resources and water supplies, natural systems, endangered species, natural resource preservation, balanced and planned development, public facilities and land use and management. These policies are required to be consistent with and further the State Comprehensive Plan and State Land Development Plan.

Each CRPP is oriented to the natural carrying capacity of the land and the systematic, logical and economic provision of public infrastructure. Application of the CRPPs to the Green Swamp indicates that appropriate development activities must be compatible with the natural functions and characteristics of the Green Swamp. Where those functions and characteristics are so important that they essentially prohibit reasonable use of property, then public acquisition should take place. In other areas suitable for very limited levels of activity, less than fee simple types of development rights acquisition could be considered.

In reviewing the applicable CRPPs, a major concern becomes evident. The CRPPs generally have not designated the Green Swamp as a critical regional resource. Two of the Regional Planning Councils, Withlacoochee and Tampa Bay, make little or no mention of the Green Swamp. None of the Critical Area occurs within their jurisdiction. East Central specifically mentions the Green Swamp in one policy concerning water resources. The East Central CRPP does not specifically address the portion of the ACSC within Lake County. The Central Florida Regional Policy Plan identifies the ACSC as a critical regional resource requiring special protection. None of the Regional Planning Councils recognize the concerns of the larger hydrologic Green Swamp.

The basis of this problem occurred with the decision to delete substantial portions of the Green Swamp from the ACSC designation. That decision was justified upon the amount of public ownership of lands in the areas of the Green Swamp which were not designated. However, the net effect of this decision is the absence of a coordinated, comprehensive approach to the entire Green Swamp for its protection and management. Joint coordination between the various Regional Planning Councils, and applicable state and federal agencies, would clarify our view of this resource without necessarily creating yet another regulatory entity. Simply put, we have not been effective in utilizing the structure of agencies, councils and counties in providing a coordinated management approach for a multi-jurisdictional resource.

Common Policy Elements

Each CRPP is required to address a common set of policy clusters. These policy clusters are contained in the State Land Development Plan. The following goals and policies, which are a common basis for each CRPP, have special applicability to the Green Swamp:

Protection of Water Resources

a. Identify and protect the functions of water recharge areas to provide incentives for their conservation.

b. Ensure that new development is compatible with existing local and regional water supplies.

c. Protect aquifers from depletion and contamination through appropriate regulatory programs and through incentives.

d. Protect surface and ground water quality and quantity in the state.

e. Encourage the development of a strict floodplain management program by state and local governments designed to preserve hydrologically significant wetlands and other natural floodplain features.

f. Ensure that development does not contaminate or deplete aquifers through degradation of water resources, restriction of water recharge, encouragement of salt water intrusion or damage to the physical, chemical, or biological integrity of the aquifer system.

Protection of Water Supply

a. Identify and model the functions of all areas of high or regionally significant recharge to groundwater aquifers, including sources and flows of water recharge, recharge and filtration rates, and existing and potential land uses and sources or pollution.

b. Through land development planning and regulation, ensure that development activities do not impair the function or high or regionally significant recharge areas, and limit roads and other impervious surfaces and watershed alterations that reduce the availability and flow of good quality water to recharge areas.

c. Ensure that new development maintains natural groundwater levels, including seasonal fluctuations, consistent with sound ecological and public safety considerations.

d. Incorporate watershed management programs that seek to protect the natural flow and quality of surface water systems into land use planning and regulation programs.

e. Ensure that local and regional comprehensive plans use groundwater basin inventories prepared by state and regional water management agencies that identify the limitations of the available groundwater supply.

f. Allow development to occur only when adequate water supplies will be concurrently available to serve such development without adversely affecting local or regional water sources.

g. Establish minimum groundwater levels for the state's major aquifers to identify when withdrawals should be curtailed to avoid impairing their functional integrity.

Protection of Natural Systems

a. Avoid interference with beneficial functions of wetlands, floodplains, and floodprone lands including: storage; floodwater conveyance; groundwater recharge; maintenance of minimum water flows, levels, and quality; and habitat for fish and wildlife.

b. Avoid alterations of the natural rate, timing, quantity, and pattern of surface water flows through careful management of development activities.

c. Avoid development that endangers the biological and ecological integrity of rivers, lakes and associated floodplains through the utilization of nonstructural flood control programs that maintain the essential character of wetlands vegetation and ecosystem functioning.

d. Avoid development that requires new structural work in river systems that may subsequently endanger the water quality and the natural hydrologic functioning of rivers.

e. Land use planning and infrastructure development should be coordinated with watershed management plans.

f. Avoid development that interferes with minimum water flows and levels necessary to provide full protection of natural ecosystems.

g. Require that land use decisions address the secondary and human-activity related impacts of development on floodplain management and ensure that such secondary impacts do not adversely impact riverine or wetland systems.

Natural Systems and Recreational Lands

a. Florida shall protect and acquire unique natural habitats and ecological systems such as wetlands, tropical hardwood hammocks, palm hammocks, and virgin longleaf pine forests, and restore degraded natural systems to a functional condition.

b. Conserve forests, wetlands, fish, marine life, and wildlife to maintain their environmental, economic, aesthetic, and recreational values.

c. Protect and restore the ecological functions of wetland systems to ensure their long-term environmental, economic and recreational value.

d. Develop and implement a comprehensive planning, management and acquisition program to ensure the integrity of Florida's river systems.

e. Prohibit the destruction of endangered species and protect their habitats.

f. Acquire, retain, manage and inventory public lands to provide recreation, conservation and related public benefits.

g. Promote the use of agricultural practices which are compatible with protection of wildlife and natural systems.

h. Encourage multiple use of forest resources, where appropriate, to provide for timber production, recreation, wildlife habitat, watershed protection, erosion control, and maintenance of water quality.

i. Emphasize the acquisition and maintenance of ecologically intact systems in all land and water planning, management and regulation.

Preservation of Natural Resources

a. Inventory forest lands, uplands, wetlands, and critical fish, marine and wildlife habitats, determine which areas need to be conserved, and identify the appropriate conservation strategy to be used for each location.

b. Identify the various types of wetlands, characterize the degree to which they function, establish a priority for those areas requiring restoration or preservation, and implement a comprehensive restoration and preservation plan.

c. Inventory the state's river systems and develop appropriate management, preservation, and acquisition strategies.

d. Land development review procedures should provide for the protection and restoration of ecological functions of wetland systems to ensure their long-term environmental, economic, and/or recreational value.

e. Ensure that local government comprehensive plans provide for the conservation and appropriate use of forests, wetlands, fisheries, minerals, soils, native vegetative communities, floodplains, wildlife, wildlife habitat and marine habitat.

f. Utilize special planning and management programs, including SWIM programs, resource planning and management committees and Areas of Critical State Concern processes to develop and implement integrated management, preservation, and acquisition strategies for identified riverine, estuarine, and wetland systems.

g. Discourage land development activities adjacent to lands held for conservation and preservation that would adversely impact the functions of those lands.

h. Prohibit development that would severely impact the aesthetic or recreational value, use and enjoyment of important natural systems historically used for such purposes by the general public.

Protection of Endangered Species

a. Identify critical habitats of endangered species following a procedure similar to that used by the federal government.

b. Ensure that local government comprehensive plans identify endangered species habitat and restrict activities known to affect the survival of endangered wildlife and plants.

c. Develop positive financial incentives to encourage land owners and developers to protect or preserve endangered and threatened species and species of special concern.

d. Consider specific land acquisition and wildlife management area programs necessary for the protection of endangered species and their habitat.

e. Prohibit development that would have a direct, or through associated human-related activities an indirect, adverse impact on significant populations or habitats of endangered or threatened species.

f. Ensure that all land use decisions involving lands containing or impacting significant listed species populations or habitats include an adequate combination of mitigative measures including preservation, management, public education, and the provision of adequate protective buffers.

g. Develop management methods and planning applications for the Statewide Wildlife Habitat System to protect threatened and endangered species.

Land Management and Use

a. Give priority to acquisition of land and water areas which will maintain or protect ecologically intact systems.

b. Establish a statewide wildlife habitat network to interconnect as many public lands as possible.

c. Discourage the approval of more intense uses for ecologically sensitive lands which are on existing state or federal acquisition lists.

d. Encourage compatible development activities adjacent to public lands held for conservation and preservation.

e. ensure that land development planning and review procedures provide for the protection of wildlife and natural systems.

f. Require development activities to be compatible with the continued protection, management, and public use of adjacent public lands held for conservation and preservation.

g. Ensure the identification and protection of significant public scenic vistas and natural wildlife corridors in land use decisions.

Balanced and Planned Development

a. Ensure that all local governments have adopted local comprehensive plans that encourage efficient compact urban development and mixed use development.

b. Limit development requiring public services to areas which have available adequate or programmed public facilities needed to concurrently serve existing and proposed development.

c. Discourage development from areas where major new transportation facilities will be needed to be constructed to accommodate new development.

This set of goals and policies provides the context within which the remainder of this study must be evaluated. If the Green Swamp study documents the presence and value of the numerous environmental qualities previously presumed to exist within the Green Swamp, then any future actions must be consistent with and further these fundamental policies within the State Land Development Plan and the

Comprehensive Regional Policy Plans. Given the absence of public infrastructure, even without these environmental values, development must be significantly discouraged.

Regional Land Use Implications

Much of this report considers the controversial issues of critical environmental values within the Green Swamp. However, this evaluation must also take place within the context of the regional land use pattern and its implication for development activity within the Green Swamp. The Green Swamp lies within some of the most rural, sparsely developed areas of Florida. The level of historical development activity reflects both the environmental characteristics of, or development limitations within, the Green Swamp and its location in relation to public infrastructure. Indeed, a major catalyst for the original ACSC designation was purported development spinoff from the initial development of Disney World. Proposals were considered for construction of a major highway through the heart of the Green Swamp. Numerous marginal, highly speculative land sales and subdivision activities were initiated at that time. Firm state and local action at that time blocked proposals to provide public infrastructure such as roads and utilities which would have opened up the Green Swamp to development activities in conflict with its environmental attributes.

Currently, development activity from the Disney World complex, eastern Lake County and the Lakeland/Winter Haven metropolitan area are stimulating interest in land development activities within the Green Swamp. What has not changed in the last two decades is the continued absence of public infrastructure. Within each region, the Green Swamp continues to be an area of low population densities without significant public infrastructure and with significant environmental attributes and development constraints. The rural location of the Green Swamp, its development constraints and lack of public infrastructure, are reflected in its low land values. Cheap land in the Green Swamp, beyond the developed fringe, continues to attract speculative land developers who are unwilling to buy higher value land, or to pay higher land prices indicative of the presence of public infrastructure. Irrespective of environmental issues, this is a major cause of urban sprawl.

With the implementation of the 1985 Growth Management Act, the management of urban sprawl has become a top state and local priority. Urban sprawl is the premature extension of urban development into agricultural, rural, or other undeveloped or sparsely developed land. Urban sprawl is often characterized by uncontrolled initial development of scattered and isolated properties located on the fringe of suburban land uses, followed by subsequent urbanization of the bypassed parcels of land. Urban sprawl is indicative of a lack of, or ineffective, land use planning and results in land uses not functionally or proximately related to adjacent development. Urban sprawl interferes with the efficient provision of public facilities and services, including roads, schools, police and fire protection, water, sewer, drainage, and other infrastructure, whether such facilities and services are provided by public or private entities. Urban sprawl often results in the degradation of natural resources and encourages the premature loss of agricultural land in rural, sparsely developed areas.

In addition to providing guidance for development of local government comprehensive plans, the regional planning councils also participate in review of Developments of Regional Impact (DRI or DRI's). A DRI is a development which, "because of its character, magnitude, or location, would have a substantial effect upon the ... citizens of more than one county."[28] DRI's are identified, however, through the application of numerical thresholds adopted by the Governor and Cabinet.[29] The Governor and Cabinet can

28. FLA. STAT. § 380.06(1) (1991).

29. FLA. ADMIN. CODE Rule 28-24 (August, 1989).

recommend that applicable thresholds be increased or decreased by up to 50 percent.[30] Changes in DRI thresholds do not become effective unless adopted by the Florida Legislature.[31] The regional comprehensive plan is used by the regional planning councils in reviewing DRI's and in deciding whether to appeal local development orders for DRI's. Residential DRI thresholds for Lake, Polk, Sumter, Hernando, and Pasco counties are contained in Table 4-1.

The Central Florida Regional Planning Council recently denied a Development of Regional Impact proposed north of the City of Lakeland in rural Polk County within the Green Swamp. Although there were an abundance of environmental and natural resource impacts which alone justified denial, the development was also denied due to urban sprawl issues. The Regional Council indicated that due to location and absence of public facilities alone, development within this portion of Polk County would be highly premature. This issue alone provided a sufficient basis for denial.

TABLE 4-1

RESIDENTIAL DRI THRESHOLDS IN THE GREEN SWAMP[32]

County*	Dwelling Units
Lake	1000
Polk	2000
Pasco	2000
Hernando	1000
Sumter	500

* Any residential development located within two miles of a county line is subject to the threshold of the least populous county.

The State's Area of Critical State Concern Program

General Description of ACSC Program

The Environmental Land and Water Management Act, (Chapter 380, F.S.), passed in 1972, and subsequently amended in 1985, contains the provisions for Areas of Critical State Concern (ACSC).[33] The program is designed to protect regional and statewide resources threatened by development. The

30. FLA. STAT. § 380.06(3)(c) (1991). *See, e.g.*, Rule 28-24.014(4), FLA. ADMIN. CODE (reducing thresholds by 50 percent in the Wekiva River Protection Area).

31. FLA. STAT. § 380.06(3)(e) (1991).

32. FLA. ADMIN. CODE § 28-24.010 (August, 1989).

33. FLA. STAT. §§ 380.012-.12 (1991).

statute sets forth criteria and procedures for designating an ACSC and identifies the state land planning agency (Department of Community Affairs (DCA)) as responsible for administering the program. An ACSC may be designated by the Governor and Cabinet, sitting as the Administration Commission only for:

> a. An area containing, or having a significant impact upon, environmental or natural resources of regional or statewide importance, including ... state or federal parks, forests, wildlife refuges, wilderness areas, aquatic preserves, major rivers ..., state environmentally endangered lands, Outstanding Florida Waters, and aquifer recharge areas, the uncontrolled development of which would cause substantial deterioration of such resources.
>
> b. An area containing, or having a significant impact upon, historical or archaeological resources, sites, or statutorily defined historical or archaeological districts....
>
> c. An area having a significant impact upon, or being significantly impacted by, an existing or proposed major public facility or other area of major public investment....[34]

Prior to designating an area, the Administration Commission must appoint a resource planning and management committee (RPMC), composed of local, regional, and state government representatives. The RPMC must study the area and develop a voluntary, cooperative program to resolve existing, and prevent future, problems which may endangered the resources of the ACSC.[35] The Administration Commission must consider the findings of the RPMC and other reports from the DCA when deciding whether to designate an area as an ACSC.

Should the Administration Commission decide to designate an area, they do so by rule, setting the boundaries of the ACSC and the principles to be used to guide development within those boundaries.[36] ACSC designations and the ensuing development regulations are based upon studies and analyses of the characteristics, problems, and needs of the individual areas. The Administration Commission is prohibited from adopting any rule which provides for a moratorium on development in an ACSC.[37] ACSC designations are subject to review by the Florida Legislature, which may reject, modify, or take no action relative to the Commission's action.[38] To date, five critical areas have been designated: the Big Cypress Swamp, the Green Swamp, the Florida Keys, the City of Key West, and the Apalachicola Bay Area.

Under the ACSC program, the state may assert authority over land use in designated areas and overrule local government land use decisions which fail to take into consideration the more-than-local impacts of development projects. Chapter 380.05, F.S., gives the state authority to review and, if necessary, require modification of any local government regulatory action in a designated critical area. This includes both local government comprehensive plans and land development regulations. Chapter 163 Part II, F. S., requires that no local government comprehensive plan or plan amendment which is applicable to a designated ACSC become effective until it has been reviewed and approved under Chapter 380.05, F.S.

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34. *Id.* § 380.05(2).

35. *Id.* § 380.045.

36. *Id.* § 380.05(1)(a),(b).

37. *Id.* § 380.05(1)(b).

38. *Id.* § 380.05(1)(b),(c).

Chapter 380 exempts agricultural activities from the definition of "development," including "the use of any land for the purpose of growing plants, crops, trees, and other agricultural or forestry products; raising livestock; or for other agricultural purposes."[39] Agricultural activities are not subject to review under the ACSC program, although they may be reviewed by local governments and other state regulatory programs.

An ACSC designation is intended to be in place long enough to ensure that local government regulatory programs are meeting the objectives of the original ACSC designation. The Administration Commission may repeal the designation if the local government plans and regulations have been in place and have been determined to be effective for at least a one year period.[40] If the plans and regulations have been determined to be effective, the designation must be repealed within three years. A repeal may apply to all or part of an ACSC. Requests for repeal of an ACSC designation may be made by any substantially interested person (as defined in Section 120.54(5), Florida Statutes), any local government or regional planning council within the ACSC, or by the DCA.[41]

Chapter 380 provides for creation of a "land authority" for counties within areas of critical state concern. A land authority is intended to help local governments implement plans and regulations required by the ACSC designation by addressing plan implementation innovatively and by acting as an intermediary between individual landowners and the governmental agencies regulating land use.[42] Members of a land authority are appointed by the county governing board. Chapter 380 provides a land authority with the power to sue, conduct studies, buy and sell real property, borrow money through the issuance of bonds, purchase bonds of the land authority, invest funds, contract, identify suitable lands for state acquisition, and to make rules to carry out the purposes of the land authority.[43] The land authority must appoint an advisory committee which must make recommendations to the land authority regarding land acquisition.

The Green Swamp Area of Critical State Concern

On July 16, 1974, the Governor and Cabinet designated 322,690 acres of the Green Swamp in Lake and Polk Counties as Florida's second ACSC. It was designated again by the Legislature in 1978. The Green Swamp was cited as a hydrologic resource of regional and statewide importance, in which the potentiometric high for the Floridan Aquifer was located, providing recharge and groundwater pressure that helped maintain free flowing springs and rivers. Additionally, the extensive wetlands of the area serve as the headwaters for five major rivers: Hillsborough, Withlacoochee, Peace, Oklawaha, and Kissimmee.

In July 1975, the Governor and Cabinet adopted Chapter 28-26, F.A.C., as the Green Swamp Principles for Guiding Development, and Chapters 28-27 and 28-28, Florida Administrative Code, as the land development regulations to protect the natural resources of the Green Swamp. The local governments affected by the designation are required to administer these land development regulations and the state must review development orders to ensure compliance with the critical area regulations as required by law.

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39. *Id.* § 380.04(3)(e).

40. *Id.* § 380.05(12),(15).

41. *Id.* § 380.05(12).

42. *Id.* § 380.0661.

43. *Id.* § 380.0666.

Chapter 28-26, F.A.C., establishes the following general guidelines for local governments to follow in protecting the hydrologic resources of the Green Swamp:

Principles for Guiding Development (Rule 28-26.003, F.A.C.)

(1) Objectives to Be Achieved

(a) Minimize the adverse impacts of development on resources of the Floridan Aquifer, wetlands, and flood-detention areas.

(b) Protect the normal quantity, quality and flow of ground water and surface water which are necessary for the protection of resources of state and regional concern.

(c) Protect the water available for aquifer recharge.

(d) Protect the functions of the Green Swamp Potentiometric High of the Floridan Aquifer.

(e) Protect the normal supply of ground and surface water.

(f) Prevent further salt-water intrusion into the Floridan Aquifer.

(g) Protect or improve existing ground and surface-water quality.

(h) Protect the water-retention capabilities of wetlands.

(i) Protect the biological-filtering capabilities of wetlands.

(j) Protect the natural flow regime of drainage basins.

(k) Protect the design capacity of flood-detention areas and the water- management objectives of these areas through the maintenance of hydrologic characteristics of drainage basins.

(2) Elements

Requiring Regulation	Regulatory Guidelines
(a) Site Platting	The platting of land should be permitted only when such platting commits development to a pattern which will not result in the alteration of the natural surface water flow regime and which will not reduce the natural recharge rate of the platted site.
(b) Site Alteration	Site alteration should be permitted only when such alteration will not adversely affect the natural surface-waterflow regime or natural recharge capabilities of the site. Site alteration should be permitted only when such alteration will not cause siltation of wetlands or reduce the natural retention and filtering capabilities of wetlands. All site alteration activities should provide for water retention and settling facilities; should maintain an overall site runoff equivalent to the natural flow regime prior to alteration and should maintain a runoff rate which does not cause erosion.
(c) Soils	All soil exposed as a result of site alteration or development activities should be located and stabilized in a manner to prevent the alteration of the natural flow regime. All soil exposed as a result of site alteration or development activities should be restored with suitable vegetation.
(d) Ground Water	Ground water withdrawal should not exceed the safe yield per [illegible] determined by the Southwest Florida Water Management District, or its successor agency.
(e) Storm-Water	Storm-water runoff should be released into the wetlands in a manner approximating the natural flow regime.

(f) Solid Waste	Solid waste disposal facilities should be located in areas and Waste operated in a manner that will not adversely affect the ground-water system.
(g) Structures	Structures should be placed in a manner that will not adversely affect the natural flow regime and which will not reduce the recharge capabilities. Placement of structures should be consistent with sound floodplain management practices such as compliance with the Flood Disaster Protection Act of 1973.

History of the Green Swamp ACSC in Polk County

The following section provides a chronological history of the Green Swamp ACSC in Polk County.[44] In order to understand the forces and thinking behind the designation of the "Green Swamp" as an area of critical state concern, it is important to review its history to the mid-1960's. In 1966 the U.S. Geological Survey, in cooperation with the Florida Geological Survey, prepared one of the first comprehensive reports on the hydrology of the Green Swamp. This report, Hydrology of Green Swamp Area in Central Florida, has been referenced numerous times in subsequent reports and discussions on the significance of the area.

Land sales activity began in the late 1960's and lasted through the early 1970's. This increased in 1967 with the announcement by the Walt Disney Company of the development of a major tourist attraction in Central Florida spurred intense interest in the area as a real estate market. There were several "land sales" projects located within what was to become the Green Swamp Area of Critical State Concern. These land sales projects typically involved large tracts in excess of several hundred acres. These large tracts were subdivided into 1 or 1 1/4 acre parcels using a grid pattern without regard for topography or land features such as wetlands. Access to individual lots is provided by private easements. The sales companies did not propose to build roads or put in any improvements such as utilities to serve the lots. These lots were marketed nationwide and some marketed worldwide. Buyers purchased lots without ever seeing the lot for little money down and low monthly payments.

In response to the lands sales activity and the numerous inquiries received by the County, the Polk County Board of County Commissioners passed a resolution on March 31, 1970 expressing their concern toward the land sales practices occurring in the County. The resolution stated:

> The County Government of Polk County, Florida, has not promised or agreed and does not intend to provide streets, drainage, water, utilities or any other improvements to this land.

The resolution also directed County staff to "study the situation with a view to devising and recommending to the County Commission ways and means of avoiding the undesirable features of such land promotions." The Florida Land Sales Board gave the County a positive response in a letter dated April 24, 1970. This letter stated that the Land Sales Board commended the County for its cooperation and that the Board's resolution was adopted by the Land Sales Board. The letter went on to state that the example set by Polk County would be used as a format for use with other counties. In partial response to the land sales activity, the Board of County Commissioners passed Ordinance Number 71-03 on June 23, 1971. This ordinance prohibited the issuance of a building permit unless the parcel hade a minimum of 25 feet of access onto a County or State road. (This ordinance was amended in 1983 to require 50

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44. This section was prepared from Polk County records by the Polk County Planning Department.

feet of access frontage.) The effect of this ordinance was to render the vast majority of "land sales" lots not possible to be permitted for structures.

In July, 1972, the Florida Legislature passed the Florida Land and Water Management Act of 1972. This act is contained in Chapter 380 of the Florida Statues and includes the authority and criteria for areas of critical state concern (Section 380.05, F.S.). On July 5, 1972, the Board of County Commissioners declared a "Green Swamp Alert". This action required that in order to issue a building permit within the Green Swamp the Board had to grant special approval. The area identified as the "Green Swamp Alert" area was all of the land lying North of the Section line two miles north of the South line of Township 26 South, East of U.S. Highway 98 and west of U.S. Highway 27 (this was north of Polk City and Interstate 4). A letter was sent to the Land Sales Board on July 10, 1972 expressing concern over a proposed 6,300 lot development in the center of the Green Swamp area. The County requested that the Land Sales Board defer any action on this project to allow time for corrective actions. Then, three days later on July 13, 1972, the County wrote a reply to an inquiry from Senator Lawton Chiles. In this letter, the County stated the concerns over the lack of available solutions to the mounting problems associated with land sales activities.

During 1972 the Four Rivers Basin Report was completed by Dr. Gerald Parker of the Southwest Florida Water Management District. Dr. Parker's report implied that 85,000 acres of State acquisition for detention areas within the Green Swamp would largely serve the surface water concerns for maintaining river flows and some aquifer recharge. This report was used later in the acquisition program of the Southwest Florida Water Management District (SWFWMD) and is referenced by subsequent reports and studies.

On March 7th and 8th, 1973, the Florida Senate Consumer Affairs Committee held a meeting in Lakeland to investigate land sales abuses in the "Green Swamp" area. A tour of the area was conducted for the committee. In June of 1973, the Legislature adjourned after having passed a package of Land Sales Laws which attempted to strengthen the existing law and provide additional protection to the State from the adverse impacts of land sales activity.

On June 5, 1973 the Florida Cabinet passed a resolution expressing concern about the "Green Swamp" and other vital fresh-water recharge sources of the state. Interestingly, this resolution identifies the Green Swamp as being located principally in Polk, Lake, Hernando, and Pasco Counties. The resolution states that the Green Swamp has been "described by scientists as the major wetlands recharge area for the Floridan Aquifer supplying vital fresh water for more than a million an a half citizens of Florida, making it--underground and along five (5) rivers--a prime source, natural filter and distribution system of fresh water of great importance." The resolution specifically directs state agencies to take the following action:

1. "Specific identification of the most environmentally sensitive wetland areas of the State with respect to sources of fresh water supplies such as the Green Swamp, other aquifer re-charging wetlands and spring-fed river watersheds, as well as estuarine shellfish-producing areas;"

2. "Specific recommendations as to which of these areas not now in public ownership can be most expeditiously protected under existing law and regulations (wilderness areas, conservation areas, wild and scenic river designations, etc.); and with regard to other environmentally sensitive areas --"

3. "Prompt submission of a list of priorities for acquisition of at least the "vital core" areas of crucial wetlands so that the State will be able to protect its people from willful, wanton and irresponsible misuse of irreplaceable elements of land and water essential to our economy, health and even survival."

The County continued to have concerns over the ability of the State's Land Sales Board to properly regulate land sales activity in the area.

During 1973 the Florida Division of State Planning, Bureau of Land and Water Management, was directed to study the Green Swamp for possible critical area designation. Perhaps this action was taken in response to the resolution passed by the Governor and Cabinet. This was a nine month study which culminated in a final report by the Division of State Planning (DSP) entitled "Final Report and Recommendations for the Proposed Green Swamp Area of Critical State Concern."

Also in 1973, the Polk County Board of County Commissioners appointed a "Blue Ribbon" Committee to study a multitude of issues within the County. One of the issues addressed by this committee was the Green Swamp. A preliminary draft of the DSP report was received by Polk County on February 6, 1974. A Polk County position paper was presented by George P. Stahlman, Polk County Development Coordination Director. The 10 page position paper recommends that the Administration Commission should reject the recommendation of the Division of State Planning.

On February 21, 1974 the Attorney General, Robert Shevin, sent a letter to the Florida Division of State Planning applauding the preliminary Green Swamp Report and requested that the matter be brought before the Cabinet at the earliest possible date. The Polk County Board of County Commissioners passed a resolution on March 26, 1974. This resolution contained four recommendations or directives:

1. "That the State of Florida has failed to prove its case that an "Area of Critical State Concern" does exist in the area known as the Green Swamp but has focused attention on the existence of an emergency situation of vital local importance that cannot wait for the cumbersome solutions of State Bureaucracy."

2. "That immediate action possible through the home rule powers of local government must be imposed until full assessment of the water resources detriment may be scientifically determined."

3. "That the problem transcends political boundaries necessitating the invitation for joint cooperative action by all Counties within the geographic area of the Green Swamp."

4. "That an Ordinance be immediately enacted to prohibit all non-agricultural ditching, draining, filling, or grading of acreage or roadways until full public hearing and scientific evidence of the purpose and effect on the natural water resources has been determined and specifically authorized by the appropriate local government holding jurisdiction over the affected lands."

The County sent a letter dated June 18, 1974 to Governor Askew. This letter expressed the County's concern with the Final Report that would be considered by the Cabinet and requested the Governor's consideration in leaving the area under local control. The Final Report from the Division of State Planning was received by Polk County on June 26, 1974. Prior to the public hearing, the county requested presentation time before the State Cabinet who would ultimately make the decision on the designation.

On July 16, 1974, in response to the DSP Final Report, Governor Askew and the Cabinet designated 322,690 acres of the Green Swamp an Area of Critical State Concern. The County received a letter dated July 23, 1974 from Robert Rhodes, Bureau Chief, Land and Water Management, Division of State Planning, formally advising Polk County of the specific area designated as an Area of Critical State Concern and enclosing a map outlining the boundaries. Mr. Rhodes advised Polk County that local governments had six months to transmit regulation to the State Planning office for approval. Failure to

receive approval of local regulations would result in the State developing regulations and adopting them by rule.

In late July 1974 a copy of the proposed "Green Swamp Development Code" prepared by Polk County was given to DSP. Several rounds of revisions followed. A public hearing was held by DSP on December 17, 1974 in the County Commission Building in Bartow on a proposed rule adoption. In July, 1975, the Florida Administrative Commission adopted Chapters 27F-6 (Polk County) and 27F-7 (Lake County), Florida Administrative Code, as the land development regulations to be implemented by the respective counties. Shortly before these regulations went into effect, Polk County adopted the Green Swamp Administrative Code (Ordinance Number 75-11). This ordinance established the local development process for administering the state's development regulation. Ordinance No. 75-11 was used by Polk County until October 30, 1986.

In 1975 a study prepared by Professor Harry Merritt was completed. This study was entitled, "The Carrying Capacity of the Green Swamp" and was funded by a research grant through the Division of State Planning. On June 28, 1977, the Polk County Board of County Commissioners adopted its first Flood Protection Ordinance (Ordinance Number 77-10) which established minimum standards for development within areas of special flood hazard and adopted the flood maps prepared by the National Flood Insurance Program.

In 1978 the Florida Supreme Court ruled that the critical area designation process established in Section 380.05, F.S. was an unconstitutional delegation of legislative authority. Based on this decision only the Florida Legislature could make a critical area designation. In response to this decision, Governor Askew convened a special legislative session on December 6, 1978. The Legislature, at the Governor's request, passed a bill designating the Areas of Critical State Concern (the Florida Keys, Big Cypress, and the Green Swamp). In addition, the legislature appointed a "Joint Select Legislative Committee" to study the Green Swamp and make recommendations for changes needed to Section 380.05, F.S.

Polk County representatives presented a three point proposal to the "Joint Select Committee" to work toward repeal of the designation. These points are summarized as follows:

1. Legislature will provide additional funding ($13 million) to complete land acquisition by SWFWMD.

2. Provide state funds to conduct a study of the importance of the Green Swamp as a recharge area. When important areas are identified they should be purchased by the state.

3. Local government will adopt appropriate regulation for flood protection and wetland preservation.

During the 1979 regular legislative session, the Legislature adopted major revisions to Section 380.05, F.S. As outlined in the 1979 amendments, local governments with a designated critical area became eligible for repeal of the designation by satisfying three conditions and upon a recommendation of the Governor and Cabinet. These condition are summarized as follows:

1. adoption of local regulations which were consistent with the state development regulations (the principles for guiding development in the Green Swamp);

2. amendments to the local comprehensive plan which bring the Plan into conformance with the principles for guiding development; and,

3. effective implementation of the local regulations for a minimum period of 12 months based on a monitoring of the local governments efforts by the State Planning Agency (by this time, known as the Department of Community Affairs-DCA).

In July, 1979, following the action of the state legislature, discussions were renewed with the State Planning Agency (the Department of Community Affairs) concerning modifications to the Green Swamp Area of Critical State Concern boundaries. On September 18, 1979, the Governor and Cabinet approved a recommended boundary modification which removed approximately 9% of the land from the Critical Area designation. These areas included approximately 18,800 acres located in Northeast Lakeland, North of Auburndale (State Road 559 area), and 8,600 acres around Clermont in Lake County.

In the fall of 1981 the Green Swamp Resource Planning and Management Committee (GSRPMC) was established pursuant to Section 380.045, F.S.. The GSRPMC was charged by Governor Graham "to work with local governments and state and regional agencies to ensure that the natural resources of the area will be preserved." In October, 1981, the Polk County Board of County Commissioners amended the Flood Protection Ordinance to include provisions for surface water management and restrict the alteration of wetlands. This was the first of many amendments to follow. The amended ordinance was called the Flood Protection and Surface Water Management Ordinance (SWMO). At an Administrative Commission meeting held on June 29, 1982 it was determined that neither Lake nor Polk County had satisfied the three requirements to consider repeal of the Critical Area designation.

On October 30, 1985 DCA amended Chapter 9B-19 F.A.C., to approve the Polk County Comprehensive Plan as being in conformance with the Principles for Guiding Development in the Green Swamp Area of Critical State Concern and to approve the Polk County Flood Protection and Surface Water Management Ordinance as superseding all provisions of the Regulations for the Green Swamp ACSC in Polk County. This date was the beginning of the minimum one year monitoring period.

The Green Swamp Resource Planning and Management Committee met again on February 12, 1987. At this meeting the Green Swamp Monitoring Report was presented by the DCA staff. It was recommended that the Technical Advisory Committee (TAC), which had been created to support the GSRPMC, prepare a report within the next three months which would meet the following objectives:

1. Clearly delineate each regulatory agency's role in protecting the Green Swamp; and,

2. Review whether such regulatory authority and its application are adequate.

In addition, the committee discussed and took action on the following five items:

1. Polk County: The committee endorsed the concept of repeal of the ACSC designation in Polk County provided that the County adopt appropriate amendments to its Surface Water Management Ordinance. In addition, with DCA as the coordinator, the TAC shall identify where state and regional regulations need strengthening or overlap and prepare a report to the full RPMC within three months.

2. Lake County: The DCA shall continue to work with Lake County to correct apparent inconsistencies between the Green Swamp ACSC regulations and Lake County Ordinances. No time table was set.

3. Land Acquisition: The Committee should review land acquisition priorities of the state (Department of Natural Resources) and the water management districts in the Green Swamp. Land acquisition was recommended as one possible way to help protect the

water resources of the Green Swamp. Land-swapping was also raised as a possible means of land acquisition within the Green Swamp. No time table was set.

4. Septic Tanks: The Committee agreed that the Department of Health and Rehabilitative Services ongoing three-year, $900,000 statewide study of septic tanks would yield information valuable for the protection of water resources within the Green Swamp. As part of this study, a comparable site in St. John's County, having a soil type similar to that of the Green Swamp would be investigated. However, a time table of three months was adopted by the Committee to review enforcement practices of Lake and Polk County Health Departments to determine whether each county is placing sufficient emphasis within their county codes on septic tank leakage enforcement in the Green Swamp.

5. Outstanding Florida Waters (OFW): The Committee agreed to the concept of determining whether certain eligible water bodies within the Green Swamp should be considered for OFW designation. No time table was set.

The Polk County Planning Division staff prepared a report which reviewed all of the regulatory agencies regulations and jurisdiction criteria for enforcing their respective regulations. This report, entitled "Green Swamp Regulatory Review Report" was presented to the Green Swamp TAC on July 29, 1987. The TAC held a follow-up meeting on September 3, 1987 to discuss this report.

The Polk County Board of County Commissioners adopted a revised (rewrite) Comprehensive Plan pursuant to Chapter 163, F.S. and Chapter 9J-5, F.A.C. on April 19, 1991. This Plan includes several policies concerning the Green Swamp and a Green Swamp Overlay as a "resource protection area" within the future land use map series. The Plan also calls for the creation of a Green Swamp Task Force. The Board of County Commissioners contracted with the Nature Conservancy in September, 1991 to provide a staff director for the Green Swamp Task force and the Board appointed the Task Force Members.

History of the Green Swamp ACSC in Lake County

The following section discusses the history of the Green Swamp ACSC in Lake County.[45] In 1974 the Governor and Cabinet concurrently designated the southcentral and southeastern territory of Lake County as part of the Green Swamp Area together with the northern territory of Polk County. Designation of Lake County occurred for the same reasons as for Polk County's designation -- it was declared a hydrologic resource of regional and state-wide importance, providing groundwater pressure that replenishes waters in artesian springs and rivers and representing the primary recharge for the Floridan Aquifer.

In 1984 Lake County took actions to incorporate state land development regulations to protect natural resources of the Green Swamp, as mandated in Chapter 27-27 and 28-28, F.A.C., by substantially revising zoning and subdivision regulations. The State approved these ordinances through Rule 9J-8, F.A.C.

Activities in the Green Swamp within Lake County primarily represented agricultural uses until the early 1980's when devastating freezes destroyed much of the citrus industry. Slow to recover from three freezes in the 1980's, land owners saw low density residential development as a means to recoup financial losses and to earn a living. Residential development pressures in this area actually began to emerge in the late 1970's and early 1980's due to impacts associated with the proximity of Disney World and its growth and with improved access between southeastern Lake County and the Disney area through improvements to S.R. 192, U.S. 27, and other roadways. About this time, the significance of the Green

45. This discussion of Lake County and the Green Swamp ACSC was prepared by the Lake County Planning Department.

Swamp as a primary recharge area for the Floridan Aquifer diminished as the Lake Wales Region to its east was identified as a more significant source of recharge.

During preparation of the 1991 Comprehensive Plan, Lake County staff met simultaneously with staff from DCA's Bureau of Local Planning, Plan Review Section, and Bureau of State Planning, Area of Critical State Concern Section, to discuss meeting State requirements for the Green Swamp through adoption of the Comprehensive Plan and its corresponding Land Development Regulations. Although adopted on July 9, 1991, the Comprehensive Plan was found not in compliance by DCA. Issues surrounding the Green Swamp ACSC were significant reason supporting DCA's determination. DCA indicated at this meeting that de-designation efforts could commence once the Comprehensive Plan and related land development regulations were approved by the State. Negotiations are continuing at the present time to enter into a stipulated compliance with DCA. Land Development Regulations are scheduled for adoption in February 1992.

Three objectives are included in the Future Land Use Element of the Comprehensive Plan that directly pertain to the Green Swamp. These objectives and their associated policies are included below.

OBJECTIVE 1-17: DEVELOPMENT WITHIN THE GREEN SWAMP AREA OF CRITICAL STATE CONCERN. Lake County Hereby Incorporates the Objectives and Policies Contained within Lake County Ordinance 1985-19 Which Amended Various Portions of the Lake County Comprehensive Plan Adopted in 1977 and 1980.

Policy 1-17.1: Uses of land determined to be of ecological or environmental value. Land determined to be of ecological or environmental value is set aside to be conserved. The Green Swamp Area of Critical State Concern is one such area that has been determined to be of environmental value. For the purpose of this Land Use Plan, "conserve" shall imply uses such as parks, agriculture, very low density residential which will not overly damage natural conditions, as well as, "no development" use. It is intended that the Conservation Element will eventually determine actual preservation areas as specific inventories and information becomes available. Within the Land Use Plan, criteria such as drainage patterns, soil types, flood types, flood zones and indigenous vegetation are utilized.

Policy 1-17.2: Conformance with the Principles for Guiding Development for the Green Swamp Area of Critical State Concern. Residential development in the Green Swamp Area of Critical State Concern shall conform to the regulatory guidelines and objectives outlined in the Principles for Guiding Development for the Green Swamp Area of Critical State Concern.

Policy 1-17.3: Transportation Related Construction Activities within the Green Swamp Area of Critical State Concern. Construction of new roads in the Green Swamp Area of Critical State Concern shall conform to the regulatory guidelines and objectives outlined in the Principles for Guiding Development for the Green Swamp Area of Critical State Concern.

Policy 1-17.4: Review of Development Proposals within the Green Swamp Area of Critical State Concern for Environmental Considerations. Development in the Green Swamp Area of Critical State Concern shall conform to the regulatory guidelines and objectives outlined in the Principles for Guiding Development for the Green Swamp Area of Critical State Concern.

Policy 1-17.5: Review of Development in the Green Swamp Area of Critical State Concern near Urban or Urban Expansion Areas. Development within the Green Swamp Area of Critical State Concern shall conform to the regulatory guidelines and objectives outlined in the Principles for Guiding Development for the Green Swamp Area of Critical State Concern.

Policy 1-17.6: Principles for Guiding Development within the Green Swamp Area of Critical State Concern. The following shall apply to the Green Swamp Area of Critical State Concern, in order to effectively and equitably conserve and protect its environmental and economic resources, provide a land and water management system to protect resources, provide a land and water management system to protect such resources, and facilitate orderly and well planned growth:

Protection Objectives

(1) Minimize the adverse impacts of development on resources of the Floridan Aquifer, wetlands, and flood detention areas.

(2) Protect the normal quantity, quality, and flow of groundwater and surface water, which are necessary for the protection of resources of State and regional concern.

(3) Protect the water available for aquifer recharge.

(4) Protect the functions of the Green Swamp Potentiometric High of the Floridan Aquifer.

(5) Protect the normal supply of ground and surface waters.

(6) Prevent further salt-water intrusion into the Floridan Aquifer.

(7) Protect or improve existing ground and surface water quality.

(8) Protect the water-retention, and biological filtering capabilities of wetlands.

(9) Protect the natural flow regime of drainage basins.

(10) Protect the design capacity of flood detention areas, and the water-management objectives of these areas through the maintenance of hydrologic characteristics of drainage basins.

Regulatory Guidelines

(1) Site Planning

The platting of land shall be permitted only when such platting commits development to a pattern which will not result in the alteration of the natural surface water flow regime, and which will not reduce the natural recharge rate of the platted site.

(2) Site Alteration

Site Alteration shall be permitted only when such alteration will not adversely affect the natural surface water flow regime, or natural recharge capabilities of the site; and when it will not cause siltation of wetlands, or reduce the natural retention and filtering capabilities of wetlands.

All site alteration activities shall provide for water retention and settling facilities, maintain an overall site runoff equivalent to the natural flow regime prior to alteration, and maintain a runoff rate which does not cause erosion. No site work shall be initiated prior to the issuance of drainage/stormwater permits by concerned agencies.

(3) Soils

All exposed soils as a result of site alteration or development activities shall be located and stabilized in a manner to prevent the alteration of the natural flow regime. All soil exposed as a result of site alteration or development activities shall be restored with suitable vegetation.

(4) Groundwater

Groundwater withdrawal shall not exceed the safe yield per acre as determined by the St. John's River or the Southwest Florida Water Management Districts, or its successor agency.

(5) Stormwater

Pre-treated stormwater runoff shall be released into the wetlands in a manner approximating the natural flow regime if consistent with the stormwater management ordinance.

Any industrial waste, sewage, or other man-induced wastes shall be effectively treated by the latest technological advances, and shall not be allowed to discharge into these waters unless approved by the Pollution Control Board in conformance with DER rules and regulations.

(6) Solid Waste

There shall be no solid waste facilities located in the Green Swamp.

(7) Structures

Structures shall be placed in a manner that will not adversely affect the natural flow regime, and which will not reduce the recharge capabilities. Placement of structures shall be consistent with sound floodplain management practices such as compliance with the Flood Disaster Protection Act of 1973.

OBJECTIVE 1-18: DEVELOPMENT WITHIN THE GREEN SWAMP AREA OF CRITICAL STATE CONCERN AS IT RELATES TO THE PROTECTION OF RESOURCES IDENTIFIED WITHIN THE CONSERVATION ELEMENT. Lake County Hereby Incorporates the Objectives and Policies Contained within Lake County Ordinance 1985-19 Which Amended Various Portions of the Lake County Comprehensive Plan Adopted in 1977 and 1980. Lake County Shall Protect its Water Resources in View of the Benefits that can be Derived by Present and Future Residents of Lake County. Protection of Water Resources in the Green Swamp Area of Critical State Concern is Required by the Principles for Guiding Development for the Green Swamp Area of Critical State Concern.

Policy 1-18.1: Minimization of Adverse Impacts to the Floridan Aquifer. Lake County shall minimize the adverse impacts of development on resources of the Floridan Aquifer.

Policy 1-18.2: Protection of Ground and Surface Waters. Lake County shall protect the normal quantity, quality, and flow of ground and surface water, which are necessary for the protection of resources of State and regional concern.

Policy 1-18.3: Protection of Amount of Water Available for Aquifer Recharge. Lake County shall protect the water available for aquifer recharge.

Policy 1-18.4: Protection of the Water Supply. Lake County shall protect the normal supply of ground and surface waters.

Policy 1-18.5: Prevention of Salt-water Intrusion into the Floridan Aquifer. Lake County shall prevent further salt-water intrusion into the Floridan Aquifer.

Policy 1-18.6: Maintenance of the Potentiometric High of the Floridan Aquifer. Lake County shall protect the functions of the Green Swamp Potentiometric High of the Floridan Aquifer.

Policy 1-18.7: Minimization of Adverse Impacts to Wetlands Caused by Development Activities. Lake County shall minimize the adverse impacts of development on wetlands.

Policy 1-18.8: Protection of the Functions of Wetlands. Lake County shall protect the water-retention, and biological filtering capabilities of wetlands.

Policy 1-18.9: Protection of Water Quality and Quantity. Water quality and quantity in the Green Swamp Area of Critical State Concern shall be protected in accordance with the Principles for Guiding Development for the Green Swamp Area of Critical State Concern.

Policy 1-18.10: Green Swamp Boundary. The Green Swamp Area of Critical State Concern was designated in 1979 by the Florida Legislature pursuant to Chapter 380, Florida Statutes, at Section 380.0551, Florida Statutes. This legislation set forth the requirements of the designation which are also found within the Florida Administrative Code. The boundary of the Green Swamp Area of Critical State Concern is shown on Maps 1-1k and 1 within the Future Land Use Element Data Inventory and Analysis of the Comprehensive Plan and is legally described within Rule Chapter 28-28, Florida Administrative Code.

OBJECTIVE 1-19: DEVELOPMENT WITHIN THE GREEN SWAMP AREA OF CRITICAL STATE CONCERN AS IT RELATES TO THE PROVISION OF PUBLIC FACILITIES AS DESCRIBED WITHIN THE PUBLIC FACILITIES SUB-ELEMENTS. Lake County hereby incorporates the Objectives and Policies contained within Lake County Ordinance 1985-19 which amended various portions of the Lake County Comprehensive Plan Adopted in 1977 and 1980. Lake County Shall Protect its Aquifer Recharge Areas. Protection of Groundwater Resources in the Green Swamp Area of Critical State Concern is Required by the Principles for Guiding Development for the Green Swamp Area of Critical State Concern.

Policy 1-19.1: Protection of Groundwater Resources. Lake County shall protect its groundwater recharge area from development which would substantially reduce the amount of potential recharge. Protection of aquifer recharge areas in the Green Swamp Area of Critical State Concern is required by the Principles for Guiding Development for the Green Swamp Area of Critical State Concern.

Policy 1-19.2: Insure the Convenience and Safety of the Public by Controlling Surface Water Runoff and Flow. Lake County shall, in the Green Swamp Area of Critical State Concern, conserve and protect the environmental resources consistent with the Principles for Guiding Development for the Green Swamp Area of Critical State Concern as it relates to stormwater runoff. Lake County shall prepare and adopt a comprehensive stormwater management ordinance which meets or exceeds the site alteration criteria as found within Section 18-18.008(7), Florida Administrative Code. Wetland alteration shall be consistent with Policy 1-2.1 (wetlands) and policies in the Conservation Element. Stormwater shall be treated to the level for quality and quantity (Levels of Service) as established within the Stormwater Sub-element Goals, Objectives, and Policies and in conformance with Policies 1-2.2 and 1-2.11 as well as policies within the Conservation Element. The Stormwater Ordinance shall contain at minimum, definitions, permit requirements, exemptions, performance criteria, system design criteria, dedication of drainage easements and rights-of-way, application requirements, payment of fees, maintenance of systems, inspections, enforcement, emergency exemptions, variance provisions, provisions for appeals, and provide for penalties and violations.

Policy 1-19.3: Minimization of Threats to Life and Property through the Provisions Contained within Ordinance 1978-8, the Lake County Flood Ordinance. Lake County shall enforce the County's Floodplain Ordinance, which shall be included within the Land Development Regulations, so as to minimize the threat of life and property from flooding. In the Green Swamp Area of Critical State Concern, enforce regulation consistent with the Principles for Guiding Development for the Green Swamp Area of Critical State Concern.

Policy 1-19.4: Stormwater Management Considerations within the Green Swamp Area of Critical State Concern. Lake County shall minimize the adverse impacts of development on flood detention areas, protect the natural flow regime of natural drainage basins, protect the design capacity of flood detention areas, and the water-management objectives of those areas through the maintenance of hydrologic characteristics of drainage basins.

How the Land Development Regulations Address the Green Swamp.

The proposed revisions to the County's Land Development Regulations includes a separate and specific chapter concerning growth management affecting the Green Swamp. Proposed land development regulations affecting the Green Swamp Area of Critical State Concern are not yet available.

Critique of Green Swamp ACSC Program

Local Governments

In the early years of designation, local governments showed little interest in achieving repeal of the designation of the Green Swamp ACSC. On November 4, 1981, the Green Swamp Resource Planning and Management Committee (RPMC) was appointed pursuant to Section 380.055(1), Florida Statutes. The Governor charged the Committee to review land development regulations for Polk and Lake Counties to determine whether they met the requirements for repeal of the critical area designation. The second task of the Committee was to address any additional problems which were not part of the original designation.

Under pressure from both developers and the Department, and under the scrutiny of the RPMC, Polk and Lake Counties made progress toward meeting the repeal requirements of the critical area designation. Polk County adopted a water management ordinance designed to protect wetlands, and Lake County substantially revised its zoning and subdivision regulations to incorporate most of the requirements of the Green Swamp land development regulations. Furthermore, the existing comprehensive plans for both counties were amended to bring them into compliance with the Green Swamp Principles for Guiding Development.

In October 1986, a one-year monitoring period was completed in Polk County. One of the primary purposes of the monitoring period was to evaluate how well Polk County ordinances functioned in protecting water resources. Changes were suggested by the Department and the RPMC to some of Polk County's ordinances and practices to strengthen wetlands protection and improve inter-governmental coordination. Many of these suggestions were adopted by Polk County. However, a more in-depth review of these regulations was instigated by local officials who wanted to ensure the full protection of the Green Swamp's water resources prior to repeal. As a result of this investigation, the RPMC recommended that Polk County adopt a mining ordinance to regulate sand mining and other mining activities in the Green Swamp that were not covered by the Polk County Surface Water Management Ordinance. A draft ordinance was prepared, but a final version was never adopted.

Presently, the Department has entered into settlement negotiations with both Polk and Lake Counties to bring their newly adopted comprehensive plans into compliance with Chapter 163, Florida Statutes and

the Green Swamp regulations. **The primary reason both comprehensive plans were found not in compliance with the Green Swamp Principles for Guiding Development, was the designation of urban areas and associated high urban densities encroaching into the critical area, particularly along U.S. Highway 27.**

Polk and Lake Counties designated these urban uses in response to recent development pressures. Disney World, located less than five miles from the ACSC, has generated significant development activity extending outward from Orlando toward the critical area. This, in combination with the loss of the citrus industry in Central Florida, has resulted in a recent explosion of development activity in the Green Swamp ACSC. Polk and Lake Counties have responded by designating the areas along the boundaries of the Green Swamp for urban development, with densities as high as ten dwelling units to the acre in some areas. **This type of urban sprawl is unacceptable for an area as environmentally sensitive as the Green Swamp.**

Urban sprawl is the premature extension of urban development into agricultural, rural, or other undeveloped or sparsely developed land. Urban sprawl is often characterized by uncontrolled initial development of scattered and isolated properties located on the fringe of suburban land uses, followed by subsequent urbanization of the bypassed parcels of land. Urban sprawl is indicative of a lack of or ineffective land use planning, and results in land uses not functionally or closely related to adjacent development.

Urban sprawl typically results in the degradation of natural resources and often interferes with the efficient provision of public facilities and services. It is generally more costly to provide capital facilities for sprawling development than to provide the same facilities for areas of compact growth. Furthermore, sprawling development often acts as a catalyst for scattered, discontinuous growth throughout the area. This is inappropriate for an environmentally sensitive area such as the Green Swamp, and makes the job of ensuring protection of its resources virtually impossible.

Once the comprehensive plans are brought into compliance and corresponding land development regulations which conform to the Green Swamp Principles for Guiding Development are adopted, and both approved by Department rule, the process for repeal of the critical area designation may begin. Both Polk and Lake Counties will have to demonstrate to the Department and a reactivated RPMC that the goals of the Green Swamp ACSC have been met. The efforts and finding of the Polk County Task Force and Technical Advisory Committee should assist both the Counties and the Department in meeting these objectives.

The Department of Community Affairs

The DCA has been less than diligent over the years in providing oversight of the Green Swamp ACSC. The ACSC program established Principles for Guiding Development which local governments must apply, subject to DCA review. Although it is true that local governments often failed to send notice of development approvals to DCA, DCA did not adequately pursue enforcement of the notice requirement. In addition, the principles have been criticized by local governments and by DCA as being too general to provide local governments with adequate guidance. This lack of specificity in the Principles for Guiding Development has fostered uncertainty as to what is actually required to meet the objectives of the ACSC designation. A monitoring report conducted by DCA in 1987 found that one reason for "ineffective water resource protection was that Chapter 27F-6, F.A.C., was vague and lacked specificity on many key

issues."[46] Although Chapter 27F-6 reflected the state of knowledge regarding surface water management in the early 1970s, the monitoring report stated that

> [a]s better surface water management techniques were developed, Chapter 27F-6, F.A.C., could have been interpreted to keep pace with this increased knowledge. However, both the DCA and Polk County continued to authorize projects designed using inappropriate methodologies. Frequently, these development applications contained insufficient data as well.[47]

Recently, with increased development pressure, and the requirements of new comprehensive plans under the Growth Management Act, DCA has taken a more active oversight role in the Green Swamp. Recent DCA findings that Polk and Lake Counties comprehensive plans are not in compliance with state planning requirements indicates a more active DCA role. In addition, DCA has requested funding to establish a field office in the Green Swamp.

Chapter 380 Green Swamp ACSC Designation and ACSC Process

The Green Swamp minimum standards are inadequate because they only address hydrologic functions. Today the Green Swamp is facing more development pressure than ever. In this time of rapid development and dwindling natural resources, the Green Swamp is also more valuable than ever. While in 1974 the Green Swamp was considered valuable primarily for its hydrologic functions, today we recognize that the Swamp provides many other valuable functions. Protection of other valuable resources within the Green Swamp, such as wildlife, wildlife habitat, vegetation, recreation, and mineral values, are currently left to the normal local government growth management process. DCA should amend The Principles for Guiding Development in the Green Swamp ACSC (Rule 28-26.003, F.A.C.), to provide more guidance for local governments. The Principles should be more specific as to what is required of local governments and should reflect current technology and treatment methodologies regarding hydrologic resource protection. Existing guidelines are vague and provide little detail.

The statutory codification of the Green Swamp ACSC (Section 380.0551, F.S.) does not provide specific focus as to the resources which should be protected in the Green Swamp. The existing rules developed pursuant to Section 380.0551 are based on a 1974 study which recommended that hydrologic resources of the Green Swamp be protected. Our 1992 study finds that there are multiple resource values in the Green Swamp which are important and unique, including, but not limited to hydrology, wildlife, wildlife habitat, wildlife corridors, recreation, aesthetics, and rare or unique habitat. Amendment of the enabling statute to specifically address these values would provide stronger authority and direction for adoption of appropriate rules. Accordingly, Section 380.0551 should be amended to require protection of all important natural resource values of the Green Swamp. DCA should take the lead in pursuing legislative changes.

The DCA rule establishing minimum standards for the Green Swamp ACSC (Chapter 28-26, F.S.) focuses on protection of the hydrologic resources of the Green Swamp. However, our study finds that there are multiple important and unique resource values in the Green Swamp which should be protected. DCA should amend the rule to require local governments to protect other important natural resource values of the Green Swamp, including wildlife, wildlife habitat, wildlife corridors, recreation, aesthetics, and rare

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46. Department of Community Affairs, "Green Swamp ACSC Summary of Monitoring Period for Polk County," 42 (Jan., 1987).

47. *Id.*

or unique habitat. While the rule could probably be broadened under existing statutory authority, it would be helpful to first amend Chapter 380.0551 as discussed above.

Local Government Comprehensive Plans and Land Development Regulations within the Green Swamp

Local governments within the Green Swamp have recently adopted new comprehensive plans designed to satisfy the requirements of Chapter 163 Part II and Rule 9J-5.[48] Local governments must implement and enforce the objectives of the comprehensive plan through land development regulations.[49] Land development regulations must: 1) regulate use of land and water; 2) ensure compatibility of adjacent uses; 3) provide for open space; 4) provide for protection of potable water wellfields; 5) regulate areas subject to seasonal and periodic flooding; 6) provide for drainage and stormwater management; and 7) ensure the protection of environmentally sensitive lands designated in the comprehensive plan.[50] Local governments typically attempt to implement the conservation and related elements of their comprehensive plans through ordinances addressing wetlands, flood plains, shorelines, stormwater, and dredge and fill.

The following discussion examines selected comprehensive plan elements and land development regulations of local governments within the Green Swamp. Review is limited to 1) future land use, conservation, recreation and open space, and intergovernmental coordination comprehensive plan elements, and 2) conservation oriented land development regulations. Table 4-2 illustrates environmental resources which are regulated by local governments in the Green Swamp.

TABLE 4-2

SUMMARY OF LOCAL GOVERNMENT ENVIRONMENTAL REGULATIONS
IN THE GREEN SWAMP

	-------Water-------		----------Wildlife----------			----------Habitat----------		
Regulator	Quality	Quantity	Wetland	Endang-ered	Other	Wetlands	Flood-plain	Uplands
Lake	R	R	N	R	N	N	R	N
Polk	R	R	N	R	N	N	R	N
Hernando	N	N	N	R	N	N	R	N

R = Regulation
N = No Regulation (Limited review may occur in the development review process.)

48. Rule 9J-5, FLA. ADMIN. CODE, provides minimum criteria for review of local government comprehensive plans and determination of compliance with the Local Government Comprehensive Planning and Land Development Regulation Act.

49. FLA. STAT. § 163.3202(1) (1991).

50. *Id.* § 163.3202(2).

Table 4-3 illustrates the status of wetlands regulations for local governments within the Green Swamp.

TABLE 4-3

LOCAL GOVERNMENT ISOLATED WETLANDS PERMITTING THRESHOLDS IN THE GREEN SWAMP

	Wetlands Ordinance	Size*	Regulatory Entity Other**
Lake County	D	0.25	Y
Polk County	D	0.0	Y
Hernando County	N	NA	Y
Lakeland	D	0.0	Y
Polk City	D	0.0 or 0.5	Y

D = Developing a wetlands ordinance.
NA = Not applicable
* = Proposed size thresholds.
** = Limited consideration of some wetland values in development review process.

Polk County

The future land use element of the existing Polk County comprehensive plan establishes a special-area overlay for the Green Swamp called the Green Swamp Area Protection Area, the boundaries of which conform to those of the state ACSC designation for Polk County.[51] Within this special area, the county "shall limit development ... to development activities and intensities which will not alter the natural function of its wetlands and aquifer-recharge areas." This objective is to be accomplished through:

a. the designation and mapping of a Green Swamp Protection Area Overlay;
b. the establishment of density transfer provisions; and
c. the establishment of criteria applicable to the development of lands within the Green Swamp Protection Areas [sic].

Within the Green Swamp Area Protection Area, development must conform with the objectives contained in the Principles for Guiding Development.[52] In addition, development within this area must also comply with requirements for Floodplain-Protection Areas and Wetland Protection Areas, when applicable. Development in Floodplain-Protection Areas is limited to "development activities and intensities which will not enlarge the off-site floodplain, [or] alter the natural function of the floodplain."[53] As with the Green Swamp Area Protection Area, this objective is to be accomplished through mapping, density transfer provisions, and development criteria. Development criteria encourage development to locate on the non-floodplain portions of the site and provide for transfer of density to contiguous non-floodplain areas.

51. Polk County Comprehensive Plan, Objective 2.120-F (April 19, 1991).

52. The objectives contained in the Principles for Guiding Development (Rule 28-26.003(1), F.A.C.), are adopted verbatim in policy 2.120-F2 of the Polk County Comprehensive Plan.

53. Polk County Comprehensive Plan § 2.120-B (April 19, 1991).

Development in Wetland Protection Areas is limited to "development activities and intensities which will have a minimal impact upon the natural functions of the County's wetland areas."[54] As with the other special areas, this is to be accomplished through mapping, density transfers, and development criteria. Development criteria for Wetland Protection Areas limit gross densities to 1 dwelling unit per 10 acres (1 DU/10 AC) and requires that development be located on the non-wetland portion of the site if any exists. Densities may be transferred from wetlands areas to contiguous upland properties.

The future land use element states that within Wetland and Floodplain Protection areas the county

> shall investigate techniques -- such as transfer of development rights (TDRs) -- that would promote and encourage:
>
> a. the transfer of density or intensity to off-site locations, and/or
> b. the transfer of density or intensity to on-site locations further removed [from the floodplain or wetland].

The future land use element also provides for creation of Aquifer Protection Areas but does not explicitly require that development within the Green Swamp Area Protection Area must conform to those requirements.

The future land use element also states that Polk County must coordinate development of specific land development regulations for the Green Swamp Area Protection Area with Lake County so that uniform development standards can be adopted within each county.[55]

The future land use element provides for creation of Resource-Protection Districts, including Mineral-Resource Protection Districts, Wellfield-Protection Districts, and Green-way Districts.[56] Mineral-Resource Protection Districts are intended to protect known deposits from encroachment by incompatible land uses, and development criteria require that "mineral extraction activities should be conducted in a manner which will minimize adverse effects to water quality, fish and wildlife, and adjacent land uses" and that a reclamation plan be provided.[57] Wellfield-Protection Districts are intended to protect public wellfields having a capacity of 100,000 GPD or greater from direct contamination. Development criteria must require that land uses be regulated "to prevent or minimize the threat of contamination ... through restrictions on the storage, generation or use of hazardous materials," and require that all development within this district go through the County's development-review process.[58] Green-way Districts are areas "desirable for future public acquisition for the creation of open spaces, habitat protection, linear parkways, and conservation areas." Within a Green-way District, development must be reviewed under the County's development review procedures, so as to provide the County with notice of the development and to allow the County to pursue acquisition of the property. The County must make a decision within 60 days of receiving a request for approval of a development order as to whether to pursue acquisition.[59]

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54. Polk County Comprehensive Plan § 2.120-C (April 19, 1991).

55. *Id.* Policy 2.120-F3.

56. *Id.* § 2.121.

57. *Id.* § 2.121-C.

58. *Id.* § 2.121-D.

59. *Id.* § 2.121-E.

The future land use map designates much of the Green Swamp ACSC for Agriculture/Residential Rural (A/RR) land uses.[60] This land use classification allows residential densities of up to 1 dwelling unit per 5 acres and encourages the continuation of existing agriculture uses.[61] More intensive land uses may be allowed within the A/RR land use designation if certain development criteria are met. Rural Residential Development (RRD) areas may allow residential development at gross densities (on the entire site) between 1 DU/2.5 AC and 1 DU/1 AC depending upon the availability of infrastructure and the proximity to existing development. Rural Mixed-Use Development (RMD) areas may be allowed within the A/RR designation and may contain gross residential densities of up to 2 DU/1 AC. Development criteria for RMD areas require a minimum size of 160 acres, availability of infrastructure, and dedication by conservation easement of at least 50% of the site. Specialized uses, which may be allowed in the Green Swamp if certain criteria are met, include isolated convenience stores, intensive-use mitigation areas, utilities, community facilities, non-phosphate mining, residentially based mixed-use developments, and non-certified electric-power generation facilities.[62]

The future land use element establishes the U.S. 27 corridor from Haines City to the Lake County Line, as a Selected-Area for study.[63] The area is important because it borders the Eastern boundary of the Green Swamp ACSC and is experiencing significant development pressure. The County may develop a Selected Area Plan (SAP) for the corridor which would consist of a detailed land-use plan for the specific area. The county is also directed to conduct Selected-Area studies for areas suitable as Green-way Districts, including

> investigating the possibility of creating a linear parkway which may connect various existing and potential state and local open spaces, recreation areas, rails-to-trails facilities, and waterbodies.

The Polk County future land use map also designates portions of the Green Swamp as Urban Growth Areas, Urban Development Areas, and Suburban Development Areas.[64] These areas are primarily along the eastern and southern boundaries of the ACSC. It is unclear from the comprehensive plan what types of densities and uses would be allowed in these areas.

The goal of the Polk County Conservation Element is to "protect, manage, and enhance the natural resources and environmental quality of Polk County." The conservation element identifies the County as containing a large portion of the Green Swamp ACSC which forms the potentiometric high for groundwater in the state.[65] The conservation element contains provisions addressing air quality, soils, mineral resources, surface water, groundwater, floodplains, wetlands, ecological communities, hazardous waste/materials, and general conservation.

The following specific provisions are particularly important for protection of the Green Swamp.

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60. Polk County Comprehensive Plan, Future Land Use Map and § 2.124 (April 19, 1991).

61. *Id.* § 2.124.

62. *Id.* § 2.125.

63. *Id.* § 2.127.

64. Polk County Comprehensive Plan, Future Land Use Map (April 19, 1991).

65. *Id.* § 2.301.

- The county must implement a sludge and septic tank removal tracking system by September 30, 1993.

- The county must adopt development regulations to establish performance standards for protection of groundwater, including standards providing for density limits, impervious-surface cover requirements, balanced water-budget requirements, vegetation preservation, stormwater-retention design consideration, and control of point and non-point source pollution.

- County development regulations must encourage wetland species diversification and re-vegetation.

- The county must promote conservation of wildlife and native vegetative communities by including design criteria and providing design incentives to conserve native vegetative communities; allowing for an on-site density transfer to preserve native vegetative communities; and requiring development to conserve or mitigate damage to endangered or threatened species.

- The county must coordinate with applicable local governments to identify and protect unique environmental resources.

- The county must coordinate with other governments or agencies to preserve Green-Way Districts, as described in the Future Land Use Element.

- The county must identify potentially environmentally sensitive areas, including the following areas: wetlands, floodplains, areas supporting endangered or threatened plant or wildlife species, areas supporting unique vegetative communities, areas providing prime and/or high recharge to the Floridan Aquifer, cones of influence of public water wells, and waterbodies.

Zoning/Land Use

The majority of the Green Swamp Area of Critical State Concern is presently zoned Rural Conservation which allows one dwelling unit per acre. Areas which are zoned differently are located along the U.S. Highway 27 corridor, and between Polk City and northeast Lakeland. The current Polk County Comprehensive Plan, adopted April 19, 1991, designates all of the rural areas of the Green Swamp as Agricultural/Rural Residential (A/RR) which limits the density to one unit per five acres (0.2 units/acre). Areas which are classified as wetlands are limited to a density of one unit per ten acres. The County's zoning ordinance also requires that only one principle structure (house or mobile home) can be permitted for a single parcel or lot. This requires that each time a permit is obtained, a separate lot (legal) description must be submitted. When three or more separate lots are requested, the landowner must comply with the subdivision regulations.

The County adopted a "vesting" ordinance which recognizes the rights of property owners with existing lots which would not meet the new requirements of the Comprehensive Plan. This ordinance allows for lots which were platted or existed on the County Property Appraiser's records and for which a building permit could be legally issued at the time of the adoption of the Comprehensive Plan, to be able to obtain a permit after the adoption of the Plan regardless of the density. The Comprehensive Plan also includes a policy which allows a one year "grace period" for property owners to develop in accordance with the zoning at the time the Comprehensive Plan was adopted. After the one year period, development must conform to the land use and density requirements of the Plan.

The Comprehensive Plan also changed the definition of subdivision which affects the requirement for platting subdivided lots. The Plan includes a policy which requires any subdivision of three or more lots,

five acres or less in size, to comply with the County's subdivision regulations. This will require that the subdivision of lots along existing roads to be platted.

Road Access

The minimum road frontage ordinance (Ordinance Number 83-13) requires that in order to be eligible for a building or mobile home set-up permit, each lot must have a minimum of 50 feet of access to a County or State road. This requirement is for the 50 feet to be part of the lot itself and not a common easement or private road. This requirement continues to render large areas of the Green Swamp Area of Critical State Concern undevelopable in its present condition. Lots may have frontage less than 50 feet, however, they must be platted and cannot be less than 25 feet.

Water and Sewer

Since most of the Green Swamp Area of Critical State Concern does not have central water or sewer service available, the standard method of providing this service is private wells and septic tanks. Polk County does not have any separate regulation for these facilities. Septic tanks are permitted by the Florida Department of Health and Rehabilitative Services (HRS), Polk County Health Unit. The regulation governing the permitting and installation of septic tanks is Chapter 10D-6, F.A.C.

The state regulation currently allows the placement of an individual septic tank on a residential parcel. If the residence is to be served by an individual well for potable water supply, the parcel must be at least one-half acre in size. If there are any flood prone areas involved, the minimum of one-half acre must be located outside of the flood area. If the parcel is served by a central water supply, the minimum lot size is a net 1/4 acre which results in a density of 3.5 to 4.0 units per acre. The state septic tank rules also allow for the septic tank drain field to be elevated above the seasonal high water table a maximum of 48 inches. This has resulted in what is commonly referred to a "mounded septic tank systems". Such systems have been placed in areas where the seasonal high water table is at or very close to the ground surface. This type of situation exist in much of the pine flatwoods and other areas adjacent to wetlands within the Green Swamp area.

Surface Water Protection Ordinance

Polk County has two ordinances which regulate development in relationship to surface water quality. These ordinances are the Surface Water Protection Ordinance (Polk County Ordinance No. 89-47) and the Flood Protection and Surface Water Management Ordinance (Polk County Ordinance No. 88-04).

The County's Surface Water Protection Ordinance gives the Polk County Health Department (HRS) the authority to approve or deny the installation of on-sit disposal systems (septic tanks) beyond the provisions of Chapter 10D-6, Florida Administrative Code. The additional provisions contained in this Ordinance require a setback of 150 feet for septic tank absorption fields (drain fields) from the ordinary high water line of surface waters on lands with soils identified in the Polk County Soil Survey as having soil limitation ratings of slight or moderate with respect to septic tanks. If the soil limitation rating is sever for septic tanks, the required setback for the drain field is 200 feet from the ordinary high water line of surface waters. Surface water is defined in the ordinance as watercourses, rivers, streams, lakes, navigable waters and associated tributaries.

In addition to setbacks for septic tank drain fields, the Surface Water Protection Ordinance requires that all new structures shall be located a minimum of fifty (50) feet landward of the ten year flood plain, adjacent to lakes or landward of the 100 year floodplain, whichever is lass restrictive.

This ordinance also gives the County authority to investigate and report possible violations of State laws and rules pertaining to the protection of surface water quality.

Flood Protection and Surface Water Management Ordinance

The portion of this ordinance dealing with flood protection was initially adopted by the County in 1977 for the purpose of implementing the Federal Flood Insurance Program. This portion of the Ordinance continues to implement the requirements of this program. If a structure is to be placed within an "area of special flood hazard" (100 year flood plain) the floor elevation must be one foot above the 100 year flood elevation.

In addition to the flood protection requirements, this ordinance restricts alteration of wetland to only 10 percent of the wetland area owned by the applicant/developer. The ordinance defines wetlands as areas having hydric (wet) soil classifications as identified by the Soil Conservation Service. Jurisdiction of the ordinance is determined by areas having hydric soils and located within areas of special flood hazard as depicted on the Flood Insurance Rate Maps for Polk County.

The enforcement of this ordinance essentially requires that the post development runoff rate from developed property equal the predevelopment runoff rate. The adoption of the Polk County Comprehensive Plan has added the additional requirement that the post development runoff volume must match the pre development runoff volume.

The ordinance requires that subdivision lots which are located within flood hazard areas must have the required minimum lot size (area) located outside of the flood plain. The ordinance also provides for the transfer of density credits from land located within the flood hazard area to contiguous upland areas. Density may be transferred based on the allowed density within the wetland area provided the overall density allowed for all of the property is met. In order to achieve the transfer, the minimum lot size may be reduced by 35 percent. This provision has been utilized with several subdivisions which have flood areas within the property being subdivided. Flood plain areas are set aside as drainage/conservation easements.

Subdivision Regulations

The County's Subdivision regulations require that subdivisions retain stormwater runoff. Retention for a 25-year frequency storm is required with provisions for overflow with a positive outfall. If a positive outfall cannot be provided, the retention area must be designed for a 100-year frequency storm. In addition to requirements for stormwater retention, the post-development rate of runoff must equal the rate for runoff prior to the development. The Polk County Comprehensive Plan includes a policy which requires that both post-development runoff rate and volume must equal the pre-development rate and volume. This is also the requirement for projects which are subject to the County's Flood Protection and Surface Water Management Ordinance.

In addition to the local permit process, copies of all development orders (permits, rezoning approvals, plats, etc.) issued for property located within the Green Swamp Area of Critical State Concern are sent to the Florida Department of Community Affairs for review pursuant to the requirements of the approved monitoring procedure.

Lake County

The existing future land use element of the Lake County Comprehensive plan states that

> Land determined to be of ecological or environmental value is set aside to be conserved. The Green Swamp Area of Critical State Concern is one such area that has been determined to be of environmental value. For the purposes of this Land Use Plan, "conserve" shall imply uses such as parks, agriculture, very low density residential which will no overly damage natural conditions, as well as, "no development" use. It is intended that the Conservation Element will eventually determine actual preservation areas as specific inventories and information becomes available.[66]

Within the Green Swamp ACSC, development must conform with the objectives contained in the Principles for Guiding Development.[67] The future land use element establishes policies to control existing and future land uses located within or adjacent to environmentally sensitive lands, and other significant natural resources.[68] The element identifies wetlands, floodplains, aquifer recharge, lake front and wetland littoral zones, and vegetative communities and wildlife habitats as environmentally sensitive lands.

Development in wetlands is limited to "uses supporting conservation and passive recreation activities," although the element provides for residential densities of up to 1 DU/5 acres in wetlands.[69] The element provides for the use of mitigation to compensate for wetlands alterations and requires that there be "no net loss of natural functional value." The element requires either 1) uniform buffers of 15 feet for isolated wetlands, 25 feet for non-isolated wetlands, and 50 feet for rivers and streams, or 2) variable width buffers averaging 25 feet (10 feet minimum width) for isolated wetlands, 50 feet (15 feet minimum width) for non-isolated wetlands, and 100 feet (35 feet minimum width) for rivers and streams. Wetland alterations within the Green Swamp ACSC must comply with these policies.[70] Lake County also must prohibit the use of septic tanks in soils with severe septic tank limitations, as defined by the Soil Conservation Service. Development densities must not exceed one unit per acre in soils with severe septic tank limitations.

The Lake County floodplain regulations must provide for 25-50 foot vegetative buffers along rivers within the 100 year floodplain. The element does allow encroachment within the 100 year floodplain by passive recreation or conservation activities; septic tanks and drain fields, roads, bridges, water and sewer distribution lines; compensating storage when no other alternative is available; and stormwater management facilities.[71]

The element requires Lake County to develop a comprehensive stormwater management program to help satisfy the Principles.[72] The County must develop shoreline protection standards which establish minimum setbacks of residential dwellings of 35 feet from the mean high water mark; establish 100 foot

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66. Lake County Comprehensive Plan Policy 1-17.1 (July 9, 1991).

67. *Id.* Policies 1-17.2 - 1-17.6, 1-18. The Principles for Guiding Development (Rule 28-26.003(1)) are adopted in policy 1-17.6 of the Lake County Comprehensive Plan.

68. *Id.* § 1-2.

69. *Id.* policy 1-2.1. However, Lake County limits development densities in wetlands located in the Wekiva River Protection Area to 1 DU/20 Acres or 1 DU/40 Acres. *Id.*

70. *Id.* policies 1-19.2, 1-2.1.

71. *Id.* policy 1-2.2.

72. *Id.* policies 1-19.2, 1-2.2.

setbacks for septic tanks from the mean high water mark; prohibit removal of more than 25% of shoreline vegetation; and prohibit more than 25% of artificial beach frontage.[73]

The future land use element requires that the County designate environmentally significant vegetative communities and wildlife habitats so as to protect these areas from the adverse effects of development. These areas should either be 1) designated as conservation open space, precluding encroachment or intrusion of development altogether, or 2) developed but required to preserve portions of developable upland (PUDs must provide 25% open space, while Commercial and Industrial uses must provide 20% open space).[74]

The Lake County future land use map designates much of the Green Swamp ACSC as Rural or Wetland areas.[75] Both of these land use classifications allow residential densities of up to 1 dwelling unit per 5 acres, although the primary functions of the rural area "shall be to allow for the continuation of existing agricultural uses, maintain open space, and protect native habitats."[76] The future land use map also designates significant areas of the Green Swamp ACSC as either Rural Village (maximum of 3 DU/AC); Semi-Rural - Future Urban (maximum of 1 DU/2 AC); Suburban (maximum of 3 DU/1 AC); Urban Expansion (1-6 DU/1 AC); and Urban (1-10 DU/1 AC).[77]

Many of the provisions contained in the Lake County future land use element are repeated in the conservation element. The conservation element contains similar language regarding natural resources, including wetlands, floodplains, aquifer recharge, lake front and wetland littoral zones, and vegetative communities and wildlife habitats as environmentally sensitive lands. Of particular interest are additional provisions which: 1) provide for an Outstanding Lake County Waters Program which would prohibit further degradation of water quality in designated waters; 2) preserve sufficient natural uplands habitat of each community type throughout the County, to maintain viable populations of all native plant and animal species; 3) conserve, appropriately use, and protect fisheries, wildlife, wildlife habitat and the freshwater habitat resources of the County; 4) assure that public land management, use, and acquisition is compatible with the maintenance of wildlife and natural systems and sufficient to meet future conservation needs; and 5) prohibit mining in environmentally sensitive areas that cannot be restored, including the limestone deposits within the Green Swamp Wildlife Management Area.[78]

Lake County has a mining and excavation ordinance which applies within the Green Swamp ACSC.[79] In addition, proposed revisions to the County's Land Development Regulations include a separate and specific chapter concerning growth management affecting the Green Swamp. However, these proposed regulations were not available at the time of this writing.

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73. *Id.* policy 1-2.6.

74. *Id.* policy 1-2.7

75. Lake County Comprehensive Plan, Future Land Use Map (July, 1991).

76. *Id.* policy 1-1.6.

77. *Id.*

78. *Id.* chapter VII.

79. Lake County, Fla., Ordinance No. 1990-8, § 1 (May 8, 1990).

Summary and Conclusions

The comprehensive plans of both Lake and Polk counties contain some provisions, which if fully developed and implemented could provide additional protection for the Green Swamp. However, the comprehensive plans fall short of ensuring comprehensive and consistent protection for the entire ecosystem. There are inconsistencies between stated goals and objectives and the actual implementation of those goals and objectives. For example, Lake County states that the Green Swamp ACSC should be conserved through land uses such as parks, agriculture, very low density residential, and no development, yet future land use map allows residential densities ranging from 1 DU/5 AC to 10 DU/1 AC within the ACSC. Similarly, Polk County allows inappropriate densities within the ACSC.

The Department of Community Affairs (DCA) has found both counties' plans not in compliance with state growth management requirements.[80] Deficiencies include inappropriate uses and intensities of use; inadequate development criteria for rural areas; inadequate guidelines to ensure protection of natural resources, including floodplains, wetlands, ground and surface water, aquifer recharge areas, potable water wellfields, natural vegetative communities, threatened ecological communities, wildlife habitat; inadequate mining controls; inadequate protection of protection of the Green Swamp ACSC as a resource of regional and state-wide significance; and inadequate intergovernmental coordination.[81]

Despite these deficiencies, the comprehensive plans contain policies which support many of the recommendations contained in this report. For example, the plans support identification and protection of environmentally sensitive lands; the potential use of density transfers and transferable development rights to help protect environmentally sensitive land; creation of buffers for wildlife and water quality purposes; creation of wildlife corridors to connect unconnected habitat areas; protection of wildlife habitat; and protection of vegetative communities.

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80. Department of Community Affairs, Notice of Intent to Find the Lake County Comprehensive Plan not in Compliance (August 30, 1991); Department of Community Affairs, Statement of Intent to Find [Polk County] Comprehensive Plan not in Compliance (June 13, 1991).

81. *Id.*

REGIONAL, STATE, AND FEDERAL ENVIRONMENTAL REGULATIONS

Activities in the Green Swamp are subject to the regulatory authority of federal, state, and regional agencies. This review is limited to those regulations having the greatest impact on the management and preservation of water, wetland, and wildlife resources of the Green Swamp. Table 4-4 illustrates environmental resources which are currently regulated in the Green Swamp by federal, state, and regional agencies.

TABLE 4-4

SUMMARY OF AGENCY ENVIRONMENTAL RESOURCE REGULATIONS
IN THE GREEN SWAMP

	Water		Wildlife			Habitat		
Regulator	Quality	Quantity	Wetland	Endangered	Other	Wetlands	Floodplain	Uplands
EPA	R	R	R	R	N	R	N	N
COE	R	R	R	R	N	R	N	N
DER	R	R	R	R	N	R	N	N
SJRWMD	R	R	R	R	N	R	R	N
SWFWMD	R	R	R	R	N	R	R	N

R = Regulation N = No Regulation

Point Source Discharges

The Environmental Protection Agency (EPA) is responsible for regulating point source discharges of pollutants into surface waters of the United States. Industrial and municipal point sources which discharge into waters, such as wastewater treatment facilities, landfills, and factories are required to obtain National Pollutant Discharge Elimination System (NPDES) permits from EPA. NPDES permit requirements are designed to insure enforcement of effluent limitations and new source performance standards. Prior to issuance of most NPDES permits, EPA must receive certification from the state of Florida that the discharge will meet state water quality standards. In Florida, most point source dischargers must also obtain permits from the Department of Environmental Regulation (DER).

Surface Water and Stormwater Management

The St. Johns River Water Management District and the Southwest Florida Water Management District regulate surface and storm water in the Green Swamp. Water Management District regulations are implemented through the management and storage of surface waters (MSSW)[82] and stormwater[83] permitting programs.

82. FLA. ADMIN. CODE Chapters 40C-4 (August 1989) and 40D-4 (Sept., 1990).

83. FLA. ADMIN. CODE Chapters 40C-42 (August 1987) and 40D-4 (Sept., 1990).

Chapter 373, Florida Statutes,[84] provides regulatory authority and guidance for Water Management District MSSW regulations. Chapter 373 authorizes the Water Management District to require permits and impose reasonable standards to 1) "assure that the construction or alteration of any dam, impoundment, reservoir, appurtenant work, or works [MSSW system] will not be harmful to the water resources of the district,"[85] and 2) "assure that the operation or maintenance of any [MSSW system] will not be inconsistent with the overall objectives of the district and will not be harmful to the water resources of the district."[86] Permits issued for maintenance or operation are permanent,[87] unless the owner abandons the MSSW system[88] or the Water Management District revokes or modifies the permit.[89]

Chapter 373 directs the Water Management Districts to conduct periodic inspections during the construction, alteration, and operation of MSSW systems[90] and to determine whether remedial measures are necessary.[91] The Water Management Districts may order that the owner of a MSSW system alter or repair the system within a reasonable time. If the owner fails to obey the order, the Water Management Districts may make the repairs and impose a lien against the owner's property for the cost of the repairs.[92] Furthermore, the Water Management Districts, state agencies, the state, and private persons may bring suit to enjoin MSSW systems which are violating the laws of the state or Water Management District standards.[93]

Chapter 373 expressly exempts certain activities from the MSSW permitting program. Agriculture, silviculture, floriculture, or horticulture activities which alter the land surface for "purposes consistent with the practice of such occupation," are exempt from the MSSW rule unless the sole or predominant purpose of the alteration is to impound or obstruct surface waters.[94] In addition, the MSSW rule does not apply

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84. FLA. STAT. Chapter 373 (1989).

85. *Id.* § 373.413.

86. *Id.* § 373.416.

87. *Id.* § 373.416(2).

88. *Id.* § 373.426. MSSW systems which are not owned by the state, and which are not used or maintained for three years, are presumed abandoned and dedicated to the Water Management Districts. *Id.*

89. *Id.* § 373.429. Water Management Districts may revoke or modify a permit if the district determines the MSSW system is a danger to the public health or safety or if operation of the system is inconsistent with the objectives of the district. *Id.*

90. *Id.* § 373.423.

91. *Id.* § 373.436.

92. *Id.* § 373.436.

93. *Id.* § 373.433.

94. *Id.* § 373.406(2).

to the construction, operation, or maintenance of closed agricultural systems.[95] However, the "taking and discharging of water for filling, replenishing, and maintaining the water level" of a closed agricultural system is subject to consumptive use regulations,[96] and dams, dikes, and levees must be constructed, operated, and maintained to conform with generally accepted engineering practices.[97]

St. Johns River Water Management District MSSW Permitting Program

Permit Thresholds

St. Johns River Water Management District (SJRWMD) MSSW regulations require a permit for "construction, alteration, operation, maintenance, removal or abandonment" of any system which meets or exceeds permitting thresholds.[98] The SJRWMD MSSW rule was recently amended to expressly require a permit for the maintenance and operation of existing agricultural surface water management systems or construction of new agricultural systems, subject to statutory exemptions contained in Chapter 373, Florida Statutes.[99] The SJRWMD has adopted a separate rule for regulation of agricultural surface water management systems which operates in conjunction with the MSSW permitting program.[100] The Water Management District may issue a conceptual approval permit, an individual permit, or a general permit.[101] Conceptual approval permits do not authorize construction and may be issued for projects which are developed in phases.[102] Within the Green Swamp, an individual or general MSSW permit must be obtained for a system which:

1. Is capable of impounding a volume of water of forty or more acre feet; or
2. Serves a project with a total land area equal to or exceeding forty acres; or
3. Provides for the placement of twelve or more acres of impervious surface which constitutes 40 or more percent of the total land area; or
4. Contains a traversing work which traverses;

    a. A stream or other watercourse with a drainage area of five or more square miles upstream from the traversing work; or
    b. An impoundment with more than ten acres of surface area; or

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95. *Id.* § 373.406(3); Corporation of President of Church of Jesus Christ of Latter-Day Saints v. St. Johns River Water Management District, 489 So. 2d 59 (Fla. 5th D.C.A. 1986), cert. denied, 496 So. 2d 142 (Fla. 1986).

96. FLA. STAT. § 373.406(3) (1991). The Water Management Districts regulate consumptive use of water through regulations contained in FLA. ADMIN. CODE chapters 40C-2 and 40D-2, which were adopted pursuant to FLA. STAT. § 373, Part II.

97. FLA. STAT. § 373.406(3) (1991).

98. FLA. ADMIN. CODE Rule 40C-4.041(1) (Oct., 1991).

99. FLA. ADMIN. CODE Rule 40C-4.041(1) (Oct., 1991).

100. FLA. ADMIN. CODE Chapter 40C-44 (August, 1991).

101. *Id.* Rule 40C-4.041(2).

102. FLA. ADMIN. CODE Rule 40C-4.041(2)(a) (Oct., 1991).

5. Contains a surface water management system which serves an area of five or more contiguous acres of wetlands with a direct hydrologic connection to:

a. A stream or other watercourse with a drainage area of five or more square miles; or
b. An impoundment with no outfall, which is not wholly owned by the applicant and which is ten acres or greater in size; or
c. A wetland not wholly owned by the applicant.

6. Is wholly or partially located within any isolated wetland.[103]

Permit Criteria

Applicants for general or individual permits for the operation, maintenance, removal, or abandonment of a system, or for conceptual approval permits, must provide reasonable assurance that the activity will not:

1. Adversely affect navigability of rivers and harbors;
2. Adversely affect recreational development or public lands;
3. Endanger life, health, or property;
4. Be inconsistent with the maintenance of minimum flows and levels established pursuant to Section 373.042, Florida Statutes;
5. Adversely affect the availability of water for reasonable beneficial purposes;
6. Be incapable of being effectively operated;
7. Adversely affect the operation of a work of the District ... ;
8. Adversely affect existing agricultural, commercial, industrial, or residential developments;
9. Cause adverse impacts to the quality of receiving waters;
10. Adversely affect natural resources, fish, and wildlife;
11. Induce saltwater or pollution intrusion;
12. Increase the potential for damages to off-site property or the public caused by:

    a. Floodplain development, encroachment or other alteration;
    b. Retardance, acceleration, displacement or diversion of surface water;
    c. Reduction of natural water storage areas;
    d. Facility failure;

13. Increase the potential for flood damages to residences, public buildings, or proposed and existing streets and roadways;
14. Otherwise be inconsistent with the overall objectives of the District.[104]

The Water Management District may balance the beneficial and harmful effects of the proposed system on the fourteen individual objectives to determine whether the system is consistent with the overall objectives of the district.[105] The phrase "overall objectives of the District" appears to mean a compilation

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103. *Id.* Rule 40C-4.041(2)(b). Lower threshold criteria for MSSW systems within the Wekiva Basin are discussed in the section of this chapter addressing Special Protection of Environmentally Sensitive Areas.

104. *Id.* Rule 40C-4.301(1)(a).

105. *Id.* Rule 40C-4.301(1)(b).

of objectives derived from the fourteen individual objectives listed in the rule,[106] the statement of policy and purpose contained in the rule,[107] the declaration of policy contained in Chapter 373, Florida Statutes,[108] and the statement of water policy contained in Chapter 17-40, Florida Administrative Code.[109]

Applicants for permits for construction, alteration, operation, or maintenance of a system or to obtain a conceptual approval permit must give reasonable assurance that the activity will meet the following eight standards:

1. Adverse water quantity impacts will not be caused to receiving waters and adjacent lands;
2. Surface and ground water levels and surface water flow will not be adversely affected;
3. Existing surface water storage and conveyance capabilities will not be adversely affected;
4. The system must be capable of being effectively operated;
5. The activity must not result in adverse impacts to the operation of works of the district ...;
6. The quality of receiving waters will not be adversely affected such that the [state] water quality standards ... will be exceeded;
7. Wetland functions will not be adversely affected;
8. Otherwise not be harmful to the water resources of the District.[110]

If an applicant provides reasonable assurance that design criteria contained in the Water Management District Applicant's Handbook are met, then the "eight harm to the water resources" standards are presumed to be satisfied.[111] Table 4-5 lists MSSW activities that must satisfy the "objectives" test and the "harm to water resource" standards.

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106. *Id.* Rule 40C-4.301(1)(a).

107. *Id.* Rule 40C-4.011.

108. FLA. STAT. § 373.016 (1991).

109. FLA. ADMIN. CODE chapter 17-40 (Dec. 1988).

110. FLA. ADMIN. CODE Rule 40C-4.301(2)(a) (Nov., 1991).

111. *Id.* Rule 40C-4.301(2)(b).

TABLE 4-5

REVIEW CRITERIA FOR SJRWMD MSSW ACTIVITIES

Activity	14 Objectives Balancing Test	Harm to Water Resources Standard
Construction	No	Yes
Operation	Yes	Yes
Maintenance	Yes	Yes
Removal	Yes	No
Abandonment	Yes	No
Conceptual Approval	Yes	Yes
Alteration	No	Yes

General Permits

General permits may be issued for MSSW systems which the Water Management District has determined do not harm the water resources of the district and are not inconsistent with the objectives of the district.[112] Applicants for MSSW general permits must provide reasonable assurances that the following general and threshold conditions are met:

(1) General Conditions

(a) The surface water management system must meet the criteria specified in Rule 40C-4.301, F.A.C. [objectives and standards contained in Rule 40C-4.301 are discussed later in this subsection].

(b) The surface water management system which ... [is located within an isolated wetland] must ... [give reasonable assurance that the activity will not 1) cause adverse impacts to the quality of receiving waters, 2) adversely affect natural resources, fish and wildlife, or 3) violate stormwater permitting standards].

(c) The system must not be subject to the jurisdiction of the Department of Environmental Regulation for the purposes of regulation of dredging and filling.

(2) Threshold Conditions

(a) The system must not be capable of impounding a volume of water more than 120 acre feet.

(b) The system must not serve a project of 120 acres or more total land area.

(c) The system must not serve a project which provides for the placement of more than 40% impervious surface in the total land area.[113]

112. *Id.* Rule 40C-40.141 (Nov. 1991).

113. *Id.* Rule 40C-40.302.

The duration of general permits for the construction, alteration, or removal of an MSSW system is five years, or for the amount of time specified in the permit.[114] Permits for operation, maintenance or abandonment of MSSW systems are permanent.[115] Any general permit may be revoked or modified as provided for in Section 373.429, Florida Statutes.[116] In addition, the Water Management District may attach limiting conditions to the permit to assure the project is consistent with the overall objectives of the district and will not be harmful to the water resources of the district.[117]

Environmental and Wetlands Protection in SJRWMD MSSW Permitting

The SJRWMD regulates wetlands through a Management and Storage of Surface Waters (MSSW) permitting program.[118] Wetlands affected by MSSW systems meeting the thresholds contained in Rule 40C-4.041, F.A.C., are evaluated as part of the review process. The Water Management District derives its authority to regulate wetlands from Chapter 373 Part IV, Florida Statutes, which authorizes the district to ensure that surface water management systems are not harmful to the water resources of the district. Wetlands are considered part of the Water Management District's water resources.

Applicants must provide reasonable assurances that projects are both consistent with the overall objectives of the district and do not harm the water resources of the district. Overall objectives of the district which relate to wetlands include consideration of: 1) minimum flows and levels; 2) availability of water for reasonable beneficial purposes; 3) quality of receiving waters; 4) natural resources, fish, and wildlife; 5) saltwater or pollution intrusion; 6) potential damages to off-site property or the public caused by: floodplain development, encroachment, or other alteration; retardance, acceleration, displacement or diversion of surface water; reduction of natural water storage areas; or facility failure; and 7) potential flood damages to residences, public buildings, or proposed and existing streets and roadways.[119] The Water Management District may balance these factors and other objectives of the district to determine whether the system is consistent with the overall objectives of the district.[120]

Wetlands values are also considered in determining whether a project may be harmful to the water resources of the Water Management District. The following standards relating to wetland values must be met and are not balanced against other considerations:

1. Adverse water quantity impacts will not be caused to receiving waters and adjacent lands;
2. Surface and ground water levels and surface water flow will not be adversely affected;
3. Existing surface water storage and conveyance capabilities will not be adversely affected;

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114. *Id.* Rule 40C-40.321.

115. *Id.*

116. *Id.* Rule 40C-40.351.

117. *Id.* Rules 40C-40.381, 40C-4.381.

118. The SJRWMD MSSW permitting program is discussed earlier in this section.

119. FLA. ADMIN. CODE Rule 40C-4.301(1)(a) (Nov., 1991).

120. *Id.* Rule 40C-4.301(1)(b).

4. The quality of receiving waters will not be adversely affected such that the [DER] water quality standards ... will be exceeded;
5. Wetlands functions will not be adversely affected;
6. Otherwise not be harmful to the water resources of the District.[121]

An earlier version of this rule referred to wetland functions as "hydrologically-related environmental functions." The term "hydrologically-related environmental functions" has been interpreted to include consideration of aquatic and wetland dependent species of wildlife but to not include upland species.[122]

The standards are presumed met if the applicant satisfies criteria contained in the Water Management District's MSSW Applicant's Handbook.[123] These criteria focus on the value that wetlands provide to aquatic and wetland dependent species of wildlife. With respect to wildlife, the scope of review is limited to consideration of the "impacts to fish and wildlife and threatened or endangered species relative to the functions the wetlands currently provide to them."[124] Applicants must provide reasonable assurance that a proposed system will not impact wetland functions so as to cause adverse impacts to:

(a) the habitat of fish, wildlife, and threatened or endangered species
(b) the abundance and diversity of fish, wildlife, and threatened or endangered species, and
(c) the food sources of fish and wildlife, including those which are threatened or endangered.[125]

Jurisdiction extends to all wetlands, including isolated wetlands.[126] Chapter 373, Florida Statutes directs the Water Management Districts to adopt a rule which includes:

(a) One or more size thresholds of isolated wetlands below which impacts on fish and wildlife and their habitats will not be considered. These thresholds shall be based on biological and hydrological evidence that shows the fish and wildlife values of such areas to be minimal;
(b) Criteria for review of fish and wildlife and their habitats for isolated wetlands larger than the minimum size;
(c) Criteria for the protection of threatened and endangered species in isolated wetlands regardless of size and land use; and

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121. FLA. ADMIN. CODE Rule 40C-4.301(2)(a) (Nov., 1991).

122. Friends of Fort George, Inc. v. Fairfield Communities, Inc., DOAH Case No. 85-3596 (Dec. 15, 1986).

123. FLA. ADMIN. CODE Rule 40C-4.301(2)((b) (Nov. 1991).

124. St. Johns River Water Management District, Applicants Handbook, Management and Storage of Surface Waters § 10.7.4 (Nov., 1991) [Hereinafter cited as SJRWMD Applicant's Handbook]. District review was previously limited to consideration of the value that wetlands provided to off-site wetland dependent fish and wildlife. St. Johns River Water Management District, Applicants Handbook, Management and Storage of Surface Waters § 10.7.4 (August 1988).

125. SJRWMD Applicant's Handbook § 10.7.4.

126. *Id.*

(d) Provisions for consideration of the cumulative and offsite impacts of a project or projects.[127]

SJRWMD rules create a presumption that an isolated wetland of less than one-half acre may be developed without the applicant providing reasonable assurance of compliance, unless the wetland is used by threatened or endangered species. This presumption may be rebutted if the District determines that the isolated wetland, or the cumulative value of several such wetlands, is of more than minimal value to fish and wildlife.[128]

SJRWMD considers several factors in determining a wetland's value to fish and wildlife species. Large wetlands are considered to support greater diversity of species and to have greater value than small wetlands.[129] Wetlands which have a regular hydrologic connection to off-site areas are considered to have greater value than intermittently connected wetlands.[130] Pristine or unique wetlands are considered to have greater value than disturbed or commonly occurring wetlands.[131] Wetlands surrounded by one or more natural community are considered to have greater value than wetlands surrounded by man-altered habitat or one natural community.[132]

Applicants may propose mitigation for projects which fail to satisfy wetland review criteria. Mitigation is "action or actions taken to offset the adverse effects of a system on the functions wetlands provide to fish, wildlife, and threatened or endangered species."[133] Mitigation proposals are considered on a case by case basis.[134] When reviewing mitigation proposals, the Water Management District examines the degree to which wetland functions are impacted, whether the impacts to these functions can be mitigated, and the feasibility of alternative project designs which would avoid impacts.[135]

Mitigation is usually required to take place on site or in close proximity to the wetland loss, although the Water Management District may allow off-site mitigation.[136] Mitigation proposals are typically required to replace the functions which were lost through wetland destruction, although the Water Management District may allow creation or enhancement of a different type of wetland if this would benefit the local or

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127. FLA. STAT. § 373.414 (1991).

128. SJRWMD Applicants Handbook § 10.7.4.

129. *Id.* § 10.7.5(a).

130. *Id.* § 10.7.5(b). Wetlands with natural off-site hydrologic connections are considered to have greater value than wetlands with man-made off-site connections. *Id.*

131. *Id.* § 10.7.5(c),(d).

132. *Id.* § 10.7.5(e).

133. *Id.* § 16.1.3(a).

134. *Id.*

135. *Id.* § 10.7.4.

136. *Id.* § 16.1.3(b).

regional ecology.[137] The preservation of uplands adjacent to preserved or enhanced wetlands may be considered as mitigation for wetland loss.[138] Similarly, creation of additional wildlife habitat in lakes, such as expanded vegetated littoral zones, fluctuating water levels, and islands may be considered as mitigation.[139]

The SJRWMD has guidelines to assist in determining how much wetland creation will be required to offset destruction of wetlands. Applicants who propose to destroy wetlands which have a direct hydrologic connection to a watercourse, impoundment, or wetland not wholly owned by the applicant may have to mitigate at the following ratios, depending upon site specific factors:

1. Hardwood swamps - The ratio of created wetland to lost wetland should be 2:1 to 5:1, or higher if the proposal depends extensively on natural recolonization.
2. Freshwater marshes - The ratio of created wetland to lost wetlands should be 1.5:1 to 2:1, or 3:1 to 4:1 if the proposal depends extensively on natural recolonization.[140]

The SJRWMD requires less mitigation than that stated above for destruction of wetlands which have a man-made direct connection or which do not have a direct hydrologic connection to a watercourse, impoundment or wetland not wholly owned by the applicant.[141] The Water Management District may adjust mitigation ratios to reflect other beneficial mitigating factors such as creation of wetlands prior to wetland loss, creation of upland buffers adjacent to wetlands, dedication of conservation easements, enhancement of wetlands, or other alternative proposals.[142]

Applicants submitting mitigation proposals are required to include a plan for monitoring and maintaining the mitigation site. The Water Management District may include specific monitoring and maintenance requirements as specific conditions in the applicant's permit. Monitoring reports may be required to include information such as the survival of planted species, the extent of invasion by non-target species, and the overall vigor of the community.[143]

Analysis of The SJRWMD MSSW Permitting Program

The SJRWMD MSSW permitting program regulates many activities which affect water quantity and quality and provides some protection for fish and aquatic and wetland dependent wildlife. However, the program does not provide sufficient protection for certain resource values within the Green Swamp, such as wildlife, wildlife habitat, and storage capacity.

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137. *Id.* § 16.1.3(c).

138. *Id.* § 16.1.3(d).

139. *Id.* § 16.1.3(e).

140. *Id.* § 16.1.4.

141. *Id.*

142. *Id.* The Water Management District does not consider the donation of money to be acceptable mitigation for wetland loss. However, the Water Management District may allow donation or preservation of wetlands or uplands if they are "regionally significant or provide unique fish and wildlife habitat." *Id.* § 16.1.6.

143. *Id.* § 16.1.5.

The MSSW permitting program provides no definite assurances that critical wildlife habitat such as river buffers will be preserved and protected. The permitting criteria allow development in environmentally sensitive areas, such as near the rivers and within their floodplains. Although the rule provides for consideration of the impacts of MSSW systems on wetland dependent fish and wildlife,[144] the MSSW rule does not require setbacks from the edges of rivers or from wetlands to preserve valuable habitat for wetland dependent and upland species of wildlife. Consideration of impacts to aquatic and wetland dependent species is limited to functions which the wetland currently provides to these types of fish and wildlife.[145] Furthermore, the MSSW rule does not provide for consideration of the impacts of MSSW systems on upland species of wildlife or their habitat.

The MSSW rule does not provide for maintenance of the overall storage capacity of the Green Swamp because the permitting criteria allow ground water tables to be lowered. Ground water levels may be lowered: 1) over the project area, up to an average of three feet lower than the average dry season low water table; or 2) at any location, up to five feet lower than the average dry season low water table; or 3) up to a level that would drain adjacent surface water bodies below minimum levels established by the Water Management District.[146]

Criteria for rates of discharge require that "post development peak rate of discharge must not exceed the pre-development peak rate of discharge."[147] By comparing only the peak rate of discharge, this standard does not address other important considerations for maintaining base flow, such as the timing and quantity of discharge. A standard which ensures that all characteristics of post-development runoff are equivalent to pre-development runoff characteristics could provide better long term maintenance of the storage capacity of the Green Swamp.

Permitting criteria require compensating storage for MSSW systems which cause a net reduction in flood storage within the 10 year flood plain.[148] The compensating storage must be outside the 10 year floodplain. Accordingly, the flood plain criteria discourages but does not prohibit development within the 10 year floodplain, and allows development within the 100 year floodplain. The standard could be strengthened by prohibiting MSSW systems which would cause a net reduction in flood storage within the 100 year floodplain of rivers in the Green Swamp and its major tributaries, regardless of whether upland compensating storage could be provided. The more stringent standard would provide better protection against flooding and would discourage development within sensitive floodplain areas.

Some projects are exempt from the MSSW program because they fall below the thresholds. Most of these projects are subject to stormwater permitting criteria, which only allow consideration of water quality

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144. SJRWMD Applicant's Handbook § 10.7.4. Arguably, the Water Management District can consider the need to protect uplands which are adjacent to wetlands and provide habitat for wetland-dependent species of wildlife. However, the Water Management District was reluctant to adopt rules which provided for upland buffers in the Wekiva River Basin without an additional grant of legislative authority. *See* Whitney, N.S. & J.C. Elledge, *Effective Environmental Action: The Case of the Wekiva River*, WATER: LAWS AND MANAGEMENT 9B-13 - 9B-22 (Symposium proceedings of the American Water Resources Association ((September, 1989)).

145. SJRWMD Applicant's Handbook § 10.7.4.

146. *Id.* § 10.6.3.

147. *Id.* § 10.3.1.

148. *Id.* § 10.5.2(a).

impacts. The cumulative impacts of sub-threshold projects could have adverse effects on the wildlife habitat and general integrity of the Green Swamp ecosystem. The MSSW program could provide more protection for the Green Swamp and river if thresholds were lowered.

Although the MSSW wetlands permitting criteria apply to all wetlands, development is routinely allowed in wetlands smaller than 0.5 acres because the criteria presume that these wetlands are of insignificant value to wetland dependent species. However, studies indicate that small ephemeral wetlands provide essential habitat to certain wildlife species.[149] While the Water Management District may rebut this presumption if it determines the wetland is of value to wetland dependent wildlife, rebuttal is unlikely unless endangered or threatened species are present.

A number of questions surround the use of mitigation in MSSW and dredge and fill[150] permitting programs in Florida. The underlying premise supporting the use of mitigation is that wetland functions which are destroyed by a project can be replaced through creation, enhancement, or restoration of other wetlands, or by preserving other wetlands or valuable lands. Ideally, each acre of wetland which is destroyed will be replaced by a new or restored acre of wetland with equivalent functional value. However, recent critiques indicate that wetland mitigation programs are allowing a net loss of wetlands because often: 1) wetland creation is unsuccessful because of unsuitable hydrology, invasions of exotic plant species, and other site specific problems; 2) applicants do not commence or follow through with construction of the mitigation area; 3) mitigation areas are constructed improperly; 4) mitigation areas are not maintained properly; 5) mitigation areas are not monitored properly, by the applicant or regulatory agencies; and 6) regulatory agencies do not pursue enforcement actions against applicants who violate mitigation criteria or permit conditions.[151]

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149. Brown, M.T., J.M. Schaefer, & K. Brandt, BUFFER ZONES FOR WATER, WETLANDS, AND WILDLIFE IN EAST CENTRAL FLORIDA, Center for Wetlands, University of Florida, publication number 89-07 (1990) (report submitted to the East Central Florida Regional Planning Council), citing ASHTON, R.E., & P.S. ASTON, HANDBOOK OF REPTILES AND AMPHIBIANS OF FLORIDA: PART THREE - THE AMPHIBIANS (1988); Caldwell, J.P., *Demography and Life History of Two Species of Chorus Frogs (Anura; Hylidae) in South Carolina*, COPEIA 1987: 114-127 (1987); Heyer, W.R., R.W. McDiarmid, and D.L. Wiegmann, *Tadpoles, Predation and Pond Habitats in the Tropics*, BIOTROPICS 7:100-111 (1975); Moler, P.E., and R. Franz, *Wildlife Values of Small, Isolated Wetlands in the Southeastern coastal Plain*, Proc. 3rd S.E. Nongame and Endangered Wildlife Sym. GA Dept. Nat. Res., Atlanta, GA (1987); Morin, T., *Predation, Competition, and the Composition of Larval Anuran Guilds*, ECOL. MONOGR. 53: 119-138 (1983); Wilbur, H.M., *Complex Life Cycles*, ANN. REV. ECOL. SYST. 1980: 67-93 (1980); Woodward, B.D., *Predator Prey Interactions and Breeding Pond Use of Temporary-pond Species in a Desert Anuran Community*, ECOLOGY 64: 1549-1555. *See also*, Lowe, G. & C. Salafrio, *The Evolution of Wetland Regulation Under Chapter 40C-4, F.A.C.*, WETLANDS: CONCERNS AND SUCCESSES 557 (1989) (published in the proceedings of a conference sponsored by the American Water Resources Association, Tampa, Fla., Sept. 17-22, 1989).

150. DER delegated dredge and fill authority to the SJRWMD in 1988. The SJRWMD applies DER mitigation criteria to dredge and fill projects and MSSW mitigation criteria to MSSW projects. If a project requires both a dredge and fill and MSSW permit then the applicant must satisfy Water Management District and DER mitigation criteria. (Interoffice memorandum from Glenn Lowe, Chief Environmental Specialist, Department of Resource Management, to Environmental Specialist Staff, Department of Resource Management, St. Johns River Water Management District (August 23, 1989)).

151. Interoffice memorandum from Lucianne Blair and Michael Dentzau to Janet Llewellyn, et al, Florida Department of Environmental Regulation (Sept. 1, 1989); Interoffice memorandum from James Beever III, Resource Management and Research Coordinator, Southwest Florida Aquatic Preserves, to

In addition, existing mitigation criteria are substantively inadequate to prevent a net loss of wetlands. While off-site, non-type for type, and monetary mitigation may be appropriate under certain circumstances, current regulatory criteria do not provide an adequate rationale or methodology for consistent consideration of often competing natural resource values. For example, SJRWMD rules provide no mitigation ratios for isolated wetlands, wetland enhancement, upland preservation, or off-site mitigation.[152] SJRWMD and other government entities recognized the inherent limitations of the MSSW program for protecting sensitive riverine habitat when they modified those requirements for the Wekiva and Econ River Basins. A discussion of these modifications is included in this volume in the section addressing Special Protection of Environmentally Sensitive Areas.

St. Johns River Water Management District Stormwater Permitting Program

Overview

The SJRWMD regulates discharges of stormwater into waters of the state under authority delegated by the Florida Department of Environmental Regulation.[153] Permits are required for construction, operation, maintenance, removal, or abandonment of stormwater discharge facilities.[154] Stormwater permitting requirements are incorporated into the review of MSSW projects.[155] Most projects which fall below MSSW thresholds must obtain stormwater discharge permits.

Permits are required for construction, operation, maintenance, alteration, removal, reconstruction, or abandonment of a stormwater management system which exceeds the following thresholds:

a) Construction of 500 square feet or more of impervious or semi-impervious surface areas subject to vehicular traffic. This area includes roads, parking lots, driveways, and loading zones;
b) Construction of 1000 square feet or more building area or other impervious area not subject to vehicular traffic, or
c) construction of 1 acre or more of recreation area. Recreation areas include but are not limited to golf courses, tennis courts, putting greens, driving ranges, or ball fields.[156]

Hank Smith, Environmental Specialist III, Bureau of State Lands Management, Division of State Lands, Department of Natural Resources (March 6, 1990); Crewz, David, Habitat-Mitigation Evaluations for Manatee-Sarasota Counties, Mid-project Summary: Projects 1-11, Report to Manasota 88 (Jan., 1990); Permit Audit, The Resource, (Resource Regulation Newsletter published by the Southwest Florida Water Management District) Vol III, Issue 2 (Mar.-Apr., 1990).

152. Memorandum from Jeff Elledge, Director, Department of Resource Management, St. Johns River Water Management District to the St. Johns River Water Management District Governing Board 5 (July 19, 1989).

153. FLA. ADMIN. CODE Chapter 40C-42 (Oct., 1991). The Florida Department of Environmental Regulation had formerly regulated stormwater systems within the District under Rule 17-25, F.A.C. The delegation was intended to minimize duplication by consolidating stormwater permitting with MSSW permitting.

154. FLA. ADMIN. CODE Rule 40C-42.011(2) (Oct., 1991).

155. *Id.* Rule 40C-42.061(1).

156. *Id.* Rule 40C-42.022.

Permits are also required for alteration, removal, reconstruction, or abandonment of existing stormwater management systems which serve a project which may result in any of the following:

a) Increase pollutant loadings (including sediment) in stormwater runoff from the project,
b) Increase in peak discharge rate,
c) Decrease in onsite or instream detention storage, and
d) Replacement of roadside swales with curb and gutter.[157]

Exemptions from the stormwater permitting requirements include stormwater facilities for

a) single family dwelling units accommodating one family,
b) single family residential projects of less than 10 acres total land areas and which have less than 2 acres impervious surface, and which:
    a) comply with all stormwater regulations adopted by an applicable local government,
    b) are not part of a larger common plan of development or sale, and
    c) discharge into a stormwater system exempted or permitted by the District which has sufficient capability and is publicly owned, and
c) silvicultural lands, if the system is constructed and operated in accordance with Chapter 40C-43 (Agriculture Rule) and Silviculture Best Management Practices.[158]

Applicants must provide reasonable assurance that the discharge

a) will not result in discharges from the system to surface and ground water of the state that cause or contribute to violations of state water quality standards;
b) will not adversely affect drainage and flood protection on adjacent or nearby properties not owned or controlled by the applicant;
c) will be capable of being effectively operated and maintained pursuant to the requirements of this chapter;
d) will be consistent with the State Water Policy, chapter 17-40, F.A.C.; and
e) meets any applicable basin criteria contained in chapter 40C-41, F.A.C.[159]

Applicants can create a presumption that the stormwater management system complies with reasonable assurances listed above by meeting design and performance criteria contained in chapter 40C-42.[160] Generally, stormwater treatment may be accomplished through the use of retention, detention with filtration, or wet detention systems. Treatment systems must be capable of accommodating a subsequent rainfall event within a specified period of time.[161] In addition, the rule provides standards for filtration systems, swales, side slopes, erosion and sedimentation, oil and grease removal, and criteria for

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157. *Id.*

158. *Id.* Rule 40C-42.0225.

159. *Id.* Rule 40C-42.023(1).

160. *Id.* Rule 40C-42.023(2). Design and performance criteria are contained in Rules 40C-42.024, 40C-42.025, 40C-42.026, and 40C-42.0265, F.A.C.

161. *Id.*

Outstanding Florida Waters.[162] The rule also provides standards for operation, maintenance, and monitoring of stormwater management systems.[163]

General and Individual Permits

Chapter 40C-42, F.A.C., establishes criteria for issuance of general and individual permits. An applicant may obtain a general permit for new stormwater discharge facilities which:

a) ... discharge into a stormwater discharge facility which ... [is already permitted] or which was previously approved pursuant to a noticed exemption under Rule 17-25.030, where appropriate treatment criteria specified in this Chapter and applied to the permitted or exempt facility are not exceeded by the discharge ... [and written consent is obtained from the owner of the permitted or exempt facility]; or

b) meet design and performance standards and comply with special criteria for filtration systems, retention systems, underdrain systems, underground exfiltration trench systems, wet detention systems, or swale systems.

c) involve modification or reconstruction by a city, county, state agency or special district with drainage responsibility, of an existing stormwater management system which is not intended to increase the original design capacity, and which will not increase pollution loading, or change points of discharge in a manner that would adversely affect the designated uses of the waters of the state; or

d) involve paving of existing public dirt roads, as long as: the road will not serve new development; the road will not add additional traffic lanes; the road will not significantly increase traffic load; the road will not significantly alter the drainage system serving the road; erosion and sediment controls are used during construction; a dredge and fill permit is not required, permanent vegetative cover is established on both sides of the road; and swale blocks, or other means are used to retain runoff and promote infiltration.[164]

An applicant must obtain an individual permit for the following systems:

a) wetlands stormwater management systems,
b) systems which propose an alternative treatment methodology not included in this rule,
c) systems which do not meet the design criteria contained in this rule.

The District will consider the following factors when determining whether the applicant has provided reasonable assurance that a system will provide equivalent treatment to methodologies specified in the rule:

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162. *Id.* Rule 40C-42.025. Stormwater discharge facilities which discharge directly to Outstanding Florida Waters must provide "an additional level of treatment equal to fifty percent of the treatment criteria" required for class III waters. *Id.* Rule 40C-42.025(10).

163. *Id.* Rules 40C-42.027, 40C-42.028, 40C-42.029.

164. *Id.* Rule 40C-42.024.

a) whether best management practices have been followed,
b) the public interest served by the system,
c) the probable efficacy and costs of alternative controls,
d) whether reasonable provisions have been made for operation and maintenance of the proposed system.[165]

Stormwater permits to construct, alter, or remove a system are usually five years in duration. Permits to operate, maintain, or abandon a system are usually permanent.[166]

Analysis of Water Management District Stormwater Permitting Program

Stormwater regulations attempt to prevent violations of state water quality standards and maintain existing water quality conditions by minimizing runoff pollution. The SJRWMD has recently amended Chapter 40C-42 to strengthen design and performance criteria. However, enforcement and compliance problems have historically plagued implementation of the rule. Properly designed stormwater treatment systems are often poorly monitored and maintained and as a result may contribute to degradation of water quality. Monitoring and enforcement actions by the Water Management District are relatively rare compared to the number of stormwater systems which are likely to be violating water quality standards. In addition, stormwater treatment systems are occasionally permitted in locations with hydrological and geological traits which prevent the treatment system from working properly, such as in wetlands or other areas with high water tables.

Another limitation involves the nutrient standard for Class III water bodies. The nutrient standard states "in no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna."[167] The standard is apparently based on the assumption that densities of aquatic flora and fauna are directly proportional to nutrient levels. However, other factors such as temperature, light, and the rate of water movement also affect densities of aquatic flora and fauna. Accordingly, it is difficult to predict whether nutrient discharges, individually or cumulatively, will cause algal blooms, accelerated growth of aquatic macrophytes, such as water hyacinths, or fish kills in slow moving downstream waters. The standard thus contains no maximum allowable concentration of nutrients. The only accurate basis for setting such limitations would be a comprehensive study of the Green Swamp which considers contributions of both point and nonpoint sources of nutrients and their effect on receiving waters.

The stormwater rule provides for consideration of the affects of water quality on wildlife but does not allow for consideration of the impacts of the creation of stormwater systems on wildlife. For example, the rule does not provide for evaluation of 1) the immediate affects of construction of detention and retention reservoirs on on-site and nearby wildlife species and 2) the cumulative long-term effects of loss of habitat caused by construction of stormwater reservoirs. In many cases, the construction of stormwater basins adjacent to wetlands has had the effect of draining water from the wetlands, thus degrading them. Current rules do not provide for consideration of this impact where the basin is constructed in uplands.

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165. *Id.* Rule 40C-42.024(3),(4).

166. *Id.* Rule 40C-42.024(5).

167. FLA. ADMIN. CODE Rule 17-3.121(19) (May, 1987).

Southwest Florida Water Management District MSSW Permitting Program

Like the SJRWMD, the Southwest Florida Water Management District (SWFWMD) is required to implement Chapter 373, Florida Statutes. Accordingly, there are many similarities between the two districts' permitting programs. Generally, SWFWMD regulates the same types of activities and issues similar types of permits. However, unlike SJRWMD, SWFWMD combines the regulation of stormwater and agriculture into its Management and Storage of Surface Waters (MSSW) rule.[168]

Unless exempted by law or district rule, SWFWMD requires a surface water management permit to be issued by the district prior to the construction and operation of any new surface water management system, or the alteration or abandonment of any surface water management system.[169]

The following are exempted from obtaining such permits:

(1) activities specified in Section 373.406, Fla. Stat.;[170]

(2) the construction, alteration, or operation of a surface water management system of agricultural or silvicultural activities which satisfy the following:

- (a) total land area does not equal or exceed ten acres;
- (b) the area of impervious surface will not equal or exceed two acres;
- (c) activities will not be conducted in wetlands;
- (d) activities will not be conducted in existing lakes, streams, or other water courses;
- (e) the surface water management system will not utilize drainage pumps or operable discharge structures;
- (f) activities will not utilize storm drainage facilities larger than one 24-inch diameter pipe, or its hydraulic equivalent;
- (g) discharges from the site will meet applicable state water quality standards, as set forth in Chapter 17-4 and Rule 17-4.242, F.A.C.;
- (h) the activities are part of a conservation plan prepared or approved by a local Soil and Water Conservation District Board. If the SCS conservation plan is not implemented according to its terms, this exemption is not applicable;
- (i) activities can otherwise reasonably be expected not to have significant adverse water resource impacts;
- (j) the surface water management system can be effectively maintained.

(3) any project, work or activity which has received all governmental approvals necessary to begin construction and is under construction prior to October 1, 1984;

(4) any project, work or activity which received a surface water management permit from the district prior to October 1, 1984;

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168. FLA. ADMIN. CODE Rule 40D-4.011(4) (Sept., 1990).

169. FLA. ADMIN. CODE Rule 40D-4.041(1) (Sept., 1990).

170. These include: (1) agricultural, silvicultural, floricultural or horticultural activities which alter the topography of the land for purposes consistent with the practice of such activity, unless it is for the sole purpose of impounding or obstructing surface water; and (2) construction, operation or maintenance of any agricultural closed system, so long as consumptive use permitting rules and accepted engineering practices are observed. FLA. STAT. § 373.406 (1991).

(5) any project, work or activity which did not require a surface water management permit form the district and had received all other necessary governmental approvals prior to October 1, 1984;

(6) any phased or long term buildout project, which has received local or regional approval prior to October 1, 1984, if the approval required a specific site plan and provided for a master drainage plan approved prior to issuance of a building permit;

(7) all normal and necessary farming and forestry operations as are customary for the area, which can be conducted without the construction or alteration of a surface water management system. Such activities must not impede or divert the flow of surface waters entering or leaving the operation or intrude into or other substantially and adversely impact significant wetlands;

(8) phosphate mining and mining related surface water management systems, provided the activities meet the conditions for exemption in Rule 40D-4.053(1);[171]

(9) phosphate mine reclamation and restoration conducted in accordance with Chapter 16C-16, F.A.C. (Mine Reclamation), provided the activities meet the conditions for exemption in Rule 40D-4.053(2);[172]

(10) construction or private use of a single family dwelling, duplex, triplex or quadruplex that is not part of a larger common plan of development or sale, and does not involve wetlands regulated under Chapter 403, Fla. Stat., or isolated wetlands regulated under Chapter 373, Fla. Stat., and the district's rules;

(11) construction of seawalls and docks which are regulated by the DER when such construction will not alter or is not part of an existing or proposed project requiring a district permit;

(12) routine maintenance of a surface water management system.[173]

The district issues three types of surface water management permits: letters of conceptual approval, construction permits[174] and operation permits.[175] Letters of conceptual approval may be issued for

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171. Among other requirements, such facilities must be designed, constructed and operated to avoid damage to offsite property or the public caused by: floodplain development or alteration; retardance, acceleration or diversion of flowing water; reduction of natural water storage areas; excessive discharge or facility failure; or other activities adversely impacting offsite water flows or levels. Additionally, natural drainage from offsite upgradient areas must not be interrupted so as to cause damage to offsite property or the public, and natural drainage patterns on undisturbed lands must be maintained to the maximum extent achievable without adversely altering the time, stage, volume and point or manner of discharge or dispersion. FLA. ADMIN. CODE Rule 40D-4.053(1) (April 1991).

172. The rule section contains requirements similar to those of Rule 40D-4.053(1) related to avoiding impacts to floodplains, flowing water, natural water storage areas, excessive discharges, and activities otherwise adversely impacting offsite water flows or levels. FLA. ADMIN. CODE Rule 40D-4.053(2) (April 1991).

173. FLA. ADMIN. CODE Rule 40D-4.051 (April 1991).

174. A construction permit authorizes construction, alteration or abandonment or a surface water management system. FLA. ADMIN. CODE Rule 40D-4.021(3) (Sept., 1990).

175. An operation permit authorizes the operation and maintenance of a surface water management system. FLA. ADMIN. CODE Rule 40D-4.021(4) (Sept., 1990).

projects to be developed in phases, but they do not authorize construction activity.[176] Construction and operation permits may be issues in three forms: individual permits, general permits and noticed general permits.[177]

Individual construction or operation permits are required for projects that do not qualify for general permits under Chapter 40D-40, F.A.C.[178] General construction or operation permits may be issued for surface water management systems which satisfy the thresholds and conditions contained in Chapter 40D-40, F.A.C.[179] Noticed general construction or operation permits may also be issued for systems which satisfy threshold and conditions in Chapter 40D-40, F.A.C.[180] Unless exempt from storm water quality regulation or approved by the district or DER, a noticed general permit is required for a surface water management system otherwise exempt under exemptions (4), (6), (7) or (8) above.[181] Systems otherwise exempt under exemptions (3) or (6) above may be required to obtain a permit if the master drainage plan is altered so as to have adverse impacts on offsite water resources in the district.[182]

Unless revoked, extended or modified, letters of conceptual approval expire two years from the date of issuance, unless within that period an application for a construction permit is filed for any portion of the project, in which case the letter of conceptual approval remains valid, as long as construction is consistent with a district approved plan of development. Construction permits expire three years from the date of issuance, unless the construction of the permitted surface water management system discharge structure has been completed, in which case the permit is valid for the duration of the project construction. Operation permits issued under Chapter 373, Fla. Stat. are perpetual.[183]

Permit Thresholds and Conditions

a. Noticed General Permits

To obtain a noticed general permit, applicants must provide reasonable assurance that:

(a) total land area does not equal or exceed ten acres;
(b) the area of impervious surface does not equal or exceed two acres;
(c) activities will not be conducted in isolated wetlands regulated under Chapter 373, Fla. Stat. and district rules, or in wetlands regulated under Chapter 403, Fla. Stat.;
(d) activities will not be conducted in existing lakes, streams or other watercourses;

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176. FLA. ADMIN. CODE Rule 40D-4.041(2)(a) (Sept., 1990).

177. FLA. ADMIN. CODE Rule 40D-4.041(2) (Sept., 1990).

178. FLA. ADMIN. CODE Rule 40D-4.041(2)(b) (Sept., 1990).

179. FLA. ADMIN. CODE Rule 40D-4.041(2)(c) (Sept., 1990).

180. FLA. ADMIN. CODE Rule 40D-4.041(2)(d) (Sept., 1990). A noticed general permit generally addresses compliance with state water quality standards under Chapter 17-3, F.A.C. and Rule 17-4.242, F.A.C. addressing stormwater run-off. *Id.*

181. FLA. ADMIN. CODE Rule 40D-4.041(4) (Sept., 1990).

182. FLA. ADMIN. CODE Rule 40D-4.041(3) (Sept., 1990).

183. FLA. ADMIN. CODE Rule 40D-4.321 (April, 1991).

(e) activities will not utilize pumps for stormwater management;
(f) activities will not utilize storm drainage facilities larger than one 24-inch diameter pipe, or its equivalent. Florida Department of Transportation projects are excepted from this provision if they will not increase the size or hydraulic capacity of an existing drainage facility;
(g) discharges from the site will meet state water quality standards and criteria in Chapter 17-3 and Rule 17-4.242, F.A.C.;
(h) proposed building floors will be above the 100 year flood elevation;
(i) activities can otherwise be expected to have acceptable or insignificant impacts on water resources;
(j) the surface water management system can be effectively maintained; and
(k) the surface water management system will meet the applicable water quality criteria in Section 3.2.2 of the district's Basis of Review.[184]

b. General Permits

To qualify for a general permit, applicants must first provide reasonable assurance that certain general conditions are met: the surface water management system must meet the criteria applicable to individual permits, contained in Rule 40D-4.301, F.A.C., and applicable local requirements, and if the project will involve use of or will affect works of the district, the permittee must have received a Works of the District permit or other district approval.[185] In addition to these general conditions, applicants for a general permit must meet the thresholds and conditions of at least one of the following additional subsections:

(a) project area must be less than 100 acres, and the project and surface water management system must have received prior approval from the applicable local government after the effective date of this rule (October 1, 1984).[186]

(b) for surface water management systems associated with public highway projects, the project must be located within a right of way dedicated to the public for highway purposes, and the project must not (1) drain lands outside the jurisdiction of the constructing or funding public body, (2) lower or have the potential to lower the dry season groundwater table outside the project's design drainage area, or (3) interfere with natural drainage patterns or flows.[187]

(c) for phased construction under conceptual approvals, the conceptual approval must have been received after October 1, 1984; the project phase must comply with the requirements of the conceptual approval; and the project phase must be under 100 acres, meet the general conditions for general permits (Rule 40D-40.302(1)), and have project and surface water management system approval from the appropriate local government after October 1, 1984.[188]

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184. FLA. ADMIN. CODE Rule 40D-40.301(1) (Feb., 1990).

185. FLA. ADMIN. CODE Rule 40D-40.302 (Dec., 1989).

186. FLA. ADMIN. CODE Rule 40D-40.302(2) (Dec., 1989).

187. FLA. ADMIN. CODE Rule 40D-40.302(3) (Dec., 1989).

188. FLA. ADMIN. CODE Rule 40D-40.302(4) (Dec., 1989).

Requests to modify a general permit or noticed general permit must be made in accordance with application requirements and applicable conditions contained in Chapter 40D-40, cited above, or by letter, if the requested modification does not: (1) substantially alter the permit authorization, (2) increase the authorized offsite discharge, (3) impact the environmental features of the project, (4) decrease the required retention/detention, (5) decrease the required flood control elevations for roads or buildings, or (6) decrease pollution removal efficiency.[189]

c. Individual Permits

Applicants which do not meet the thresholds for general or noticed general permits must apply for an individual construction or operation permit. In order to receive an individual construction or operation permit, an applicant must give reasonable assurances that the surface water management system:

(a) provides adequate flood protection and drainage,
(b) will not cause adverse water quality and quantity impacts on receiving waters and adjacent lands regulated pursuant to Chapter 373, Florida Statutes,
(c) will not cause discharges which result in any violation, in surface waters of the state, of [state water quality standards],
(d) will not cause adverse impacts on surface and groundwater levels and flows,
(e) will not diminish the capability of a lake or other impoundment to fluctuate through the full range established for it in Chapter 40D-8,
(f) will not cause adverse environmental impacts, or adverse impacts to wetlands, fish and wildlife, or other natural resources,
(g) can be effectively operated and maintained,
(h) will not adversely affect public health and safety,
(i) is consistent with the requirements of other public agencies,
(j) will not otherwise be harmful to the water resources within the District,
(k) will not interfere with the legal rights of others as defined in Rule 17-40.070, and
(l) is not against public policy.[190]

Limiting Conditions

Several limiting conditions are attached to all types of surface water management permits. Among other requirements, permittees must perform the authorized construction so as to minimize any adverse impact of the system on fish, wildlife, natural environmental values, and water quality. This includes instituting measures necessary to avoid such impacts during the construction period.[191] Permittees must also comply with all applicable local requirements, and must obtain all federal, state and local authorizations prior to any construction or alteration.[192] Offsite discharges during construction and development must be made only through facilities authorized by the permit, and any water discharges must be made through structures with the ability to regulate upstream stages.[193]

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189. FLA. ADMIN. CODE Rule 40D-40.331 (Dec., 1989), *citing* FLA. ADMIN. CODE Rule 40D-4.331(2)(b) (Sept., 1990).

190. FLA. ADMIN. CODE Rule 40D-4.301(1) (April, 1991).

191. FLA. ADMIN. CODE Rule 40D-4.381 (2)(a) (Sept., 1990).

192. FLA. ADMIN. CODE Rule 40D-4.381(2)(c) (Sept., 1990).

193. FLA. ADMIN. CODE Rule 40D-4.381(2)(g) (Sept., 1990).

Environmental and Wetlands Protection in SWFWMD MSSW Permitting

Standards and criteria in the SWFWMD document entitled "Basis of Review for Surface Water Management Permit Applications within the Southwest Florida Water Management District" (Basis of Review)[194] are intended to insure that applicants provide the reasonable assurances required by district rules. Applicants must submit information regarding environmental parameters which district staff evaluates to determine anticipated impacts of the proposed work on the water resources of the district and on natural upland systems.[195] In making this determination, the district evaluates the following environmental features:

(a) wetland habitat except those isolated wetlands exempt from consideration of impacts to fish and wildlife and their habitats,
(b) significance of site environmental features, including uplands and wetlands, to local and regional landscape patterns,
(c) habitat for threatened or endangered species.[196]

Expected or potential impacts are predicted by comparing the existing natural system to the proposed post-development conditions. In so doing, the district balances the positive and negative impacts of the project to "achieve a reasonable degree of protection for significant environmental features consistent with the overall protection of the water resources of the District."[197]

Wetlands and other environmentally sensitive areas are protected by considering and balancing:

(a) the project's impact on environmental features;
(b) the current condition and relative value of functions being performed by areas affected by the proposed activity;
(c) the predicted ability of the wetlands and environmentally sensitive areas to maintain their present functions as part of the proposed surface water management system;
(d) the potential for replacement of or compensation for wetland functions which might be lost as a result of the proposed activity;
(e) the extent to which particular disturbances of wetlands benefit essential economic development.[198]

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194. South West Florida Water Management District, Management and Storage of Surface Waters Permit Information Manual, Vol. 1, Part B, "Basis for Review of Surface Water Management Permit Applications within the Southwest Florida Water Management District" § 3 (Oct., 1990) [hereinafter cited as Basis of Review].

195. Basis of Review § 3.1.5. Required information includes number and composition of species comprising representative components of the wetland community; evidence of trends indicating projected habitat functions under current conditions; significance to local and regional landscape patterns; population statistics on selected species comprising the subject wetland; water quality and hydroperiod in the subject wetland. Basis of Review § 6.0.

196. Basis of Review § 3.1.5.5.

197. Basis of Review § 3.1.5.6.

198. Basis of Review § 3.2.3.1.

Compensation measures are required for impacts to all regulated wetlands and must be consistent with protection of fish and wildlife and result in no net loss of wetlands.[199] Only isolated wetlands[200] below 0.5 acres in size are nonregulatory, though such wetlands will be subject to review for impacts to fish and wildlife and their habitats if: the wetland is used by endangered or threatened species; or the total acreage of isolated wetlands exceeds 30% of the acreage of a project over 40 acres; or the wetland is located in an Area of Critical State Concern; or two or more wetlands have a combined area over 0.5 acre and are connected by surface water during average wet season high water levels.[201]

Compensation can include:

(a) mitigation, the replacement of a wetland, type for type, to restore those specific physical and functional characteristics which will be lost as a result of a proposed activity;
(b) inclusion of upland areas, beyond any required buffer zones, to maintain upland/wetland habitat diversity;
(c) establishment of vegetated littoral zones in onsite open waterbodies;
(d) protection of exempt wetlands;
(e) restoration of wetlands that have been previously impacted;
(f) compensation on offsite lands; and
(g) other reasonable measures, such as providing unlike wetland habitat.[202]

Except for previously disturbed wetlands,[203] required compensation must comply with either the rigid or flexible wetland design criteria.[204] Incorporating wetlands into the surface water management system is preferred to either set of design criteria, because of the uncertainty of current mitigation technology to restore or create wetland functions and values.[205] Destruction of wetlands, with compensation, is considered only when an applicant shows that there are no reasonable development alternatives to adverse wetland impacts for the site, compensation measures can be successful, and the protection of threatened and endangered species is reasonably assured.[206]

Rigid wetland design criteria require that forested wetland acreage be mitigated at a ratio of 2.5 to 1, while non-forested wetlands require mitigation at a ratio of 1.5 to 1. If mitigation is successful, as measured by several parameters specified in the Basis of Review, prior to any impact to wetlands, the required ratio

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199. Basis of Review § 3.2.3.1.2.

200. Defined as "any wetland as defined pursuant to Chapter 40D-4, F.A.C., which is not within the Department of Environmental Regulation jurisdiction for purposes of regulation of dredging and filling." Basis of Review, Appendix 4, § 2.1.

201. Basis of Review, Appendix 4, § 3.0.

202. Basis of Review, Appendix 4, § 2.2

203. Defined as a wetland "altered prior to October 1, 1984, by drainage, dredging, filling or invasion by exotic plants so that hydrologic and biologic functions are significantly diminished." Basis of Review, Appendix 4, § 2.6.

204. Basis of Review § 3.2.3.1.2

205. Basis of Review, Appendix 4, § 5.0.

206. *Id.*

of acres impacted to mitigated acres is 1 to 1.[207] For isolated wetlands below 5.0 acres, mitigation does not have to be successful prior to wetland impact, though reasonable assurance of mitigation success is required, as measured by parameters specified in the Basis of Review. A buffer zone 15 feet wide is required on all mitigated wetlands, with vegetation left undisturbed within the buffer. Compensation proposals for wetlands used by threatened or endangered species are reviewed by the district on a case-by-cases basis.[208]

Flexible wetland design criteria allow and encourage the applicant to work closely with staff in creating a post-development functioning wetland/upland system. Though such compensation proposals must meet requirements related to monitoring and success evaluation,[209] and protection of threatened and endangered species, the district will consider approaches such as:

(a) acreage credit at a ratio greater than 1 to 1 for protection of wetlands below the exemption size in exchange for impacts to larger wetlands which can more easily absorb the impact;
(b) establishment of wildlife corridors;
(c) designation of additional buffer zone beyond that required;
(d) development of disturbed wetlands, with the loss compensated for at lesser mitigation ratios, based on the degree of disturbance and remaining functional qualities;
(e) compensation on other lands, with final approval dependent on the governing board;
(f) mitigation and other reasonable compensation measures.[210]

Impacts to wetlands determined on a case-by-case basis to be sensitive environmental areas are not permitted unless the applicant provides reasonable assurance that the loss of type, nature and function can be successfully mitigated within a reasonable period of time.[211]

Wetlands

The development of wetlands is regulated by both the U.S. Army Corps of Engineers (Corps)[212] and the U.S. Environmental Protection Agency (EPA)[213] at the federal level. At the state level, the Florida Department of Environmental Regulation (DER) regulates dredge and fill activities in wetlands.[214] The Florida Department of Natural Resources (DNR) regulates the use of state-owned submerged lands,[215] which can include extensive areas of vegetated wetlands along the shores of navigable rivers and lakes.

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207. Basis of Review, Appendix 4, § 5.1.

208. Basis of Review, Appendix 4, § 5.2.4.

209. Basis of Review, Appendix 4, § 5.2.

210. Basis of Review, Appendix 4, § 5.2.2.

211. Basis of Review § 3.2.3.1.1.

212. 33 C.F.R. § 320.2 (July, 1988).

213. 40 C.F.R. part 230 (July, 1988).

214. FLA. STAT. § 403.91-403.938 (1989); FLA. ADMIN. CODE ch. 17-312 (July, 1989).

215. FLA. STAT. § 253.03 (1989); FLA. ADMIN. CODE ch. 18-21 (March, 1987).

In addition, wetland impacts are a major consideration in the management and storage of surface waters permitting programs of the St. Johns River Water Management District and Southwest Florida Water Management District, in the review of Developments of Regional Impact by the East Central Florida Regional Planning Council and the Department of Community Affairs, and in local government comprehensive plans and implementing regulations discussed elsewhere in this volume. There is considerable variation among the programs with respect to those activities subject to regulation, the geographic area regulated, and the criteria used for determining whether to permit an activity. Table 4-6 illustrates isolated wetlands permitting thresholds for federal, state, and regional agencies.

TABLE 4-6

REGIONAL, STATE, AND FEDERAL ISOLATED WETLANDS PERMITTING THRESHOLDS IN THE GREEN SWAMP

Regulatory Entity	Acres
SWFWMD	0.5*
SJRWMD	0.5*
DER	NA**
EPA/COE	0.0***

* Wetlands are regulated through the Water Management Districts' MSSW permitting programs. Accordingly, MSSW thresholds must be triggered before the Water Management Districts will evaluate the effects of a project on wetlands. The water management districts will regulate wetlands smaller than 0.5 acres if endangered species are present.

** DER regulates wetlands connected to waters of the state but does not regulate isolated wetlands.

*** The EPA and COE have jurisdiction over all "adjacent" wetlands and isolated wetlands, the loss or destruction of which would adversely affect interstate commerce. 40 C.F.R. § 230.3(s) (July 1, 1988). Nationwide permits may authorize activities which do not cause the loss or substantial adverse modification of 1 to 10 acres of wetlands. 33 C.F.R. § 330.5(a)(26) (Nov. 13, 1986). Activities which cause the loss or substantial adverse modification of 1 to 10 acres of wetlands must notify the COE. *Id.*

Federal

The wetlands regulatory authority of the U.S. Army Corps of Engineers is derived from two federal statutes, the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. Under Section 10 of the Rivers and Harbors Act, the Corps has broad authority to regulate activities affecting the course, location or capacity of navigable waters.[216] Jurisdiction is generally limited to activities below the ordinary high water mark of navigable waters. Under the Clean Water Act, on the other hand, jurisdiction extends to nonnavigable tributaries and adjacent wetlands. A hydrologic connection to navigable waters

216. 33 C.F.R. § 320.2(b) (July, 1988).

is not required. Only activities involving the discharge of dredged or fill material, however, are subject to permitting. Although land clearing and other activities involving a re-deposition of fill material are regulated, the excavation or drainage of wetlands may be unregulated.

The criteria for permitting involve the application of a public interest test adopted by the Corps[217] and a set of guidelines adopted by EPA[218] in consultation with the Corps. Only the public interest criteria are used in evaluating Rivers and Harbors Act permits. The public interest criteria involve a balancing of the various factors affecting the public interest, including the public interest in the preservation of wetlands and associated wildlife.

Guidelines adopted by EPA under section 404(b)(1) of the Clean Water Act are used to evaluate discharges of dredge or fill material. EPA can enforce these guidelines by "vetoing" Corps-issued permits under section 404(c), which is extremely rare. The guidelines prohibit the discharge of dredge or fill material unless the individual and cumulative effects on water quality, wildlife and other resource values associated with wetlands are not adverse. If there is a practicable alternative that would be less damaging, the discharge is prohibited and if the activity is not water dependent, practicable alternatives are presumed to be available.

State

State wetlands regulation was significantly reformed in 1984 with passage of the Warren S. Henderson Wetlands Protection Act.[219] Many developments, however, were vested under the existing statutes and regulations. The Wetlands Protection Act extended jurisdiction to encompass additional wetlands, expanded permitting criteria to allow consideration of a broad range of factors, required DER to consider mitigation, and exempted agricultural activities from permitting under the Act.

Jurisdiction applies to construction, dredge, or fill activities conducted in "waters of the state" whose landward extent is defined by the dominance of listed plant species. In all instances, water quality standards must be maintained.[220] Beyond that, permitting depends on the application of public interest tests.[221] Generally, a permit must be issued if it is "not contrary to the public interest".[222] A project located within or which significantly degrades an Outstanding Florida Water must be "clearly in the public interest". In making the relevant public interest determination, DER is required to consider and balance a list of factors that include the project's effects on the general public health, safety and welfare, the property of others, fish and wildlife and their habitats, navigation, the flow of water, erosion, shoaling, fishing, recreation, marine productivity, and significant historical and archeological resources. DER is also required to consider the current condition and relative value of affected areas and whether the activity is of a temporary or permanent nature. Cumulative impacts must also be considered. If the applicant is unable to otherwise meet the public interest test, DER must consider proposals to mitigate the adverse effects of the project. Stricter permitting criteria may be adopted for Outstanding Florida Waters, aquatic

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217. *Id.* § 320.4.

218. 40 C.F.R. part 230 (1988).

219. FLA. STAT. § 403.91-403.938 (1989); FLA. ADMIN. CODE ch. 17-312 (July, 1989).

220. FLA. STAT. § 403.918(1) (1989).

221. *Id.* § 403.918(2).

222. FLA. ADMIN. CODE § 17-312.080(2) (July, 1989).

preserves, Areas of Critical State Concern, and areas subject to resource management plans adopted under chapter 380, Florida Statutes.

Water Management Districts

The St. Johns River Water Management District regulates many wetlands through its MSSW permitting program, which is discussed in this volume. In addition, the Florida Department of Environmental Regulation has delegated its dredge and fill permitting and enforcement authority to the St. Johns River Water Management District.[223] By operating agreement with DER, the St. Johns River Water Management District applies DER dredge and fill regulatory criteria for all projects which require a stormwater or MSSW permit, except for some exceptions including landfills, wastewater treatment plants, and wetland treatment facilities.[224] DER continues to regulate these exceptions, as well as dredge and fill activities which do not require a stormwater or MSSW permit from the St. Johns River Water Management District.[225] If a project requires a dredge and fill and MSSW or stormwater permit, then the applicant must satisfy both St. Johns River Water Management District and DER regulatory criteria.[226] Initial assessments by DER indicate that the St. Johns River Water Management District's dredge and fill program has not yet attained the quality of regulation which existed prior to the delegation of authority.

The Southwest Florida Water Management District also regulates many wetlands through its MSSW permitting program, which is discussed in this volume.

Consumptive Use Permitting and Water Shortage Provisions

St. Johns River Water Management District

The St. Johns River Water Management District permits consumptive uses of water under the provisions of Chapter 40C-2, Florida Administrative Code and the district document entitled, "Applicant's Handbook, Consumptive Uses of Water" (November 12, 1991). Under district rules, all uses of water must receive a general permit or individual permit, or must be exempted. Permits may be granted for no more than twenty years,[227] although staff makes recommendations based on criteria that suggest a seven-year

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223. FLA. ADMIN. CODE Rule 17-101.040(12)(a)3 (Sept., 1989). The Water Management District's dredge and fill authority became effective on October 1, 1988. *Id.*

224. Interoffice memorandum from Glenn Lowe, Chief Environmental Specialist, Department of Resource Management, to Environmental Specialist Staff, Department of Resource Management, St. Johns River Water Management District (August 23, 1989); Telephone interview with Glenn Lowe, Chief Environmental Specialist, Department of Resource Management, St. Johns River Water Management District (March, 1990).

225. *Id.*

226. *Id.*

227. FLA. ADMIN. CODE Rule 40C-2.331(1) (November 1991), referencing FLA. STAT. § 373.236 (1991).

duration for most types of uses.[228] Where two or more applications, which otherwise comply with the provisions of Chapter 40C-2, are competing for a quantity of water which is inadequate for both or all proposed uses, the board will approve or modify the application which best serves the public interest.[229] If such applications are judged to equally qualify under the public interest test, a renewal application will receive preference over a new application.[230]

Unless exempted, proposed uses require an individual permit if: (1) average annual daily withdrawal is over 100,000 gallons per day (gpd), (2) withdrawal equipment or other facilities have a capacity of over one million gpd, (3) withdrawal is from a combination of wells, facilities or both, having a combined capacity of over one million gpd, or (4) withdrawal is from a well in which the outside diameter of the largest water bearing casing is greater than or equal to six inches.[231] Thresholds in the first three categories above refer to total capacity of withdrawal facilities which are located on contiguous properties owned, operated or controlled by any one legal entity, or which comprise a contiguous system. If these thresholds are not met or exceeded, the proposed use may be exempt or eligible for a general permit. The district governing board may designate by rule specific areas where lesser thresholds will apply.

Several types of uses receive general permits, requiring minimal application procedures and conditions, so long as permitting thresholds for an individual permit are not met or exceeded. These uses include: irrigation for landscape, agricultural crops, nursery plants, and golf course and recreational areas, provided the irrigation occurs between the hours of 4:00 p.m. and 10:00 a.m. Variations in the permitted hours of application are allowed under certain circumstances related to use of micro-irrigation and seepage systems, reclaimed or recycled water, chemigation and fertigation, and protection of agricultural crops and nursery plants, among others.[232] Withdrawals of ground or surface water for construction dewatering purposes are authorized by general permit, with conditions, fourteen days after publication of the district's receipt of a completed notice of intent.[233]

There are several classes of exempted consumptive uses. These include domestic uses by individual users[234] and those users with certification under the Florida Electric Power Plant Siting Act or the Florida Industrial Siting Act. Also exempted are groundwater or surface water withdrawals to facilitate construction on or below ground surface or to remove pollutants from contaminated water, in the following circumstances: (1) groundwater is recharged onsite to the aquifer from which was withdrawn by either filtration or direct injection, or (2) surface water is withdrawn from wholly-owned impoundments or works

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228. Section 6.5.1, "Applicant's Handbook, Consumptive Uses of Water," St. Johns River Water Management District (November 12, 1991). Permits for uses in which 50% or more of the total allocation is from reclaimed water or stormwater sources are generally granted for ten years, while those in which 100% is derived from reclaimed water or stormwater sources are generally granted for twenty years. *Id.*

229. FLA. ADMIN. CODE Rule 40C-2.311(1) (November 1991).

230. FLA. ADMIN. CODE Rule 40C-2.311(2) (November 1991).

231. FLA. ADMIN. CODE Rule 40C-2.041 (August 1991).

232. *See* FLA. ADMIN. CODE Rule 40C-2.042(1) (August 1991).

233. FLA. ADMIN. CODE Rule 40C-2.061 (November 1991).

234. Domestic uses are defined to include those for household purposes of drinking, bathing, cooking or sanitation. FLA. ADMIN. CODE Rule 40C-2.042 (August 1991).

which are no deeper than the lowest extent of the uppermost water bearing stratum and which have no surface hydrologic connection off site, with the surface water recharged onsite to the uppermost water bearing stratum by infiltration or direct injection.[235] Withdrawals of groundwater for aquifer performance tests are exempted when requested by the district in order to review a proposed consumptive use permit application, as well as withdrawals of surface water solely for flood control when exempted or when performed under approved district MSSW permits.[236]

New consumptive use permits are subject to several general conditions. Initially, such permits must show that the proposed use: (1) is a reasonable beneficial use[237], (2) will not interfere with any existing legal use of water,[238] and (3) is consistent with the public interest.[239] To be considered "reasonable beneficial," a use must:

(a) be in such quantity as is necessary for economic and efficient utilization;
(b) be for a purpose that is both reasonable and consistent with the public interest;
(c) be from a source of water capable of producing the requested amounts of water;
(d) reduce the environmental or economic harm to an acceptable amount;
(e) be implemented with all available water conservation and reuse measures unless the applicant demonstrates that implementation is not economically, environmentally or technologically feasible;
(f) use reclaimed water, when readily available, in place of higher quality water, unless the applicant demonstrates that its use is not economically, environmentally or technologically feasible;
(g) utilize the lowest acceptable quality water source, including reclaimed water, unless the applicant demonstrates that its use is not economically, environmentally or technologically

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235. FLA. ADMIN. CODE Rule 40C-2.051(1)-(3) (November 1991).

236. FLA. ADMIN. CODE Rule 40C-2.051(4), (5) (November 1991).

237. FLA. ADMIN. CODE Rule 40C-2.301(2) (October 1989). The district defines a "reasonable and beneficial" use as one which has a purpose which is reasonable and consistent with the public interest, which reduces environmental harm to an acceptable amount, and which does not seriously harm the water quality of the receiving body. FLA. ADMIN. CODE Rule 40C-2.301(4) (October 1989).

238. "Presently existing legal uses" are defined to mean those legal uses which exist at the time of the receipt of the application for the consumptive use permit. FLA. ADMIN. CODE Rule 40C-2.301(3) (November 1991). Case law suggests that legal consumptive uses only include those which involve an active withdrawal from groundwater or surface water. West Coast Regional Water Supply Authority v. Southwest Florida Water Management District, DOAH Case Nos. 87-4644, -4645, -4657, 88-1169 (Recommended Order, July 10, 1989); Final Order No. 89-20, Southwest Florida Water Management District (August 30, 1989) (farmer's use of ambient ground and surface water to support crops and water cattle not considered existing legal use where use of water did not involve active withdrawal). *See, however*, Section 9.4.3, "Applicant's Handbook, Consumptive Uses of Water," (November 12, 1991), specifying potential adverse impacts to existing adjacent land uses, which if unmitigated, are considered inconsistent with the public interest, and will result in the denial of a permit. These include: significant reduction in water levels in an adjacent surface water body, significant potential for land collapse or subsidence caused by a reduction in water levels, or damage to crops, wetlands or other types of vegetation.

239. FLA. ADMIN. CODE Rule 40C-2.301(2) (November 1991).

feasible, or unless the applicant demonstrates that its use would result in adverse environmental impacts that outweigh water savings;

(h) not cause significant saline water intrusion or further aggravate currently existing saline water intrusion problems;

(i) not cause or contribute to flood damage;

(j) not seriously harm the water quality of the source of water;

(k) not seriously harm the water quality of the receiving body of water;

(l) comply with monitoring requirements on or before January 1, 1994, unless waived by the governing board due to extreme hardship.[240]

The district also makes reference to the rule on State Water Policy as additional factors to be used in determining reasonable-beneficial use.[241] Among others, these require consideration of:

(a) the quantity of water requested for the use;

(c) the suitability of the use to the source of water;

(e) the extent and amount of harm caused;

(f) the practicality of mitigating any harm by adjusting the quantity or method of use;

(g) whether the impact of the withdrawal extends to land not owned or legally controlled by the user;

(h) the method and efficiency of use;

(m) the extent of water quality degradation caused;

(p) the amount of water which can be withdrawn without causing harm to the resource;

(r) other relevant factors.[242]

A proposed consumptive use will not be considered to have met the criteria of Rule 40C-2.301(2), F.A.C. regarding reasonable-beneficial use and the public interest if it will:[243]

(a) significantly induce saline water encroachment, or

(b) cause the water table or surface water level to be lowered so that stages or vegetation will be adversely and significantly affected on lands other than those owned, leased or otherwise controlled by the applicant, or

(c) cause the water table or aquifer potentiometric surface level to be lowered so that significant and adverse impacts will affect existing legal users, or

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240. FLA. ADMIN. CODE Rule 40C-2.301(4) (November 1991).

241. *See* Section 10.2, "Applicant's Handbook, Consumptive Uses of Water," St. Johns River Water Management District (November 12, 1991).

242. FLA. ADMIN. CODE Rule 17-40.401(2) (October 1990).

243. *See* FLA. ADMIN. CODE Rule 40C-2.301(5) (November 1991).

(d) require the use of water which, pursuant to Section 373.223(3), Fla. Stat.,[244] and Rule 40C-2.301(6), F.A.C.,[245] the board has reserved from use by permit, or

(e) cause the rate of flow of a surface water course to be lowered below a minimum flow which has been established pursuant to Section 373.042(1), Fla. Stat.,[246] or

(f) cause the level of a water table aquifer, the potentiometric surface of an aquifer source, or the water level of a surface water source to be lowered below a minimum level which has been established pursuant to Section 373.042(2), Fla. Stat.[247]

Both general and individual permits are subject to several additional limiting conditions.[248] Among these are requirements that legal uses existing at the time of permit application not be adversely impacted by the consumptive use, and that off-site land uses existing at the time of application not be significantly adversely impacted as a result of the use.[249]

Though the district's rules require that potential consumptive uses not cause surface water flows and levels or ground water levels to be lowered below established minimum flows and levels, as of this writing none have been established by the district. A draft rule is currently being developed for the establishment of minimum surface water levels and flows, which posits five categories of regulatory elevations and flow discharges for watercourses in the district.[250] The draft rule specifies that in establishing minimum flows and levels, the governing board "must consider, and at its discretion may provide for, the protection of non-consumptive uses, including navigation, recreation, and the preservation of natural resources, fish and wildlife."[251]

Under the draft rule, one category of regulatory elevation or flow is the "minimum average surface water level." This is considered an optimum level for the health of the system, corresponding to approximately

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244. The section authorizes, but does not require a governing board to reserve from use water "in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety."

245. The rule tracks the language of Section 373.223(3), Fla. Stat., authorizing the reservation from use of water necessary for the protection of fish and wildlife or the public health and safety. The reservation must be made by rule, and is subject to periodic review and revision by the board.

246. The section requires the DER or the district governing board to establish minimum flows for all surface watercourses in the district. "Minimum flow" is defined as the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. FLA. STAT. § 373.042(1) (1991).

247. The section requires the DER or the district governing board to establish minimum water levels for the district. "Minimum water level" is defined as the level of ground water in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area. FLA. STAT. § 373.042(2) (1991).

248. *See* FLA. ADMIN. CODE Rule 40C-2.381 (Novernber 1991).

249. FLA. ADMIN. CODE Rule 40C-2.381(2)(a)5, 6 (November 1991).

250. Draft Rule 40C-8, F.A.C. (April 29, 1991). The draft rule is scheduled for presentation to the governing board no sooner than May 1992, with an adoption date subsequent to that board meeting.

251. Draft Rule 40C-8.041(1), F.A.C. (April 29, 1991).

the 60 percent of inundation level based on the overall period of record, and approximately 0.3 foot below the floodplain surface.[252] The "minimum frequent low surface water level" is a low water level that may be reached during extended periods of reduced rainfall.[253] The "minimum infrequent low surface water level" is the water level which may be reached during periods of extreme drought.[254]

Water levels and flows above the minimum average surface water level include the "frequent high surface water flood level," and the "infrequent high surface water level." The first of these is the high water level expected to be reached frequently during periods when rainfall is normal,[255] while the second is an infrequent high water level expected to be reached during or immediately after periods of high rainfall with a frequency of approximately one in five years.[256]

In the draft rule, the only watercourses for which regulatory minimum flows are proposed are the Wekiva River and Blackwater Creek.[257] Until minimum flows and levels are established for all waterbodies in the district, including consideration of instream and inplace water needs of wildlife, the district's consumptive use permitting conditions will not reflect, to a significant degree, the protection of habitat.

The St. Johns River district water shortage plan[258] is similar to that of the Southwest Florida district. The district includes in its resource monitoring parameters the levels of surface and ground waters, the demand of natural systems, and impacts on fish and wildlife.[259] However, in its monitoring of demands, it also includes data related to the needs of natural systems,[260] a factor not expressly considered by other water management districts under demand monitoring. In estimating present and anticipated available supply, the district considers, among other factors: historic, current and anticipated levels in surface and ground waters; historic, current and anticipated flows in surface waters; and historic, current and anticipated demand of natural systems.[261]

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252. Draft Rule 40C-8.021, F.A.C. (April 29, 1991).

253. *Id.*

254. *Id.*

255. *Id.*

256. *Id.*

257. *See* Draft Rule 40C-8.624, F.A.C. (April 29, 1991). By March 1, 1991, the district was to have established minimum flows and minimum water levels for surface watercourses in the Wekiva River System and minimum water levels for the groundwater in the aquifer underlying the Wekiva Basin. FLA. STAT. § 373.413(3) (1989).

258. FLA. ADMIN. CODE Rules 40C-21.001--40C.21.651 (1989).

259. FLA. ADMIN. CODE Rule 40C-21.401(3) (1989).

260. FLA. ADMIN. CODE Rule 40C-21.401(4)(c) (1989).

261. FLA. ADMIN. CODE Rule 40C-21.221(3)(a) (1989).

One factor in determining whether a shortage will be declared is the potential for serious harm to the water resource.[262] In evaluating the potential for serious harm to the resource, the district considers: (1) potential for increased saltwater intrusion or other ground water contamination; (2) potential for *significant* adverse impacts on fish and wildlife, and the ecology of the area; and (3) other factors adversely impacting the water resource.[263] Thus, the approach of the St. Johns River district appears to be slightly less sensitive than that of the Southwest Florida district.

In deciding whether a water shortage emergency should be declared, the district utilizes the same factors used to evaluate available water supplies for water shortage purposes, including surface water levels and flows, and the needs of natural systems.[264] As with other districts, the analysis is to "determine whether any user's estimated present and anticipated available water supply will be insufficient to protect the public health, safety or welfare, or the health of animals, fish or aquatic life, a public water supply, or meet the minimum needs of commercial, industrial, agricultural, recreational, or other reasonable-beneficial use."[265] In evaluating the potential for such adverse impacts, the district considers the same factors it uses to determine present and anticipated user demands, and the potential for serious harm to the water resource, including potential for "significant adverse impacts on fish and wildlife, and the ecology of the area."[266]

The St. Johns River district has established four water shortage phases,[267] with corresponding restrictions aimed at reducing overall demand by 15% (moderate shortage),[268] 30% (severe shortage),[269] 45% (extreme shortage),[270] and 60% (critical shortage).[271] Specific restrictions for the different phases do not reference the need to maintain and preserve the long-term integrity of surface waterbodies and associated habitat for fish and wildlife, however the general water use restrictions which may be imposed include provisions designed to maintain minimum flows and levels established pursuant

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262. FLA. ADMIN. CODE Rule 40C-21.231(1) (1989).

263. FLA. ADMIN. CODE Rule 40C-21.221(3)(c) (1989) (emphasis added).

264. FLA. ADMIN. CODE Rule 40C-21.331(3)(a) (February 1991).

265. FLA. ADMIN. CODE Rule 40C-21.331(3) (1989).

266. FLA. ADMIN. CODE Rule 40C-21.331(3)(b) (1989), referencing FLA. ADMIN. CODE Rule 40C-21.221(3)(b), (c) (1989).

267. FLA. ADMIN. CODE Rule 40C-21.251(2) (1989).

268. *See* FLA. ADMIN. CODE Rule 40C-21.621 (1989) for specific restrictions applicable to Phase I shortages.

269. *See* FLA. ADMIN. CODE Rule 40C-21.631 (1989) for specific restrictions applicable to Phase II shortages.

270. *See* FLA. ADMIN. CODE Rule 40C-21.641 (1989) for specific restrictions applicable to Phase III shortages.

271. *See* FLA. ADMIN. CODE Rule 40C-21.651 (1989) for specific restrictions applicable to Phase IV shortages.

to Section 373.042, Fla. Stat.[272] The water shortage rules also include provisions for variances from any restrictions that may be imposed.[273]

Southwest Florida Water Management District

The Southwest Florida Water Management District permits consumptive uses of water under the provisions of Chapter 40D-2, Florida Administrative Code and the district document entitled, "Basis of Review for Water Use Permit Applications," (October 1989). Unless exempted by law or district rule, a water use permit must be obtained prior to any withdrawal of water if any of the following thresholds will be exceeded:

(a) total withdrawal from single or combined sources is greater than or equal to 1,000,000 gallons per day (gpd);
(b) annual average withdrawal from single or combined sources is greater than or equal to 100,000 gpd;
(c) withdrawal is from a well with an outside diameter of six inches or more at the surface;
(d) withdrawal is from a surface water body and the outside diameter of the withdrawal pipe or the sum of the outside diameters of the withdrawal pipes is four inches or greater.[274]

A permit is also required when evidence indicates a withdrawal is likely to cause significant adverse impacts to existing water or land uses or the water resource.[275] Water use permits with annual average daily withdrawals equalling or exceeding 500,000 gpd must be approved by the governing board, while those with an annual average daily withdrawal less than 500,000 gpd may be issued by district staff as general permits.[276] Where two or more applications, which otherwise comply with district rules and orders, are competing for a quantity of water which is inadequate for both or all, or which are in conflict for any other reason, the board will approve or modify the applications in a manner which best serves the public interest.[277] If such applications are judged to equally qualify under the public interest review, a renewal application will receive preference over a new application.[278]

Typical permit duration is six years for: new permits greater than or equal to 500,000 gpd annual average withdrawal, permits where the potential for significant adverse impacts are predicted, and renewals with modification to increase the quantity withdrawn by more than or equal to 100,000 gpd or 10% or more of the existing permitted quantity, whichever is greater.[279] Ten year durations are typical for: new

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272. FLA. ADMIN. CODE Rule 40C-21.271(3)(c) (1989).

273. FLA. ADMIN. CODE Rule 40C-21.275 (1989).

274. FLA. ADMIN. CODE Rule 40D-2.041(1) (December 1990).

275. FLA. ADMIN. CODE Rule 40D-2.041(4) (December 1990).

276. FLA. ADMIN. CODE Rule 40D-2.041(2), (3) (December 1990).

277. FLA. ADMIN. CODE Rule 40D-2.311(1) (May 1990).

278. FLA. ADMIN. CODE Rule 40D-2.311(2) (November 1991).

279. Section 1.9, "Basis of Review for Water Use Permit Applications," (hereinafter, "Basis of Review") Southwest Florida Water Management District (October 1989). *See also*, FLA. ADMIN. CODE Rule 40D-2.321 (May 1990).

permits less than 500,000 gpd annual average withdrawal, renewals with an approved mitigation plan to address potential adverse impacts, and renewals with changes less than 100,000 gpd or 10% of the annual average withdrawal and no significant potential for adverse impacts.[280] Longer-termed permits, up to 50 years in duration, may be granted under appropriate circumstances.[281]

Several types of uses receive exemptions under the rule and do not require a permit. These include: domestic consumption of water by individual users, though any use exceeding the threshold quantities for a permit are not exempt; users with certification under the Florida Electric Power Plant Siting Act[282] or the Florida Industrial Siting Act;[283] temporary withdrawals for contamination cleanup with proper notification and permits; temporary withdrawals from test wells; and temporary dewatering for construction of buildings, roadways, pipelines, cables, culverts and catch basins.[284]

Generally, in order to receive a permit, an applicant must demonstrate that a proposed use is reasonable and beneficial, is in the public interest, and will not interfere with any existing legal use of water, by providing reasonable assurances, on an individual and cumulative basis, that the water use:

(a) is necessary to fulfill a reasonable demand;[285]
(b) will not cause quantity or quality changes which adversely impact the water resources, including both surface and ground water;
(c) will not cause adverse environmental impacts to wetlands, lakes, streams, estuaries, fish and wildlife or other natural resources;
(d) will not cause water levels or rates of flow to deviate from the ranges set forth in Chapter 40D-8;[286]
(e) will utilize the lowest quality water the applicant has the ability to use;
(f) will not significantly induce saline water intrusion;
(g) will not cause pollution of the aquifer;
(h) will not adversely impact offsite land uses existing at the time of the application;[287]

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280. *Id.*

281. *Id.*

282. *See also*, FLA. ADMIN. CODE Rule 17-17 (February 1991).

283. *See also*, FLA. ADMIN. CODE Rule 17-23 (1990).

284. FLA. ADMIN. CODE Rule 40D-2.051 (December 1990).

285. *See* Section 3.0, "Basis of Review," Southwest Florida Water Management District (October 1989) for district guidelines and presumptions in determining reasonable water needs for most types of water uses.

286. Chapter 40D-8, F.A.C. sets forth the district's procedures and methods for establishing minimum flows and levels, as well as a schedule of levels for lakes and other impoundments in certain parts of the district.

287. Adverse impacts on existing land uses include: significant reduction in water levels in an adjacent surface water body, including impoundments to the extent that utilization of the water body is impaired, and significant damage to crops or other types of vegetation. Section 4.7, "Basis of Review," Southwest Florida Water Management District (October 1989).

(i) will not adversely impact an existing legal withdrawal;[288]
(j) will utilize local water resources to the greatest extent possible;
(k) will incorporate water conservation measures;
(l) will incorporate reuse measures to greatest extent possible;
(m) will not cause water to go to waste; and
(n) will not otherwise be harmful to the water resources within the district.[289]

The district utilizes several performance standards and presumptions in evaluating permits, to ensure that unacceptable adverse impacts to environmental features do not occur.[290] Environmental features that are evaluated include: (a) surface water bodies such as lakes, ponds, impoundments, sinks, springs, streams, canals, estuaries, or other watercourses; (b) wetland habitats; (c) on-site environmental features and their relationship to local and regional landscape patterns; (d) habitat for threatened and endangered species; and (e) other environmental features which are dependent on the water resources of the district.[291]

For jurisdictional wetlands,[292] performance standards are that:

(a) wet season water levels must not deviate from normal ranges;
(b) wetland hydroperiods must not deviate from normal ranges and durations to the extent that wetland plant species composition and community zonation are adversely impacted;
(c) wetland habitat functions, such as providing cover, breeding, and feeding areas for obligate and facultative wetland animals must be temporally and spatially maintained, and not adversely impacted as a result of withdrawals;
(d) habitat for threatened or endangered species must not be altered to the extent that utilization by those species is impaired.[293]

The district presumes that a withdrawal of water will not cause unacceptable environmental impacts if the proposed withdrawal, combined with other withdrawals, does not lower the water table at the wetland by more than one foot.[294]

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288. The district presumes that adverse impacts do not occur to existing legal uses if the applicant's withdrawals will not lower the potentiometric surface more than five feet at an affected well, or if the withdrawal will not lower the water table more than two feet at an affected well. Section 4.8, "Basis of Review," Southwest Florida Water Management District (October 1989).

289. FLA. ADMIN. CODE Rule 40D-2.301(1) (May 1990).

290. *See*, Section 4.2, "Basis of Review," Southwest Florida Water Management District (October 1989).

291. *Id.*

292. The district does not evaluate impacts to isolated wetlands less than 0.5 acres, unless used by a threatened or endangered species, or located in an Area of Critical State Concern, or where two or more wetlands, disregarding property boundaries, have a combined area greater than 0.5 acres and area connected by standing or flowing surface water during average wet season high water levels. *Id.*, Section 4.2 A.2.

293. *Id.*, Section 4.2 A.4.

294. *Id.*, Section 4.2 A.5.

The performance standards for lakes require that water levels not deviate from the normal rate and range of fluctuation, to the extent that:

(a) water quality, vegetation, or animal populations are adversely affected;
(b) flows to downgradient watercourses are adversely impacted; and/or
(c) recreational use or aesthetic qualities of the water resource are adversely impacted.[295]

The district presumes that a surface water withdrawal will not cause unacceptable environmental impacts to lakes if:

(a) the total annual withdrawal, combined with other surface withdrawals, does not exceed the volume contained within the top foot of water at average lake area;
(b) the withdrawal of water, combined with other surface withdrawals, does not exceed a rate of one-quarter inch per day over a 30-day period (the volume contained in the top quarter inch of water at average lake area).[296]

For ground water permits, the district presumes a withdrawal will not cause unacceptable environmental impacts if the withdrawal of water, combined with other ground water withdrawals, does not lower the water table at the lake by more than one foot.[297]

For evaluation of potential adverse impacts to streams, the district's performance standards are that:

(a) flow rates must not deviate from the normal rate and range of fluctuation to the extent that water quality, vegetation, and animal populations are adversely impacted in streams and estuaries;
(b) flow rates must not be reduced from the existing level of flow to the extent that salinity distributions in tidal streams and estuaries are significantly altered as a result of withdrawals;
(c) flow rates must not deviate from the normal rate and range of fluctuation to the extent that recreational use or aesthetic qualities of the water resource are adversely impacted.[298]

The district presumes that a withdrawal will not cause unacceptable environmental impacts to streams if the withdrawal, combined with other withdrawals, does not reduce the rate of daily flow by more than ten percent at any point in the drainage system at the time of withdrawal.[299] The effects of water retention in instream impoundments are included in the district's determination of flow reduction. Estimated available yield is determined based on historical flow records or best available data and existing permitted uses.

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295. *Id.*, Section 4.2 B.1.

296. *Id.*, Section 4.2 B.2.

297. *Id.*

298. *Id.*, Section 4.2 C.1.

299. *Id.*, Section 4.2 C.2. Scientifically sound, site specific studies may be used to support variances from the ten percent figure. For an explanation of the research history and rationale behind the district's adoption of this approach, see Flannery, M., "Memorandum to David Moore, Re: Part II Rule Revision: Evaluation of Potential Impacts to Streams and Estuaries," Southwest Florida Water Management District (February 28, 1989).

The ten percent presumption also applies to groundwater withdrawals with potential impacts on riverine and estuarine systems, but as yet, such impacts have not been observed in the district, probably due to the hydrological isolation of most streams from the aquifers from which most groundwater is withdrawn. However, in northwest Hillsborough County, Pinellas County and Pasco County, there are well established interconnections between groundwater and many surface watercourses, suggesting that in those areas, and possibly others, the consumptive use permitting process for groundwater withdrawals could require consideration of adverse effects on surface water flows.

Several standard conditions are attached to water use permits.[300] Among others, these include requirements to cease or reduce surface water withdrawals, as directed by the district, if water levels in lakes fall below applicable minimum water levels or rates of flow fall below minimum established levels,[301] or if water levels in aquifers fall below established minimum levels.[302] The district can also require metering to record withdrawal quantities, where necessary to analyze impacts to the water resource or to existing users.[303] If the district establishes special regulations for Water Use Caution Areas or under water shortage rules, water use permits in those areas become subject to the revised regulations.[304]

To aid in ensuring that permit criteria continue to be met after issuance, the district may, and often does, require monitoring of several parameters, including withdrawal quantities, saline water monitoring, pollution source monitoring, ground water levels, surface water levels and flows, rainfall, and surface water quality.[305] Permittees must monitor withdrawal quantities from each withdrawal point when: (a) annual average withdrawal is greater than or equal to 500,000 gpd; (b) annual average withdrawal is greater than or equal to 100,000 gpd for public supply use; (c) the district determines that there is a potential for harm to the resource or potential for adverse impacts to existing users.[306]

Where there is the potential for significant impacts to environmental features, because of the proposed size of a withdrawal, its predicted impact on surface waters or water tables, or the sensitivity of associated

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300. *See generally*, FLA. ADMIN. CODE Rule 40D-2.381 (May 1990).

301. FLA. ADMIN. CODE Rule 40D-2.381(3)(h) (May 1990).

302. FLA. ADMIN. CODE Rule 40D-2.381(3)(i) (May 1990).

303. FLA. ADMIN. CODE Rule 40D-2.381(3)(n) (May 1990).

304. FLA. ADMIN. CODE Rule 40D-2.381(3)(d), (k) (May 1990). *See* FLA. ADMIN. CODE Rule 40D-2.801 (March 1991) for rule requirements and designated Water Use Caution Areas. The following factors are considered in determining whether an area should be so designated: (a) the quantity of water available for use from ground water sources, surface water sources, or both; (b) the quality of water available from such sources, including impacts such as saline water intrusion, mineralized water upconing, or pollution; (c) environmental systems, such as wetlands, lakes, streams, estuaries, fish and wildlife, or other natural resources; (d) lake stages or surface water rates of flow; (e) offsite land uses; and (f) other resources deemed appropriate by the governing board. FLA. ADMIN. CODE Rule 40D-2.801(2) (March 1991).

305. *Id.*, Sections 5.0-5.7.

306. *Id.*, Section 5.1. The district provides and installs flow meters for agricultural withdrawals permitted at greater than or equal to 500,000 gpd, for those agricultural withdrawal points in existence prior to October 1, 1989. *Id.*

environmental features, the district may require monitoring of several types of parameters.[307] For wetlands, lakes, streams, springs, canals, estuaries or other water courses, monitoring parameters may include surface water levels; groundwater levels; rainfall at the site; surface water quality, including salinity distributions in estuaries; biological parameters such as the abundance and species composition of benthic fauna, fishes, zooplankton, phytoplankton, submersed macrophytes, emergent or intertidal plants, and periphyton; inventories of plants and animals in or dependent on the site; wildlife monitoring; sediment characteristics; aerial photography identifying the distribution of riparian or estuarine vegetation; and hydrographic parameters, such as bathymetry and distribution of bottom features.[308]

Standard permit conditions require permittees to mitigate actual or imminent adverse impacts to existing legal users caused by withdrawals.[309] These include reductions in water levels which impair the ability of a well to produce water; significant reduction in levels or flows in water bodies such as lakes, impoundments, wetlands, springs, streams or other watercourses; or significant inducement of natural or manmade contaminants into a water supply or into a usable portion of an aquifer or water body.[310]

Permittees must also mitigate actual or imminent adverse impacts to environmental features or offsite land uses.[311] Such adverse impacts include: significant reductions in levels or flows in water bodies such as lakes, impoundments, wetlands, springs streams, or other watercourses; sinkholes or subsidence causes by reduction in water levels; damage to crops and other vegetation causing financial harm to the owner; and damage to the habitat of endangered or threatened species.[312] The district governing board may temporarily or permanently revoke a permit, in whole or in part, if, among other factors, it finds that the use causes significant, unmitigated adverse impacts to water resources, environmental systems, or existing legal users.[313]

The Southwest Florida district has adopted rules related to the declaration of water shortages and emergencies, and implementation of restrictions on use.[314] Several water quality and quantity parameters are monitored, to determine whether a shortage or emergency should be declared. These parameters include: levels in surface and groundwaters; water quality of surface and groundwaters; flows of surface waters; demand of natural systems; rainfall; and impacts on fish and wildlife.[315] Current data are periodically compared to historical data to determine whether estimated present and future water

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307. *Id.*, Section 5.8.

308. *Id.* at C-32--34.

309. FLA. ADMIN. CODE Rule 40D-2.381(3)(l) (May 1990).

310. *Id.*

311. FLA. ADMIN. CODE Rule 40D-2.381(3)(m) (May 1990).

312. *Id.*

313. FLA. ADMIN. CODE Rule 40D-2.341(2) (May 1990).

314. FLA. ADMIN. CODE Rules 40D-21.011--40D-21.641 (1989).

315. FLA. ADMIN. CODE Rule 40D-21.401(3) (May 1987).

supply within any source class will be insufficient to meet estimated human needs, or whether "serious harm to water resources" can be expected.[316]

Factors considered in determining whether serious harm to the water resource may occur include:

(1) the occurrence of or potential for saltwater intrusion or other ground water contamination;
(2) significant reductions of stream flow or spring discharge, or significant lowering of the water table;
(3) the occurrence of or potential for adverse impacts on fish and wildlife; and
(4) other factors adversely impacting the water resource.[317]

The Southwest Florida district expressly includes consideration of stream flow, spring discharge and water table levels in its evaluation of serious harm to the resource. It does not qualify the types of adverse impacts to fish and wildlife to be included in the analysis.[318]

For the purposes of water shortage determinations, the needs of fish and wildlife are not included in the analysis of present and anticipated demands.[319] However, the factors considered in estimating water supplies include, among others: historic, current, and anticipated flows in surface waters; and historic, current, and anticipated demand of natural systems, including losses due to evapotranspiration and seepage.[320]

In deciding whether a water shortage emergency should be declared, the district utilizes the same factors used to evaluate available water supplies for water shortage purposes, including surface water flows and the needs of natural systems.[321] The analysis is to "determine whether present and anticipated future available water supply would be insufficient to protect the public health, safety or welfare, or the health of animals, fish or aquatic life, a public water supply, or commercial, industrial, agricultural, recreational, or other reasonable-beneficial use."[322]

The district provides for three types of restrictions to be used in responding to a water shortage declaration or water shortage emergency.[323] These range from a Phase I (moderate) water

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316. FLA. ADMIN. CODE Rule 40D-21.221(2) (1989).

317. FLA. ADMIN. CODE Rule 40D-21.221(2)(c) (1989).

318. *Compare*, South Florida Water Management District ("potential for *irreversible* adverse impacts on fish and wildlife"); St. Johns River Water Management District ("potential for *significant* adverse impacts on fish and wildlife, *and the ecology of the area*"); Northwest Florida Water Management District ("potential for *significant* adverse impacts on fish and wildlife, *and the ecology of the area*").

319. FLA. ADMIN. CODE Rule 40D-21.221(2)(b) (1989).

320. FLA. ADMIN. CODE Rule 40D-21.221(2)(a) (1989).

321. FLA. ADMIN. CODE Rule 40D-21.331(3)(a) (May 1987).

322. FLA. ADMIN. CODE Rule 40D-21.331(2) (May 1987).

323. FLA. ADMIN. CODE Rule 40D-21.251 (July 1986).

shortage,[324] to a Phase II (severe) shortage,[325] to a Phase III (extreme) shortage.[326] Restrictions applicable to each phase specify which type of uses must implement cutbacks, and to what degree. For Phase I through Phase III restrictions, the rule states that "(a)ugmentation shall be limited to the minimum necessary to maintain and preserve the long-term integrity of the surface water body and associated habitat for fish and wildlife."[327]

Additional language in the Phase I rule requires that, "(w)here minimum water levels have been established by the District, no augmentation shall occur when water levels are above the applicable minimum water level."[328] Phases II and III require that where minimum water levels have been established, no augmentation shall occur "when water levels are above the extreme low management level."[329] The water shortage and emergency rules do not specifically address minimum flows for watercourses. The district's rules do allow for variances from any restrictions that may be imposed.[330]

Agriculture

The Southwest Florida Water Management District regulates agricultural surface water management systems through its MSSW permitting program. However, St. Johns River Water Management District has recently developed a new rule pertaining specifically to agriculture, Rule 40C-44, F.A.C.

St. Johns River Water Management District Agriculture Rule

Chapter 40C-44 came into effect on August 1, 1991.[331] The St. Johns River Water Management District (SJRWMD) adopted this Chapter to prevent discharges of agricultural stormwater and associated wastewater in a manner which is inconsistent with the objectives of the District or which may cause harm to the water uses of the District.[332] Chapter 40C-44 provides an overall framework for agricultural permitting District-wide.[333]

Any examination of agricultural permitting in the SJRWMD must begin with a discussion of Chapter 40C-4. Chapter 40C-4 is the primary rule implementing the District's permitting program for management and

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324. FLA. ADMIN. CODE Rule 40D-21.621 (May 1987).

325. FLA. ADMIN. CODE Rule 40D-21.631 (1989).

326. FLA. ADMIN. CODE Rule 40D-21.641 (1989).

327. FLA. ADMIN. CODE Rules 40D-21.621(7)(d), 40D-21.631(7)(d), 40D-21.641(7)(d) (1989).

328. FLA. ADMIN. CODE Rule 40D-21.621(7)(d) (1989).

329. FLA. ADMIN. CODE Rules 40D-21.631(7)(d), 40D-21.641(7)(d) (1989). Extreme low management levels are operating levels established in Rule 40D-8, F.A.C. for lakes and impoundments.

330. FLA. ADMIN. CODE Rule 40D-21.291 (1989).

331. FLA. ADMIN. CODE Rule 40C-44.031(1) (August, 1991).

332. *Id.* Rule 40C-44.011(2).

333. *Id.* Rule 40C-44.011(3).

storage of surface waters.[334] Unless an express exemption exists, section 40C-4.041 requires a permit for the maintenance and operation of existing agricultural surface water management systems or the construction of new surface water management systems which meet district thresholds. District thresholds under Chapter 40C-4 which pertain to the Green Swamp are included in the discussion of SJRWMD MSSW permitting contained in this chapter.

Whenever the alteration, modification or construction of a new or existing agricultural surface water management system requires that a MSSW permit be obtained, the performance standards and water quality practices established in Chapter 40C-44 must be reviewed as part of those permit applications. A separate Chapter 40C-44 permit application will not be required.[335] However, the applicant must provide the required technical information as part of those applications to demonstrate compliance with Chapter 40C-44.[336]

Agricultural systems are also permitted under Chapter 40C-44. Two types of permits are issued under this chapter: general and individual. Unless expressly exempt by statute or rule, a permit is required under Chapter 40C-44 when the following thresholds are met:

(1) Existing agricultural surface water management systems.

(a) An individual or general permit is required for the maintenance and operation of existing agricultural surface water management systems which incorporate pumped discharges from stationary or portable facilities as part of the surface water management system and which have pumps with a capacity, either individually or cumulatively, of 10,000 gallons per minute (GPM) or greater.[337]

(b) Notwithstanding the above provision, the District may require that an agricultural operation, including pumped or gravity-drained systems, obtain an individual 40C-44 permit or modification of a permit issued pursuant to Chapter 40C-4, if it causes or contributes to a violation of state water quality standards within waters of the state.[338]

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334. *Id.* Rule 40C-4.011.

335. *Id.* Rule 40C-44.071(4).

336. *Id.*

337. *Id.* Rule 40C-44.041(1)(a). Pumped agricultural operations, which have a valid Industrial Waste permit or consent order issued by DER or the District, and which pump less than 10,000 GPM, can continue to operate according to the terms of the permit or consent order until it expires. Ninety days prior to the expiration date of the permit or consent order, the agricultural operation must apply for a Chapter 40C-44 permit or, if they also have a MSSW permit issued prior to June 1, 1988, must apply to modify the MSSW permit. St. Johns River Water Management District, Draft, Applicant's Handbook, Agricultural Surface Water Management Systems, Chapter 40C-44, F.A.C. (January 20, 1992) [hereinafter referred to as SJRWMD Draft].

338. In determining whether state water quality standards have been violated, the District considers water quality data; size of the operation; characteristics of the site; the findings of basin-specific studies, and the existence of mixing zones, variances, or site specific alteration criteria granted by the Department of Environmental Regulation. FLA. ADMIN. CODE Rule 40C-44.041(1)(b) (August, 1991).

(2) New or altered agricultural surface water management systems.

Unless expressly exempt by statute or rule, a surface water management system permit must be obtained for the construction, maintenance and operation of new agricultural surface water management systems, or alteration of existing systems, which drain an agricultural area greater than 2 acres and are not required to obtain a permit pursuant to Chapters 40C-4 and 40C-40, F.A.C.[339]

General Permits

The following types of agricultural surface water management systems, should they require a Chapter 40C-44 permit as discussed above, will qualify for a general permit provided they comply with the conditions for issuance of a permit (discussed later):

(1) Existing agricultural surface water management systems which are required to obtain a permit as discussed in (1) above, provided they:

(a) Continue to maintain and operate the surface water management system, and associated treatment system, as previously permitted or authorized by consent order, and

(b) Demonstrate compliance with the performance standards described in Chapter 40C-44, based upon data collected in compliance with monitoring conditions.[340]

(2) New or altered agricultural surface water management systems which are required to obtain a permit as discussed in (2) above, provided that they have a Conservation Plan, implement the Conservation Plan within 180 days of permit issuance, and maintain the Conservation Plan.

(3) Minor alterations which are defined as:

(a) regrading or reconfiguring of ditches and other conveyance systems necessary to implement a management practice recommended by a Conservation Plan or as required by Chapter40C-44 water quality practices (discussed later).

(b) installation of new internal ditches or other conveyance systems necessary to implement a management practice recommended by a Conservation Plan or as required by Chapter 40C-44 water quality practices (discussed later).

(c) installation of internal water control structures necessary to implement a management practice recommended by a Conservation Plan, or as required by Chapter 40C-44 water quality practices.

(d) modification or expansion of existing detention ponds within previously diked areas, provided that public safety concerns are addressed, no floodplain encroachment occurs, and impacts to wetlands do not require a permit pursuant to section 40C-4.041, F.A.C.

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339. *Id.* Rule 40C-44.041(2).

340. *Id.* Rule 40C-44.055(2)(a),(b).

(e) construction of new detention ponds within previously diked areas, provided that public safety concerns are addressed, no floodplain encroachment occurs, and impacts to wetlands do not require a permit pursuant to section 40C-4.041, F.A.C.[341]

Alterations of existing agricultural surface water management systems, which would otherwise require MSSW permits are considered minor alterations and may qualify for a general permit if they do not:

(a) increase the peak discharge rate and total discharge volume, when applicable;

(b) alter off-site storage and conveyance capabilities of the water resource;

(c) adversely affect hydrologically related environmental functions; or

(d) increase the off-site pollutant loading.[342]

(4) Surface water management systems which drain an agricultural operation of less than 120 acres, which do not contain a concentrated animal feeding operation, which implement and maintain a Conservation Plan, provided the permittee satisfies the following monitoring conditions:

(a) The permittee must maintain hour meters, in operating order, on each drainage pump.

(b) The permittee must maintain a staff gauge, referenced to NGVD, in each detention pond.

(c) The permittee must monitor the water quality on a quarterly basis at each discharge point from pumps or pond outfalls to waters of the state. Water samples must be analyzed for specific water quality parameters listed in Table 1 of Chapter 40C-44, F.A.C.[343]

After five years the District must reduce or eliminate the monitoring requirements, or notify the permittee that he must apply for an individual permit.[344]

(5) Surface water management systems which drain an agricultural operation which do not contain a concentrated animal feeding operation, and which implement and maintain a Conservation Plan, if:

(a) The permittee satisfies the monitoring requirements discussed above in number 4; and
(b) The system has not previously been subject to a permit or consent order, issued by DER or the district, pursuant to the DER Industrial Wastewater Facilities Rule (Chapter 17-660, F.A.C.) or the DER Dairy Wastewater Rule (Chapter 17-670, F.A.C.).

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341. FLA. ADMIN. CODE Rule 40C-44.071(3).

342. *Id.* Rule 40C-44.071(2).

343. *Id.* Rule 40C-44.055(4)(a)-(c), Table 1.

344. *Id.* Rule 40C-44.055(4)(d),(e).

Individual Permits

Agricultural surface water management systems which are required to obtain a Chapter 40C-44 permit and which do not qualify for a general permit, are required to obtain an individual permit. An individual permit may be issued if the applicant affirmatively provides the District with reasonable assurance that the construction, expansion, alteration, modification, operation or activity of the surface water management system will comply with the performance standards and conditions for permit issuance.

Existing systems, which incorporate appropriate water quality practices are presumed to provide reasonable assurance of compliance with Chapter 40C-44 performance standards provided that adequate provisions have been made for maintenance and operation of the proposed surface water management system and water quality practices. New systems are presumed to provide reasonable assurance of compliance if they incorporate appropriate water quality practices and install a surface water management system designed to provide a level of treatment and pollutant reduction so that pollutant load discharges are 80% less than those from a similar operation which did not incorporate a treatment system or water quality practices. New systems must also provide for maintenance and operation of the proposed surface water management system and water quality practices.

New and existing systems which discharge to Class I, Class II, or Outstanding Florida Waters may be required to provide an additional level of treatment to provide reasonable assurance that the construction, expansion, alteration, modification, operation or activity of the surface water management system will comply with the performance standards and conditions for permit issuance.[345]

Conditions for Issuance of Permits

To obtain a general or individual permit for operation, maintenance, removal or abandonment of a system an applicant must give reasonable assurance that the activity will not:

1. Endanger life, health, or property;
2. Be inconsistent with the maintenance of minimum flows and levels established pursuant to Section 373.042, F.S.;
3. Adversely affect the availability of water for reasonable beneficial purposes;
4. Be incapable of being effectively operated;
5. Adversely affect the operation of a Work of the District established pursuant to Section 373.086, F.S., and Chapter 40C-6, F.A.C.;
6. Adversely affect existing agricultural, commercial, industrial, or residential developments;
7. Cause adverse impacts to the quality of receiving waters;
8. Adversely affect natural resources, fish and wildlife;
9. Increase the potential for damages to off-site property or the public caused by:

    a. Floodplain development, encroachment or other alteration;
    b. Retardance, acceleration, displacement or diversion of surface water;
    c. Reduction of natural water storage areas;
    d. Facility failure;

10. Increase the potential for flood damages to residences, public buildings, or proposed and existing streets and roadways; or
11. Otherwise be inconsistent with the overall objectives of the District.

345. *Id.* Rule 40C-44.061(1)-(5).

The District may balance the effects on individual objectives to determine whether the project is consistent with the overall objectives of the District.

An applicant for a general or individual permit must also give reasonable assurance that the activity meets the following standards:

1. Adverse water quantity impacts will not be caused to receiving waters and adjacent land.
2. Surface and groundwater levels and surface water flow will not be adversely affected.
3. Existing surface water storage and conveyance capabilities will not be adversely affected;
4. The system must be capable of being effectively operated;
5. The activity must not result in adverse impacts to the operation of Works of the District established pursuant to Section 373.086, F.S.;
6. Hydrologically-related environmental functions will not be adversely affected;
7. Otherwise not be harmful to the water resources of the District.

It is presumed that a system meets the standards listed above if the system meets the criteria required to obtain a Chapter 40C-4 or 40C-40, F.A.C. permit.[346]

Existing systems are presumed to satisfy the objectives and standards listed above if the applicant demonstrates compliance with the performance standards discussed below.

Performance Standards

The District has delineated the following performance standards which must be met to demonstrate that the proposed activity will not be harmful to the water resources of the District and will not cause adverse impacts to the quality of the receiving waters:[347]

> (1) Discharges from the agricultural surface water management system shall not cause or contribute to a violation of water quality standards in waters of the state, as set forth in Chapters 17-3, 17-302 and 17-4, F.A.C.
>
> (2) The surface water management system shall be designed and operated to provide a level of treatment so that discharges will not contain more than 20mg/l BOD or 20 mg/l of total suspended solids.
>
> (3) Discharges from the agricultural surface water management system shall comply with approved waste load allocations developed pursuant to a Surface Water Improvement and Management Plan or other state or District programs, or a pollutant load reduction goal established and adopted by the District, pursuant to Chapter 17-40, F.A.C., such that the operation is consistent with the objectives of the District.[348]

Water Quality Practices

Chapter 40C-44 contains water quality practices which, if followed, are presumed to provide reasonable assurance that the system will comply with the performance standards described above. Applicants may

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346. SJRWMD Draft § 10.2.1.

347. SJRWMD Draft § 10.1.1.

348. FLA. ADMIN. CODE Rule 40C-44.065.

have to implement additional water quality practices if the District determines these practices may not result in compliance with the performance standards for issuance of an individual permit.

(1) Reduce the volume of stormwater and associated wastewater discharged to waters of the state by:

(a) Implementing management practices designed to reduce the volume of water discharged off-site, including Water Table Control in Open Channels, Irrigation Land Leveling and Irrigation Water Management, and

(b) Maximizing on-site recycling to satisfy irrigation, freeze protection and pest control needs. The applicant may demonstrate maximum reuse by using all the practically available water from reservoir storage prior to using groundwater.

(2) Implement and maintain a Conservation Plan, which includes a Nutrient Management Plan and Pesticide Management Plan.

(3) Provide treatment of the pollutants generated by the agricultural operation. The treatment method required depends on the intensity of land use and associated pollutants, and includes use of wet detention ponds, overland flow, vegetative filters, detention in isolated wetlands, and other innovative methodologies that the District approves.

Duration of Permit

Permits are generally granted for an indefinite period, although they may be revoked or modified under certain conditions.[349]

Exemptions

The following types of agricultural surface water management systems are expressly exempt from Chapter 40C-44 permitting requirements:

(1) Concentrated Animal Feeding Operations with a valid permit issued by the Department of Environmental Regulation (DER) pursuant to Chapter 17-670, F.A.C., provided that:

(a) For dairy farms, the permitted design incorporates a high intensity use area, from which the stormwater runoff is centrally collected for storage and disposal by land application, or is treated prior to discharge.

(b) For egg production facilities, the permitted design prevents the discharge of process wastewater and stormwater runoff to surface waters, except in the event of a storm greater than a 25 year, 24 hour event.

(c) For any concentrated animal feeding operation which does not incorporate a high intensity use area, the permitted design includes provisions to treat stormwater and associated wastewater from adjacent animal loafing and feeding areas; manure pits; animal watering systems; washing, cleaning or flushing pens; or other pollutant sources, so that discharges through the surface water management system from the operation will not cause or contribute to a violation of water quality standards in waters of the state.

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349. *Id.* Rule 40C-44.321.

The exemptions for certain animal feeding operations, whose activities have been reviewed by DER, and which provide treatment of their pollutant sources, are placed in the rule to minimize overlap between the SJRWMD and the DER.[350]

(2) Concentrated Animal Feeding Operations, exempt from the permit requirements of Chapter 17-670, F.A.C., which do not discharge except in the event of a storm greater than a 25 year, 24 hour event.

(3) Privately owned or operated agricultural surface water management systems lying within the boundaries of an active water control district which has been formed and operated in accordance with Chapter 298, F.S., or a special district or improvement district created under Florida law which has the power to construct, operate and maintain agricultural surface water management systems, and which district has obtained or elected to obtain a permit pursuant to the requirements of Chapter 40C-44, F.A.C. No exemption is implied or expressed here for any permits required by any other rule within Chapter 40C, F.A.C., or the water control district or special district.

(4) New or altered agricultural surface water management systems which are required to obtain a permit because they drain an agricultural area greater than two acres and are not required to obtain a permit pursuant to Chapters 40C-4 and 40C-40, F.A.C., to implement one or more of the following practices under the District's Best Management Practices Cost-Sharing Program: SJ1 (Backflow Prevention), SJ5 (Pump Platform Fuel and Oil Containment) or SJ6 (Pesticide Mixing and Storage Area Containment).

(5) Minor alterations of new or existing agricultural surface water management systems permitted under this chapter, Chapter 40C-4, or Chapter 40C-40, F.A.C.[351]

In addition to the above specific exemptions from permitting, Chapter 373 of the Florida Statutes states that "[N]othing herein, or in any rule, regulation or order adopted pursuant hereto, shall be construed to affect the right of any person engaged in the occupation of agriculture, silviculture, floriculture, or horticulture to alter the topography of any tract of land for purposes consistent with the practice of such occupation. However, such alteration may not be for the sole or predominant purpose of impounding or obstructing surface waters."[352]

In determining whether an exemption is available to a person engaged in the occupation of agriculture, silviculture, floriculture or horticulture, the following questions must be addressed:

1. Is the proposed topographic alteration consistent with the practice of agriculture, silviculture, floriculture or horticulture?

2. Is the proposed topographic alteration for the sole or predominant purpose of impounding or obstructing surface waters?

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350. SJRWMD Draft § 3.4.2.

351. FLA. ADMIN. CODE Rule 40C-44.051.

352. FLA. STAT. § 373.406(2) (1991).

If the first question is answered affirmatively and the second is answered negatively, an exemption under Section 373.406(2), F.S., is available.[353]

In determining consistency with the practice of agricultural occupations, the District will refer to the following publication: "A Manual of Reference Management Practices for Agricultural Activities (November, 1978)". The following practices described in the manual are considered as having impoundment or obstruction of surface waters as a primary purpose, and, therefore, are not exempt:

1. Diversion, when such practice would cause diverted water to flow directly onto the property of another landowner.
2. Floodwater Retarding Structure
3. Irrigation Pit or Regulating Reservoir
4. Pond
5. Structure for Water Control
6. Regulating Water in Drainage Systems
7. Pumping Plant for Water Control, when used for controlling water levels on land.

Other practices which are described in the manual and which are constructed and operated in compliance with Soil Conservation Service standards and approved by the local Soil and Water Conservation District are presumed to be consistent with agricultural activities. Practices which are not described in the manual are presumed to be inconsistent with the practice of agriculture and a permit is required for the construction, alteration, operation, maintenance, removal or abandonment of a system, subject to the thresholds.[354]

Analysis

Prior to the adoption of Chapter 40C-44, agricultural systems were permitted either as industrial wastes by DER pursuant to Chapter 17-6, F.A.C. (renumbered as Chapters 17-660 and 17-670), or as urban stormwater runoff by the SJRWMD pursuant to Chapter 40C-42. Those discharges brought under Chapter 40C-44 by section 40C-44.041(1)(a) and (b) (pumped agricultural discharges of greater than 10,000 GPM, and those discharges that violate state water quality standards) were considered to be industrial wastes, and were therefore regulated by Chapter 17-6. New or altered systems, brought under Chapter 40C-44 by section 40C-44.041(2), were permitted using the same criteria as urban stormwater runoff by the SJRWMD pursuant to Chapter 40C-42. Of course, surface water management systems that triggered the threshold for Chapter 40C-4 MSSW permits were permitted in accordance with that chapter. Under the previous system, applicants were required to satisfy the water quality requirements of Chapter 40C-42 and the permitting requirements of Chapter 40C-4.

This system was done away with by the adoption of Chapter 40C-44, which consolidated the permitting of all agricultural systems that do not meet the thresholds for Chapter 40C-4 (MSSW) permitting under one rule. The adoption of Chapter 40C-44 was motivated by a DER directive stating that the WMDs were to develop their own rules for review of agricultural stormwater discharge. The definition of stormwater was changed by the legislature to include every discharge from an agricultural operation - for example, irrigation return flow - whether or not that discharge directly resulted from a storm event. As a result, an industrial stormwater permit under Chapter 17-6 was no longer required, and this led to the creation of Chapter 40C-44.

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353. SJRWMD Draft § 3.4.1.

354. *Id.* § 3.4.1(a).

As with Chapter 40C-42, Chapter 40C-44 is mainly applied in regulating new or altered systems. Existing systems which were permitted by the DER pursuant to Chapter 17-6 have not been modified or altered must obtain a Chapter 40C-44 or 40C-4 permit, as appropriate, when the Chapter 17-6 permit expires. Agricultural systems already existing prior to the adoption of Chapter 40C-4 are grandfathered - no permit required - unless they involve pumped discharges of greater than 10,000 GPM or contribute to a violation of state water quality standards, in which case the grandfathering is voided and a permit is required.

One problem that has been encountered under the new system is due to the fact that regulation of agricultural discharges went from stormwater regulation under Chapter 40C-42 to surface water management system regulation under Chapter 40C-44. Chapter 40C-42 permitting thresholds were triggered by increases in the pollutant load, while those of Chapter 40C-44 are triggered by the existence and size of a surface water management system. As a result, operations such as nurseries and greenhouses, which do not have surface water management systems but which do discharge polluted water, are not required to obtain a discharge permit under the new system. Therefore, such operations are still being permitted as urban stormwater under Chapter 40C-42, which seems to defeat the purpose and intent of creating a separate agriculture stormwater rule in the first place.

Silviculture

The Southwest Florida Water Management District regulates silvicultural surface water management systems through its MSSW permitting program. However, the St. Johns River Water Management District has a rule which applies specifically to silviculture, Chapter 40C-43, F.A.C.

St. Johns River Water Management District Silviculture Rule

Chapter 40C-43 of the St. Johns River Water Management District (SJRWMD) serves to exempt upland silvicultural roads from any permitting requirements and to provide for a general permit after notice for certain silvicultural surface water management systems. Surface water management systems which are not exempt, by statute or rule, and which do not qualify for a general permit after notice under Chapter 40C-43, are required to obtain either a general permit pursuant to Chapter 40C-40, F.A.C., an individual permit pursuant to Chapter 40C-4, F.A.C., or a Work of the District permit pursuant to Chapter 40C-6, F.A.C., where relevant permit thresholds for these three permitting programs are met.[355] Chapter 40C-43 took effect on October 11, 1987.[356]

Silvicultural Surface Water Management System General Permitting

Any person conducting, operating, maintaining, altering, abandoning, or removing surface water management systems:

(a) for the purpose of placing the property into silvicultural use or to perpetuate the maintenance of the property in silvicultural use, and
(b) who satisfies the Conditions for Issuance, discussed below,

355. FLA. ADMIN. CODE Rule 40C-43.011 (April, 1990).

356. *Id.* Rule 40C-43.031(1).

is authorized to undertake such activity subject to the requirements of Chapter 40C-43.[357] This general permit applies only to those surface water management systems which are not exempt and which meet permit thresholds under the District's MSSW and Works of the District rules.[358]

Notice of Intent

An applicant must provide the District with a notice of intent prior to commencing an activity which qualifies for a general permit. Silvicultural activities undertaken without providing notice are considered unauthorized by the District. If the District discovers that a Notice of Intent has been received for an activity which does not qualify for a general permit or the activity is not being conducted in conformance with the conditions for issuance of a general permit, the District may require application for an individual permit pursuant to Chapter 40C-4, F.A.C., or application for a general permit pursuant to Chapter 40C-40, F.A.C., or application for a Work of the District permit pursuant to Chapter 40C-6, F.A.C., or take administrative or judicial enforcement action.[359]

Conditions for Issuance

General silvicultural permits may be granted for proposed systems which satisfy certain threshold criteria,[360] which are not located in wetlands used by aquatic or wetland dependent endangered or threatened species, and which consist of the following:

> (a) A culverted fill road placed in or crossing a stream or other watercourse with a drainage area upstream of the work of five (5) or more square miles but less than ten (10) square miles provided that the design allows for conveyance of normal flows and for overtopping during large storm events and that less than one half (½) acre of fill is placed in wetlands associated with the stream or other watercourse. Under this paragraph, there is no limit on the height of road fill placed in the stream or other watercourse for that part of the road between culverts and that part fifty (50) feet landward of the first and last culverts. The height limitation for fill on the remaining sections of the road (the approaches) shall be a maximum of twenty-four (24) inches. The road must be designed and culverts positioned to provide an overflow area or areas which will prevent erosion and adverse effects to water levels upstream and downstream of the road. Under this paragraph,

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357. *Id.* Rule 40C-43.042.

358. Exemption and permit thresholds for MSSW permits are contained in Rules 40C-4.051 and 40C-4.041, F.A.C., respectively. Exemptions and permit thresholds for works of the district are contained in Rules 40C-6.051 and 40C-6.041, F.A.C., respectively.

359. *Id.* Rule 40C-43.112.

360. Applicants for general silvicultural permits must meet or exceed thresholds stated in the District's MSSW (40C-6.041, F.A.C.) or Works of the District Rules (40C-6.041, F.A.C.), but the system must not exceed the following MSSW threshold criteria (40C-4.041(2)(b)1,4,8, F.A.C.): [Be] capable of impounding a volume of water of forty or more acre feet; or provide[s] for the placement of twelve or more acres of impervious surface which constitutes 40 or more percent of the total land area; or contain[s] a surface water management system which serves an area of five or more contiguous acres of wetlands with a direct hydrologic connection to: a) a stream or other watercourse with a drainage area of five or more square miles, or b) an impoundment with no outfall, which is not wholly owned by the applicant and which is ten acres or greater in size, or c) a wetland not wholly owned by the applicant.

there must be no landowners other than the permittee within one half (½) mile either upstream or downstream of the work.

(b) A culverted fill road or a bridge placed in or crossing a stream or other watercourse with a drainage area upstream of the work of five (5) or more square miles but less than ten (10) square miles provided that the design allows for conveyance of normal flows and for overtopping during large storm events, and that less than one half (½) acre of this fill is placed in wetlands associated with the stream or other watercourse. The fill material shall be no more than twenty-four (24) inches above culvert structures. The fill material on the road approaches shall return to the twenty-four (24) inch above grade limit within a maximum of fifty (50) feet of either side of a culvert. The road must be designed and culverts positioned to provide an overflow area or areas which will prevent erosion and adverse effects to water levels upstream and downstream of the road. Under this paragraph, there must be no landowners other than the permittee within one quarter (¼) mile either upstream or downstream of the work.

(c) A culverted fill road or bridge placed in or crossing a wholly owned impoundment where less than one half (½) acre of fill is placed in the impoundment.

(d) Clearing and snagging, without redirecting the channel, in a stream or other watercourse within fifty (50) feet of the center line of a culverted fill road or a bridge described in paragraphs (1)(a), (b) or (c) above, necessary to construct said work.

(e) A low water, hard surfaced crossing in a stream, other watercourse or impoundment consisting of the placement of rock or logs no more than six (6) inches higher than the bed of the stream, other watercourse, or impoundment. Such crossings must be designed only to facilitate the movement of equipment by creating a stable foundation in shall streams, other watercourses, or impoundments.

(f) Upland field ditches of a temporary nature to facilitate only harvesting, site preparation, and planting, with a maximum cross-sectional area of eighteen (18) square feet spaced no closer than six hundred and sixty (660) feet from any other parallel ditch. After seedling establishment, the ditches shall be allowed to revegetate naturally. The permittee will not be required to fill field ditches after seedling establishment.[361]

Applicants which comply with the following performance standards are presumed to have provided reasonable assurance that the systems described above will satisfy the public interest test and standards contained in the District's MSSW Rule (40C-4.301, F.A.C.):

(a) A road or bridge must be designed to convey normal water flow while being adequately stabilized to allow for overtopping during storm events without washing out.

(b) A low water crossing, road, or bridge placed in or crossing a stream, other watercourse or impoundment may be placed no closer than one half (½) mile from any traversing work which traverses the same stream, other watercourse or impoundment. The one half (½) mile measurement shall apply to land owned by the permittee, and shall be measured along the stream, other watercourse or impoundment.

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361. *Id.* Rule 40C-43.302(1).

(c) A low water crossing, road, or bridge placed in or crossing a stream, other watercourse or impoundment must not cause increased velocities downstream of the work that would cause scour outside of the area of clearing and snagging described in Rule 40C-43.302(1)(d).

(d) A low water crossing, road, or bridge placed in or crossing a stream, other watercourse or impoundment must not cause increased flooding on property not owned by the permittee.

(e) Erosion control measures must be undertaken to limit the transfer of suspended solids into the receiving waterbody during and after construction of the proposed work.

(f) Field ditches may connect only to works which are permitted by the District or are exempt from permitting by the District and only if the connection will not cause the work to exceed its conveyance capacity or to increase flooding on property not owned by the permittee; however, this section does not authorize connection to works without the consent of the owner of the work. Field ditches which are separated from streams, other watercourses, or impoundments by at least a thirty-five (35) foot buffer zone of undisturbed vegetation, provided the integrity of this buffer is maintained, will be presumed to meet the erosion control requirements of Rule 40C-43.302(2)(e) above.

(g) In addition to the performance standards set forth in (a)-(f) above, all systems described in Rule 40C-43.302(1)(a)-(f), F.A.C., must meet the best management practices set forth in "Silviculture Best Management Practices Manual" (1979) published by the Florida Division of Forestry, Department of Agriculture and Consumer Services.[362]

Duration of Permit

The duration of a general permit authorized by Chapter 40C-43 is one year for construction, alteration, abandonment, or removal of silvicultural surface water management systems. Permits for operation or maintenance of silvicultural surface water management systems are permanent.[363]

Exemptions

Specifically exempt from permitting under Chapter 40C-43 and under Chapters 40C-4, 40C-6, and 40C-40, F.A.C., are the construction, operation, maintenance, alteration, abandonment and removal of above grade, unpaved, upland silvicultural roads with up to twenty-eight (28) feet of road surface within a construction corridor up to fifty (50) feet in width. These roads must also incorporate sufficient culverts at grade and may have associated borrow ditches. Road ditches exempted under this provision are those constructed only to obtain road material for the exempt road and to provide only enough storage to maintain a dry road surface. Exempt road ditches must not be designed nor may they serve to provide drainage to the tract adjoining the road. These road ditches must not connect directly or indirectly to any works not owned by the person who owns the exempt road and must be separated from streams, other watercourses or impoundments by at least a thirty-five (35) foot buffer zone of indigenous vegetation and a water turnout prior to said buffer zone. The road must be constructed in a manner consistent with the "Silvicultural Best Management Practices Manual" (1979) published by the Florida Division of Forestry, Department of Agriculture and Consumer Services.[364]

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362. *Id.* Rule 40C-43.302(2).

363. *Id.* Rule 40C-43.321.

364. *Id.* Rule 40C-43.051.

In addition to the above specific exemptions from permitting, Chapter 373 of the Florida Statutes states that "[N]othing herein, or in any rule, regulation or order adopted pursuant hereto, shall be construed to affect the right of any person engaged in the occupation of agriculture, silviculture, floriculture, or horticulture to alter the topography of any tract of land for purposes consistent with the practice of such occupation. However, such alteration may not be for the sole or predominant purpose of impounding or obstructing surface waters."[365]

In determining whether an exemption is available to a person engaged in the occupation of agriculture, silviculture, floriculture or horticulture, the following questions must be addressed:

1. Is the proposed topographic alteration consistent with the practice of agriculture, silviculture, floriculture or horticulture?

2. Is the proposed topographic alteration for the sole or predominant purpose of impounding or obstructing surface waters?

If the first question is answered affirmatively and the second is answered negatively, an exemption under Section 373.406(2), F.S., is available.[366]

The SJRWMD presumes that the following activities are consistent with the practice of silviculture when they are undertaken to place property into silvicultural use or to perpetuate the maintenance of property in silvicultural use. The following activities are also presumed not to be for the sole or predominant purpose of impounding or obstructing surface waters:

1. normal site preparation for planting of the tree crop;
2. planting; and
3. harvesting.[367]

If any activity is undertaken to place the property into a use other than silviculture (for example: harvesting which is designed to clear property in preparation for commercial, industrial or residential development rather than regeneration) the activity is not considered to be consistent with the practice of silviculture and will be subject to the permitting jurisdiction of the District. Examples of activities which are considered to be for the sole or predominant purpose of impounding or obstructing surface waters because they have the effect of more than incidentally trapping, obstructing or diverting surface water are activities which create canals, ditches, culverts, impoundments or fill roads.[368]

In determining consistency with the practice of agriculture occupations, the District refers to the following publication: "A Manual of Reference Management Practices for Agricultural Activities (November, 1978)". The following practices described in the manual are considered as having impoundment or obstruction of surface waters as a primary purpose:

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365. FLA. STAT. § 373.406(2) (1991).

366. St. Johns River Water Management District Applicant's Handbook, Management and Storage of Surface Waters § 3.4.1(b) (January 3, 1992).

367. *Id.*

368. *Id.*

1. Diversion, when such practice would cause diverted water to flow directly onto the property of another landowner.
2. Floodwater Retarding Structure
3. Irrigation Pit or Regulating Reservoir
4. Pond
5. Structure for Water Control
6. Regulating Water in Drainage Systems
7. Pumping Plant for Water Control, when used for controlling water levels on land.[369]

Other practices which are described in the manual and which are constructed and operated in compliance with Soil Conservation Service standards and approved by the local Soil and Water Conservation District are presumed to be consistent with agricultural activities. Practices which are not described in the manual are presumed to be inconsistent with the practice of agriculture and a permit is required for the construction, alteration, operation, maintenance, removal, or abandonment of a system, subject to the thresholds.[370]

Analysis

Chapter 40C-43 has very liberal permitting requirements. Since the rule provides for a general permit after notice for most silvicultural operations, the District has very little interface with or control over silvicultural operations within its jurisdiction.[371] For example, there is current controversy involving this rule and a landowner's plan to remove native plants from a 50 acre wetland tract and replace them with commercial species.[372] This plan is exempt from Chapter 40C-43 permitting requirements, since it is considered to be normal harvesting and planting under Chapter 373.[373] It does not fall within 40C-4 and 40C-44 regulations, either, and as a result may escape permitting entirely.[374]

Mining

St. Johns River Water Management District regulates mining activities through its MSSW permitting program. However, the Southwest Florida Water Management District has a separate rule which regulates mining of materials other than phosphate, Chapter 40D-45, F.A.C.

Southwest Florida Water Management District Mining Rule

Chapter 40D-45 of the Southwest Florida Water Management District (SWFWMD) governs surface water management for mining of materials other than phosphate.[375] The intent of the rules in the chapter is

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369. *Id.*

370. *Id.*

371. Telephone interview between Victor McDaniel of the SJRWMD and Center for Governmental Responsibility research assistant Andrew Norris (January 31, 1992).

372. *Id.*

373. *Id.*

374. *Id.*

375. FLA. ADMIN. CODE Rule 40D-45.011.

to protect the water resources of the SWFWMD both during and following completion of mining and mine related activities.[376] The district derives its authority and responsibility for the protection of surface waters within its boundaries from Part IV of Chapter 373, Florida Statutes.[377] Phosphate mining activities are not governed by these rules; rather, they are reviewed in accordance with a memorandum of understanding between SWFWMD and the Florida Department of Natural Resources (DNR).[378] The district only examines water quantity impacts for phosphate mines.[379]

Permit System

Chapter 40D-45 came into effect on April 1, 1990, and establishes a permitting program to protect waters from potential adverse effects of mining operations.[380] There are two types of permits: a construction permit and an operation permit.[381] Each type of permit may be issued in two forms, individual permits and general permits.[382] Individual permits are issued for project areas greater than or equal to 100 acres, and general permits are issued for project areas less than 100 acres.[383]

A construction permit authorizes the permittee to conduct mining and mining related activities which construct, alter, or abandon a surface water management system.[384] Permits for construction during mining are not limited in duration.[385] However, mining or mining related activities must commence within three years of permit issuance.[386] If such activities do not begin within three years, the permit becomes invalid, although extensions up to three years may be granted.[387] Within 30 days after completion of construction of the surface water management system, the permittee is required to notify the district and to submit certification that all facilities were constructed in accordance with the design permitted by the

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376. *Id.*

377. Basis of Review for Permitting Surface Water Management for Mining of Materials Other Than Phosphate, § 2.1 [hereinafter cited as Basis for Permitting].

378. *Id.*

379. Telephone Interview between Dawn Turner at the Tampa Office of the SWFWMD and Center for Governmental Responsibility research assistant Andy Norris (Jan. 17, 1992) [hereinafter cited as SWFWMD Mining Interview].

380. FLA. ADMIN. CODE Rules 40D-45.011, 40D-45.041 (April, 1990).

381. *Id.* Rule 40D-45.041(2).

382. *Id.*

383. *Id.*

384. *Id.* Rule 40D-45.041(3).

385. *Id.* Rule 40D-45.321(1) (Feb., 1991).

386. *Id.*

387. *Id.* Rule 40D-45.321(2).

district.[388] The district may inspect the system and require remedial measures before the operation permit takes effect.[389]

An operation permit authorizes the permittee to operate a surface water management system upon completion of all requirements of the construction permit.[390] Operation permits are of indefinite duration.[391] The operation permit does not become effective until the permittee certifies that all facilities have been constructed in accordance with the design permitted by the district.[392]

Conditions for Permit Issuance

In order to obtain a permit under this Chapter, an applicant must give reasonable assurance that the surface water management system:

(1) Provides adequate flood protection and drainage. Off-site discharge is limited to the rate and/or amount which will not cause adverse off-site impacts.[393] No net encroachment by any mine related activities into the flood plain, up to that encompassed by the 100-year event, which may result in increased flood levels on adjacent lands is allowed.[394]

(2) Will not cause adverse water quality. The district relies on the Department of Environmental Regulation (DER) to set water quality standards.[395] District policy requires waters leaving the site or discharging into aquifers to meet state water quality standards of Chapter 17-3, F.A.C., and Rule 17-4.242, F.A.C.[396] The applicant is required to install erosion and sediment control systems, and is encouraged to use natural areas and existing bodies of water as retention areas, provided that state water quality is maintained.[397]

(3) Will not cause adverse impacts on surface or groundwater levels and flows. Impacts are considered to be adverse in the following situations:

(a) Lakes - Water levels shall not deviate from their normal range and rate of fluctuation to the extent that water quality, vegetation, or animal populations are adversely impacted,

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388. *Id.* Rule 40D-45.381(2)(l).

389. *Id.*

390. *Id.* 40D-45.041(3) (April, 1990).

391. *Id.* 40D-45.321(3) (Feb., 1991).

392. *Id.* Rule 40D-45.381(2)(l).

393. Basis for Permitting, § 3.1.1.

394. *Id.* § 3.1.2.

395. SWFWMD Mining Interview.

396. FLA. ADMIN. CODE Rule 40D-45.301(1)(c) (Feb., 1991).

397. Basis for Permitting, § 3.2.2, § 3.2.3.

or that off-site recreational use or aesthetic quality is reduced.[398] In no instance shall lake water levels be reduced below the applicable minimum levels established in Chapter 40D-8, F.A.C.[399]

(b) Streams - Flow rates and water levels shall not deviate from normal conditions to the extent that:

1. water quality is degraded;
2. vegetation composition or zonation is altered;
3. habitat value to fauna currently using the area is reduced;
4. salinity distribution in tidal streams and estuaries is significantly altered; or
5. off-site recreational use or aesthetic quality is reduced.[400]

In no instance shall stream flow be reduced below the minimum regulatory flow level established in Chapter 40D-8, F.A.C.[401]

(4) Will not cause adverse environmental impacts, or adverse impacts to wetlands, fish and wildlife, or other natural resources. The following factors will be considered in determining the environmental impact of the proposed activity:

(a) the present condition and functional value of the subject area;

(b) environmental impacts, both on-site and off-site, anticipated as a result of the proposed activities;

(c) the predicted habitat value of existing wetlands if incorporated into the proposed surface water management system; and

(d) the value of compensation measures provided.[402]

Wetlands impacts are considered to be adverse if:

(a) wet season water levels deviate from their normal range of fluctuation;

(b) wetland hydroperiods are altered to the extent that plant species composition or zonation is affected;

(c) wetland habitat functions are not temporally and spatially maintained; or

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398. *Id.* § 3.4.2(b).

399. *Id.*

400. *Id.* § 3.4.2(c).

401. *Id.*

402. *Id.* § § 3.4.1-3.4.4.

(d) wetland habitat use by endangered or threatened species is impaired.[403]

Activities must be conducted in a manner that avoids or minimizes the extent and duration of wetland impacts.[404] Permit applications proposing wetland impacts will be evaluated by the following criteria:

(a) no reasonable alternatives shall exist which would allow the proposed activities to be conducted with lesser wetlands impacts;

(b) impacts to on-site or off-site wetlands shall be offset by appropriate compensation measures. Section 3.7 of the Basis for Review provides detailed procedures for the establishment and enforcement of compensation plans for mitigation of wetland impacts. Impacts to the wetlands determined to be sensitive environmental areas will not be permitted unless the permit applicant provides reasonable assurance that the loss of type, nature, and function of the wetlands sought to be impacted can be successfully mitigated within a reasonable period of time;

(c) buffer zones shall be created in adjacent uplands;

(d) reasonable assurance must be provided that wetland activities will not affect endangered or threatened species.[405]

Isolated wetlands less than 0.5 acres in size are exempt from review for impacts to fish and wildlife and their habitats unless:

(a) the wetland is used by endangered or threatened species;

(b) the total acreage of isolated wetlands exceeds 30% of the acreage of a project greater than 40 acres;

(c) a wetland is located in an area of critical state concern; or

(d) two or more wetlands regardless of property boundaries have a combined area greater than 0.5 acres and are connected by standing or flowing surface water during wet season average high water levels.[406]

(5) Can be effectively operated and maintained.

(6) Will not adversely affect public health and safety.

(7) Will not otherwise be harmful to the water resources of the district.

(8) Is consistent with the state water policy set forth in Chapter 17-40, F.A.C.

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403. *Id.* § 3.4.2(a).

404. *Id.* § 3.5.

405. *Id.* § § 3.5.1-3.5.4.

406. *Id.* § 3.6.

(9) Is not against public policy.[407]

Modification of Permits

A permittee may seek modification of any of the terms and conditions of an unexpired permit.[408] A request for modification shall be reviewed in accordance with the rules in effect at the time the modification is filed.[409] The Governing Board may order the modification of any permit if it determines that the operation is detrimental to the water resources or that it no longer meets the conditions of issuance.[410]

Revocation of Permits

Permits can be revoked either in whole or in part, temporarily or permanently, if the Governing Board determines that the permitted operation:

(1) has become a danger to the public health and safety;

(2) is inconsistent with the objectives of the district; or

(3) is in violation of any rule or order of the district, or the conditions of the permit.[411]

Transfer of Permits

Provided the land use remains the same, the district will transfer the surface water management permit following sale or transfer of the surface water management system or the land on which the system is located.[412]

Limiting Conditions

The district may impose special conditions as are necessary to ensure that the permitted operation will be consistent with the overall objectives of the district and will not be harmful to the water resources of the district or existing legal uses.[413] In addition, the rule establishes general conditions, which apply to all permits. The following general conditions are of particular interest.

• Mining and mining related activities shall be performed in a manner which minimizes adverse impacts to fish, wildlife, natural environmental features, and water quality. The permittee shall

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407. FLA. ADMIN. CODE Rule 40D-45.301 (Feb., 1991).

408. *Id.* Rule 40D-45.331(1).

409. *Id.*

410. *Id.* Rule 40D-45.331(3).

411. *Id.* Rule 40D-45.341.

412. *Id.* Rule 40D-45.351.

413. *Id.* Rule 40D-45.381(1).

institute necessary measures during mining and rehabilitation to reduce erosion, turbidity, nutrient loading, and sedimentation in receiving waters, including wetlands.

• The operation of the permitted system must not be detrimental to the water resources and must continue to meet the conditions for issuance.

• Water quality data for the water discharged from the permittee's property or into surface waters of the state shall be submitted to the district as required. If water quality data are required, the permittee shall provide data as required on volumes of water discharged, including total volume discharged during the days of sampling and total monthly discharges from the property or into surface waters of the state.

• Off-site discharges shall occur only through the facilities authorized by the permit. Discharge structures shall be fixed so that discharge will not occur below the control elevation except that emergency devices may be installed with secure locking devices.

• Each year, within 30 days following the anniversary date of permit issuance, the permittee shall submit to the district an annual report describing all activities conducted during the previous year which affect the surface water management system. The report must include sufficient detail to demonstrate whether the activities have been conducted in compliance with district rules and permit conditions and specifications.[414]

Exemptions

The following are exempt from permitting under Chapter 40D-45.

(1) Any surface area associated with mining and mining related activities that has received all government approvals to begin mining prior to April 1, 1990, with the following exceptions:

(a) Those isolated wetland areas regulated under Chapter 40D-45 and Section 373, Florida Statutes, impacted by mining and mining related activities after April 1, 1990; or

(b) Those areas where construction or lateral expansion of above-grade impoundments, settling ponds, holding ponds which exceed 5 feet in height as measured from the top of berm to natural grade, and other associated appurtenant works, occurs after April 1, 1990.

(2) Reclamation of existing mined areas consistent with the standards provided in Chapter 378 (Land Reclamation) and the rules adopted by the State of Florida Department of Natural Resources pursuant to that Chapter.

(3) Vertical excavation in an existing mined area.

(4) Vertical additions to existing above-grade impoundments that will not increase storage beyond the design volume.

(5) Any mining or mining related activity for which a permit has been obtained pursuant to Chapter 40D-4 or 40D-40.

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414. *Id.* Rule 40D-45.381(2).

(6) Any new mining or new mining related activity which meets all of the following conditions:

(a) The size of the mine pit will not exceed 10 acres within contiguously owned lands;

(b) The new mining and new mining related activities do not require dewatering by gravity or mechanical means;

(c) All mining and mining related activities must be conducted outside of wetlands. Minimum setback from wetlands for all mining and mining related activities shall be 50 feet;

(d) No paved roads, water control structures or ditches will be constructed;

(e) Depth of pit will not penetrate rock;

(f) Any elevated roads or stockpile areas must be graded to existing land surface upon abandonment of the site;

(g) Best Management Practices (BMPs) will be used to control erosion and sediment transport during and after the mining activities; and

(h) The district reserves the right to rescind an exemption if the new mining and new mining related activities are shown to impact the water resource.[415]

Prospecting

Prospecting is defined as "activities considered normal and reasonably necessary to retrieve core samples of subsurface geologic sediments for the specific purpose of locating, mapping, and determining the quality and quantity of sedimentary strata or deposits."[416] Prospecting is also exempt from permitting requirements as long as the following conditions are met:

(1) prospecting in uplands must not alter an existing surface water management system;

(2) no prospecting shall be conducted in open water bodies such as natural lakes, ponds, streams or rivers;

(3) prospecting in wetlands must meet the following conditions:

(a) No activities shall be conducted in Outstanding Florida Waters, Aquatic Preserves, Class I waters, Class II waters, waters approved for shellfish harvesting, or wetlands used by endangered or threatened species designated in Rules 39-27.003 and 39-27.004, F.A.C., or 50 Code of Federal Regulations, Section 17.12. For purposes of Chapter 40D-45, a wetland is used by endangered or threatened species if reasonable scientific judgment indicates that the wetland provides a habitat function including, but not limited to, nesting, reproduction, food source or cover for such species.

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415. *Id.* Rule 40D-45.051 (April, 1990).

416. *Id.* Rule 40D-45.021(11).

(b) Vehicles used for prospecting in wetlands shall be of a type generating minimum ground pressure to minimize rutting and other environmental impacts. Disturbed areas along each prospecting line shall be restored to original contours upon completion of prospecting activities along that specific alignment.

(c) Disturbances within wetlands shall be no wider than 15 feet along any portion of the prospect line, except at the immediate site of the drill hole where disturbance shall not exceed 25 feet.

(d) Prospecting lines shall be aligned to minimize wetland impacts and avoid the destruction of mature wetland trees to the greatest extent practicable.

(e) All drill tailings shall be returned to the drill hole and the excess removed so that no spoil material will be left above grade in a wetland.

(f) If clearing is required, a minimum interval of 300 feet shall exist between individual parallel prospecting lines.

(g) No debris or spoil shall be placed outside the width of the prospect line.

(h) Any wetland disturbed by prospecting activities shall be restored by replanting native indigenous vegetation of the same species as were displaced. Exotic species and nuisance species shall be controlled at densities not exceeding the densities of these species in undisturbed portions of the wetland.

(i) Appropriate turbidity and erosion control measures shall be utilized, as necessary, to prevent violation of state water quality standards.

If the activity does not meet all of the above requirements, it is not an exempt activity and is subject to the permitting requirements of Chapter 40D-45.[417]

Alterations of Exempt Projects

(1) A permit is required for activities other than mining or mining related activities that constitute an alteration of exempt mined areas.

(2) A permit is required for any alteration of an exempt mined area which causes off-site adverse water quantity impacts or which causes water quality impacts, on-site or off-site, by discharging water not meeting applicable state water quality requirements.[418]

Analysis of SWFWMD Mining Rule

Chapter 40D-4 controls the regulation of surface water management systems in the SWFWMD in general.[419] Prior to the adoption of Chapter 40D-45, agricultural and mining operations were exempt

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417. *Id.* Rule 40D-45.053.

418. *Id.* Rule 40D-45.054.

419. FLA. ADMIN. CODE ch. 40D-4 (Sept., 1990).

from 40D-4 permit requirements.[420] These exemptions were deemed to be contrary to Florida law, however, and as a result Chapter 40D-45 was enacted in April 1990 to govern the regulation of mining operations other than phosphate.[421] Until early 1991, the Tampa office of the SWFWMD handled all 40D-45 permitting; however, local services offices now are responsible for their own areas.[422]

Since the provisions of Chapter 40D-45 were extensively copied from those of Chapter 40D-4, many of the loopholes that may exist with a new rule have not been seen with Chapter 40D-45. One potential problem area in the definition of mining, which encompasses the extraction of earth products for sale or transport off-site.[423] This definition may allow an individual mining for his or her own use on the same site as a commercial operation to avoid Chapter 40D-45 regulation.[424]

Another possible loophole arises from the fact that the lowest layer of material impacted by the mining operation is considered by rule to be the object of the mining activity.[425] In one instance, a permit applicant proposed to use sand from a mine on-site, and to transport the layer of peat extracted from above the sand layer off-site to a sister company for sale.[426] The applicant hoped to escape Chapter 40D-45 entirely, since sand, which was not going to be transported off-site, was the lowest stratum of material being mined and as such was defined by rule as the object of the mining.[427] However, this situation was resolved when it was found that the sand was to be used on-site for development purposes.[428] Mining that occurs incidental to development is subject to the permitting requirements of Chapter 40D-4, F.A.C., and as a result the project applicant was required to obtain this more stringent permit.[429]

There is speculation that Chapter 40D-45 may be eliminated in the next few years.[430] Chapter 40D-4 would serve in its stead, with different bases of review depending on the type of activity being regulated.[431] This is exactly the situation now existing with regard to the regulation of agricultural

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420. SWFWMD Mining Interview.

421. *Id.*

422. *Id.*

423. FLA. ADMIN. CODE Rule 40D-45.021(5) (April, 1990).

424. SWFWMD Mining Interview.

425. *Id.*

426. *Id.*

427. *Id.*

428. *Id.*

429. *Id.*

430. *Id.*

431. *Id.*

surface water management systems in the district.[432] The decision about whether or not to eliminate Chapter 40D-45 will depend upon the degree of success the district experiences in applying Chapter 40D-4 to the regulation of agricultural activities.[433]

Endangered Species

Endangered and threatened species in Florida receive legal protection under both federal and state law. Although the biological criteria for determining whether a species is "endangered" or merely "threatened" does differ, there is no corresponding difference between the legal protection species classified under each receives. State law also protects another category of species known as "species of special concern," such as the Florida Gopher Tortoise. These are species whose numbers are declining but have not yet reached the level of biological endangerment that would qualify them for endangered or threatened status. Neither of these laws protects ecosystems, although federal law may in some cases protect the habitat of an endangered species. Protection of certain species, known as indicator or keystone species, may, because of the niche they occupy, incidentally serve to protect a variety of other species and, in some instances, large portions of entire ecosystems. The red-cockaded woodpecker and the northern spotted owl are examples of these. Such species are the exception rather than the rule, however.

The federal Endangered Species Act (ESA)[434] affords listed species the greatest protection, and has been expansively interpreted in the federal courts. The Act is administered by the United States Fish and Wildlife Service (FWS). Two provisions of the Act provide substantive protection for endangered species. Section 7, which applies only to actions of the federal government, prohibits any federal agency from jeopardizing the continued existence of an endangered or threatened species.[435] To comply with Section 7 any agency proposing an activity, including the issuance of a permit, must first consult with FWS and obtain a "no jeopardy" opinion. Failure to do so, or undertaking a federal action in the face of a "jeopardy" opinion, will subject the agency to the prospect of an injunction to halt the proposed activity.

Section 9 of the Act prohibits any person, including individuals, corporations and government agencies, from "taking" an endangered species.[436] Take is broadly defined to mean to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The Fish and Wildlife Service has adopted regulatory definitions of harm and harass which include habitat modification where the modification results in significant impairment in essential behavioral patterns, such as breeding and feeding, which, in turn, is manifested by species decline. This aspect of Section 9 remains among the most controversial provisions of the Act, and a taking by habitat modification has never been tested on private lands. More recently, in Florida, the United States Fish and Wildlife Service has issued warnings to local governments that land use decisions that result in takings may subject the local government itself to liability.

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432. *Id.*

433. *Id.*

434. 16 U.S.C. §§ 1531-1544.

435. 16 U.S.C. § 1536. *See generally*, White, David J., *Section 7: Jeopardy, Critical Habitat and Consultation Under the Endangered Species Act*, WILDLIFE, HABITAT AND LAND USE LAW: FLORIDA'S DEVELOPING ZOO 2.1 (Feb. 8-9, 1991).

436. 16 U.S.C. § 1538. *See generally*, Ankersen, Thomas T., *Section 7: The Takings Prohibition*, WILDLIFE, HABITAT AND LAND USE LAW: FLORIDA'S DEVELOPING ZOO 3.1 (Feb. 8-9, 1991).

The Federal Act also contains a provision that requires the FWS to designate "critical habitat" for endangered and threatened species to the maximum extent "prudent and determinable" concurrently with the listing of the species. In practice, few species have had critical habitat designated, although one court recently held that designation should be the rule rather than the exception. Moreover, it does not necessarily follow that all of the habitat of a listed species will be regarded as critical. In any event, the designation of critical habitat does not impose any new liabilities. It may, however, raise a presumption of taking in Section 9 habitat modification cases.

The ESA permits the "incidental take" of individuals within a species under certain circumstances. A formal permitting procedure has been established which requires the applicant to submit a "habitat conservation plan." The Plan must demonstrate that the incidental taking will not jeopardize the species as a whole.

Florida law also protects endangered and threatened species, and species of special concern,[437] although, as presently interpreted, to a lesser extent than its federal counterpart. The Florida law is administered under the regulatory authority of the Florida Game and Freshwater Fish Commission (GFC). Florida has no analog to Section 7 that would require state agencies to consult with the GFC prior to undertaking actions, such as the issuance of permits, that may adversely affect a listed species. Florida does prohibit the "taking" of listed species. However, the GFC has not interpreted the definition to include the modification of habitat. Moreover, the GFC appears extremely reluctant to engage in activities that may be perceived as land use regulation on private lands. For example, recent efforts to establish a Gopher Tortoise mitigation rule and guidelines for development in Scrub Jay habitat were rejected by the agency as beyond its authority.

Florida has no regulatory provision for incidental takings, similar to the federal ESA, through permits for taking listed species are required. In the case of the gopher tortoise, for example, several options are available. These options range from burrow mitigation to tortoise relocation, which may satisfy permit requirements. A copy of a Commission document interpreting its existing role is in Appendix J.

While the federal and state laws governing endangered species are important tools to protect individual species they do not protect biological diversity as a whole. Except in extremely unusual circumstances they do not regulate the use of land or require that overall biological diversity be considered in decisions affecting the use of the land. For these reasons there are bills pending in Congress and in a number of states that seek to incorporate biodiversity into administrative decision making. These bills have failed in previous legislative and Congressional sessions.

SPECIAL PROTECTION OF ENVIRONMENTALLY SENSITIVE AREAS

There have been a number of efforts in Florida to provide special protection for natural areas which are perceived to be of special or unique value. The ACSC program discussed previously in this chapter is one example. Recently, considerable effort has been directed toward protecting river basins in Florida. The following section will discuss four different efforts in Florida to provide protection for the ecosystems surrounding the Wekiva, Suwannee, Myakka, and Econlockhatchee Rivers. A fifth effort undertaken to protect a more complex ecosystem in New Jersey is also discussed. Examination of these regulatory efforts helps identify some of the problems and potential solutions for managing the Green Swamp.

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437. FLA. ADMIN. CODE ch. 39-27 (April, 1990).

Wekiva River[438]

In February of 1988, amid intense public concern over increasing development near the Wekiva River, Governor Martinez issued an executive order creating the Wekiva River Task Force (Task Force).[439] The order directed the Task Force to create a report describing and evaluating existing planning, regulatory, and land acquisition programs of state, regional, and local government which pertain to the management and protection of the Wekiva River. In May of 1988, the Task Force submitted its report which recommended new legislation and changes in current planning, management, and regulatory processes.[440]

The Task Force found that the Wekiva River system was subject to intense development pressure which threatened to adversely affect many of the system's resource values. Appendix C contains a complete list of the Task Force's recommendations for the Wekiva River Basin. The following Task Force recommendations are of particular interest:[441]

> • The Task Force recommends the immediate purchase of existing proposed CARL properties within the Wekiva Basin ...
>
> • The Task Force recommends that the East Central Florida Regional Planning Council prepare a comprehensive management plan and principles for guiding development for the entire Wekiva basin for inclusion in its Comprehensive Regional Policy Plan.
>
> • The Task Force endorses the proposed SJRWMD [St. Johns River Water Management District] rule changes to Chapter 40C-41, F.A.C., which address the impact of permitted development activities on the water quality, water quantity and wildlife habitat values of wetlands within the Wekiva Basin.
>
> • The Task Force endorses two proposed amendments to the East Central Florida Comprehensive Regional Policy Plan ... that propose a new regional policy which recognizes the Wekiva River as a significant regional resource deserving special protection and that would revise an existing policy regarding buffers and regionally significant wetlands in order to clarify its intent and application.
>
> • The Task Force recommends that local governments adopt changes to their local comprehensive plans, zoning codes and land use designations and that they adopt ordinances that would require minimum setbacks of 550 feet from the edge of the Wekiva River, that would encourage and promote clustering of development to allow greater expanses of undeveloped areas preserved in perpetuity in conservation easements, and that would prohibit land uses and

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438. *See* Whitney, N.S. & J.C. Elledge, *Effective Environmental Action: The Case of the Wekiva River*, WATER: LAWS AND MANAGEMENT 9B-13 (Sept., 1989) (published in the proceedings of a conference sponsored by the American Water Resources Association, Tampa, Florida, Sept. 17-22, 1989); Lowe, G. & C. Salafrio, *The Evolution of Wetland Regulation Under Chapter 40C-4, F.A.C.*, WETLANDS: CONCERNS AND SUCCESSES 557 (1989) (published in the proceedings of a conference sponsored by the American Water Resources Association, Tampa, Fla., Sept. 17-22, 1989).

439. Fla. Exec. Order No. 88-26 (Feb. 4, 1988).

440. Wekiva River Task Force, Report to Governor Bob Martinez (May 20, 1988).

441. *Id.* at p. v-ix.

intensities of development that would adversely affect the natural resources of the Wekiva River Basin.

- The Task Force recommends that each affected local government adopt a permanent restriction of development in designated buffer areas along tributaries and wetlands in the Wekiva Basin.

- The Task Force recommends that the Legislature enact legislation that would reduce the thresholds for developments of regional impact in the Wekiva River Basin by at least one-half.

- The Task Force recommends that where development is permitted to occur adjacent to public preserve areas and state parks, it be of sufficiently low intensity to prevent adverse impacts to the public lands.

- The Task Force endorses an amendment to Chapter 373, F.S., to include a provision that the [Water Management District]...not issue any permit within the Wekiva River Protection Area until the appropriate local government has provided written notification to the district that the proposed activity is consistent with the local comprehensive plan and is in compliance with any land development regulation in effect in the area where the development will take place.

State, regional, and local government entities responded quickly to provide additional regulatory protection for the Wekiva River System.

The Florida legislature enacted the Wekiva River Protection Act[442] (Act) which directs the counties having jurisdiction within the Wekiva River Protection Area (Wekiva Area) to revise their comprehensive plans and land development regulations to protect the Wekiva Area by April 1, 1989.[443] The Act directs the counties to adopt goals, policies, and objectives for the Wekiva Area which will protect:[444]

1. Water quantity, water quality, and hydrology ....
2. Wetlands ....
3. Aquatic and wetland-dependent wildlife species ....
4. Habitat ... of species designated pursuant to Rules 39-27.003 [Designation of Endangered Species by Florida Game and Fresh Water Fish Commission (GFC)], 39-27.004 [Designation of Threatened Species by GFC], and 39-27.005 [Designation of Species of Special Concern], Florida Administrative Code ....
5. Native vegetation ....

The county plans must also provide for land uses, and densities and intensities of development which will protect the resources and rural character of the Wekiva Area.[445] County comprehensive plans must include:

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442. FLA. STAT. § 369.301 (1989).

443. *Id.* § 369.305(1).

444. *Id.* § 369.305(1)(a).

445. *Id.* § 369.305(b).

1. Provisions to ensure the preservation of sufficient habitat for feeding, nesting, roosting, and resting so as to maintain viable populations of designated ... [endangered, threatened, or special concern species].

2. Restrictions on the clearing of native vegetation within the 100-year flood plain.

3. Prohibition of development that is not low-density residential in nature, unless that development has less impacts on natural resources than low-density development.

4. Provisions for setbacks along the Wekiva River for areas that do not fall within the protection zones established pursuant to s. 373.415 ,F.S., [Water Management District protection zones for MSSW permitting in Wekiva River Protection Area].

5. Restrictions on intensity of development adjacent to publicly owned lands to prevent adverse impacts to such lands.

6. Restrictions on filling and alteration of wetlands in the Wekiva River Protection Area.

7. Provisions encouraging clustering of residential development when it promotes protection of environmentally sensitive areas, and ensuring that residential development in the aggregate shall be of a rural density and character.

The county comprehensive plans must require that development which is permitted on property adjacent to the Wekiva River be concentrated on portions of the property furthest away from surface waters and wetlands of the river system.[446]

The Act directs the counties to develop land development regulations to implement the Wekiva River protection provisions of their comprehensive plans. The counties must also develop regulations restricting the location of septic tanks and drain fields within the 100 year floodplain and discharges of stormwater to the river system.[447]

The Act directs the counties to adopt comprehensive plan revisions and land development regulations for the Wekiva River Protection Area by April 1, 1989 and submit them for review by the Department of Community Affairs (DCA) and the Governor and Cabinet. Orange,[448] Seminole,[449] and Lake[450] counties have adopted provisions for the Wekiva River Protection Area. Orange County regulations were reviewed by DCA and approved by the Governor and Cabinet.[451] Seminole County regulations have

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446. *Id.* § 369.305(1)(c).

447. *Id.* § 369.305(1)(e).

448. Orange County, Fla., Wekiva River Small Area Study, Ordinance 88-6 (April 18, 1988).

449. Seminole County, Fla., Amendments to the Elements of the Seminole County Comprehensive Plan (Feb. 28, 1989).

450. Lake County, Fla., Wekiva River Protection Area Amendment to Development Regulations (March 6, 1990).

451. Telephone interview with Jim Farr, Department of Community Affairs (Jan., 1990).

not been approved due to a five acre parcel within the Wekiva Area which is zoned commercial.[452] Lake County comprehensive plan and land development regulation amendments are currently being reviewed by DCA.[453]

In addition to requiring local governments to amend their comprehensive plans and land development regulations, the Act also mandates other regulatory actions. The Act directs that the numerical thresholds for DRIs located in the Wekiva River Protection Area be reduced by 50 percent.[454] The Act declares that the Wekiva River Protection Area is a "natural resource of state and regional importance," and directs the East Central Florida Regional Planning Council to adopt policies to protect "water quantity, water quality, hydrology, wetlands, aquatic and wetland-dependent wildlife species, habitat of species ... [designated by FGFWFC as endangered, threatened, and of special concern], and native vegetation in the Wekiva River Protection Area."[455] Finally, the Act directs the Department of Natural Resources to pursue acquisitions of conservation and recreation lands within the Wekiva River Protection Area.[456]

Section 373.415, Florida Statutes, amends the St. Johns River Water Management District MSSW permitting authority by directing the District to adopt rules establishing protection zones along the watercourses in the Wekiva River System.[457] The protection zones must be wide enough to "prevent harm to the Wekiva River System, including water quality, water quantity, hydrology, wetlands, and aquatic and wetland-dependent species" from activities regulated by the MSSW permitting program.[458] Section 373.415 directs the Water Management District to consider the following factors when determining the widths of the protection zones:[459]

> (a) The biological significance of the wetlands and uplands adjacent to the designated watercourses ... including the nesting, feeding, breeding, and resting needs of aquatic species and wetland-dependent species.
> (b) The sensitivity of these species to disturbance, including the short-term and long-term adaptability to disturbance of the more sensitive species, both migratory and resident.
> (c) The susceptibility of these lands to erosion, including the slope, soils, runoff characteristics, and vegetative cover.

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452. *Id.*

453. Telephone interview with Jim Farr, Department of Community Affairs (Feb., 1990).

454. *Id.* § 369.307(2). DRI applications filed prior to June 1, 1988 which were issued a development order on or before April 1, 1989 are exempt from the provisions of the Act. *Id.* § 369.307(4).

455. *Id.* § 369.307(3).

456. *Id.* § 369.307(5).

457. FLA. STAT. § 373.415 (1989). The boundaries of the Wekiva River System are defined in FLA. STAT. § 369.303(10) (1989).

458. FLA. STAT. § 373.415(1) (1989).

459. *Id.* § 373.415(1)(a),(b),(c).

In addition, Section 373.415 authorizes the Water Management District to establish permitting thresholds, permitting exemptions, or general permits which do not allow significant adverse affects to the river system.[460]

Section 373.415 prohibits the Water Management District from issuing a MSSW permit without first obtaining the appropriate local government's certification that the proposed activity is consistent with the local comprehensive plan and is in compliance with land development regulations.[461] Section 373.415 does not affect the authority of local governments to establish setbacks from waters.[462]

Section 373.415 directs the Water Management District to develop a groundwater basin resource availability inventory for the Wekiva River Protection Area. The Water Management District must also establish minimum flows and minimum water levels for surface waters in the Wekiva River System and minimum groundwater levels within the Wekiva Basin.[463]

The Water Management District promulgated rules to implement the statutory directives of Section 373.415, Florida Statutes, which lower permitting thresholds[464] and provide for additional standards and criteria[465] for MSSW applications in the Wekiva River Hydrologic Basin (Basin). The permitting program for areas outside the Basin is discussed *supra*. Applicants for MSSW permits within the Basin must satisfy the district wide standards and criteria in Chapters 40C-4 and 40C-40, Florida Administrative Code, and the basin specific criteria contained in Chapters 40C-4 and 40C-41, Florida Administrative Code.

A MSSW permit is required prior to the "construction, alteration, operation, maintenance, abandonment or removal of a surface water management system" within the Basin which 1) serves a project with a total land area greater than or equal to ten acres, 2) involves the placement of one half acre or more of impervious surface, or 3) is located within the Wekiva River Riparian Habitat Protection Zone.[466] Table 4-7 illustrates the differences between MSSW permitting thresholds for systems inside and outside of the Wekiva Basin.

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460. *Id.* § 373.415(1).

461. *Id.* § 373.415(2).

462. *Id.* § 373.415(6).

463. *Id.* § 373.415(3).

464. FLA. ADMIN. CODE Rule 40C-4.041(2)(b)3,5,8 (August, 1989).

465. FLA. ADMIN. CODE Chapter 40C-41 (Sept. 1988).

466. *Id.* § 40C-4.041(2)(b)3,5,8.

TABLE 4-7

DIFFERENCES BETWEEN MSSW AND WEKIVA BASIN
MSSW PERMIT THRESHOLDS

Parameter	MSSW Permit	Wekiva MSSW Permit
Project Size	40 acres	10 acres
Impervious Surface	12 acres	0.5 acres
Riparian Zone	Not Applicable	Any MSSW System

Projects which trigger the MSSW permitting thresholds within the Wekiva Basin must satisfy the criteria in Rule 40C-4.301 as well as criteria specific to the Basin. Rule 40C-41.063 establishes five criteria for projects within the Wekiva River Hydrologic Basin:

1. Recharge Standard: Projects located in Most Effective Recharge Areas must retain within the project three inches of runoff from all directly connected impervious areas, or show that post development recharge capacity is equivalent or greater than pre-development recharge capacity;

2. Storage Standard: MSSW systems are prohibited from causing a net reduction in flood storage within certain 100 year flood plains within the Basin;

3. Erosion, Sediment Control, and Water Quality Standard: The rule creates a Water Quality Protection Zone which extends one half mile from the Wekiva River and many of its tributaries, and also extends one quarter mile from any wetland abutting an Outstanding Florida Water. MSSW systems which serve projects located partially or completely within the zone, or which serve projects with a total land area equal to or greater than 120 acres, must submit an erosion and sediment control plan as part of their MSSW permit application. Applicants must submit a plan which provides

> reasonable assurance ... that during construction or alteration of the system (including revegetation and stabilization), erosion will be minimized and sediment will be retained on-site.[467]

In addition, the plan must conform with erosion and sediment control principles and criteria contained in Sections 18.2 and 18.3 of the Water Management District Applicant's Handbook. Figure 4-8 illustrates the Water Quality Protection Zone.

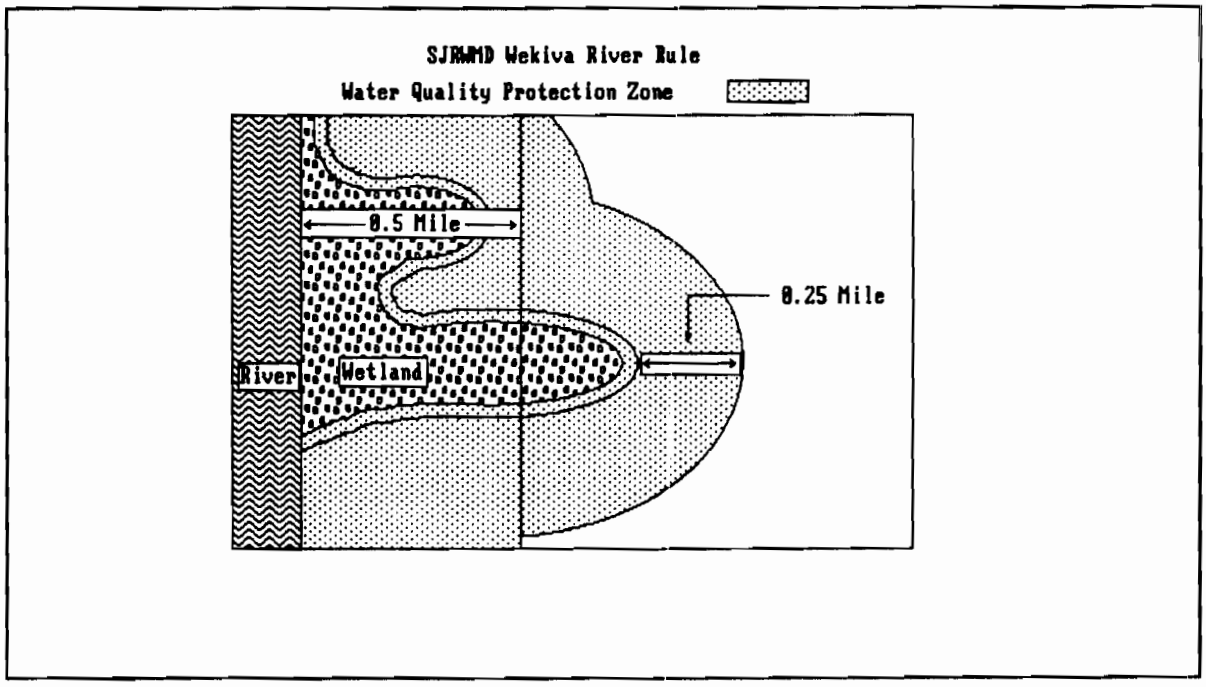
Projects located within 100 feet of an Outstanding Florida Water (OFW) (the Wekiva River and most of its tributaries are designated OFWs) or within 100 feet of a wetland which is adjacent to an OFW must provide

> reasonable assurance that the construction or alteration of the system will not cause sedimentation within these wetlands and that filtration of runoff will occur prior to

467. *Id.* § 40C-41.063(C)1.

FIGURE 4-8

Wekiva River Water Quality Protection Zone



discharge into these wetlands and waters.[468]

The standard is presumed met if any one of the following criteria is satisfied: 1) a 100 foot strip of undisturbed vegetation is retained landward of the OFW or abutting wetland, through which runoff from construction or alteration of the system is allowed to naturally sheetflow (limited construction of outfall structures may be permitted within this vegetative strip); 2) perimeter controls specified in the rule are constructed and maintained at all outfall points prior to construction or alteration of the system, and a 25 foot strip of undisturbed vegetation is retained landward of the OFW or abutting wetland (limited construction of outfall structures may be permitted within this vegetative strip); 3) during construction or alteration of the system, no direct discharge occurs to the OFW or abutting wetland during the 10 year 24 hour storm event or during de-watering activities. On site storage must be available for use within 14 days of the rainfall event. A 25 foot strip of vegetation must be retained landward of the OFW or abutting wetland (limited construction of outfall structures may be permitted within this vegetative strip).

4. Drawdown Standard: The rule creates a Water Quantity Protection Zone which extends 300 feet landward from wetlands which abut the Wekiva River and many of its tributaries. When any part of a system is located within the zone, the applicant must provide

> reasonable assurance that ... the system will not cause ground water table drawdowns which would adversely affect the functions provided to aquatic and wetlands dependent species ... by the referenced wetlands.[469]

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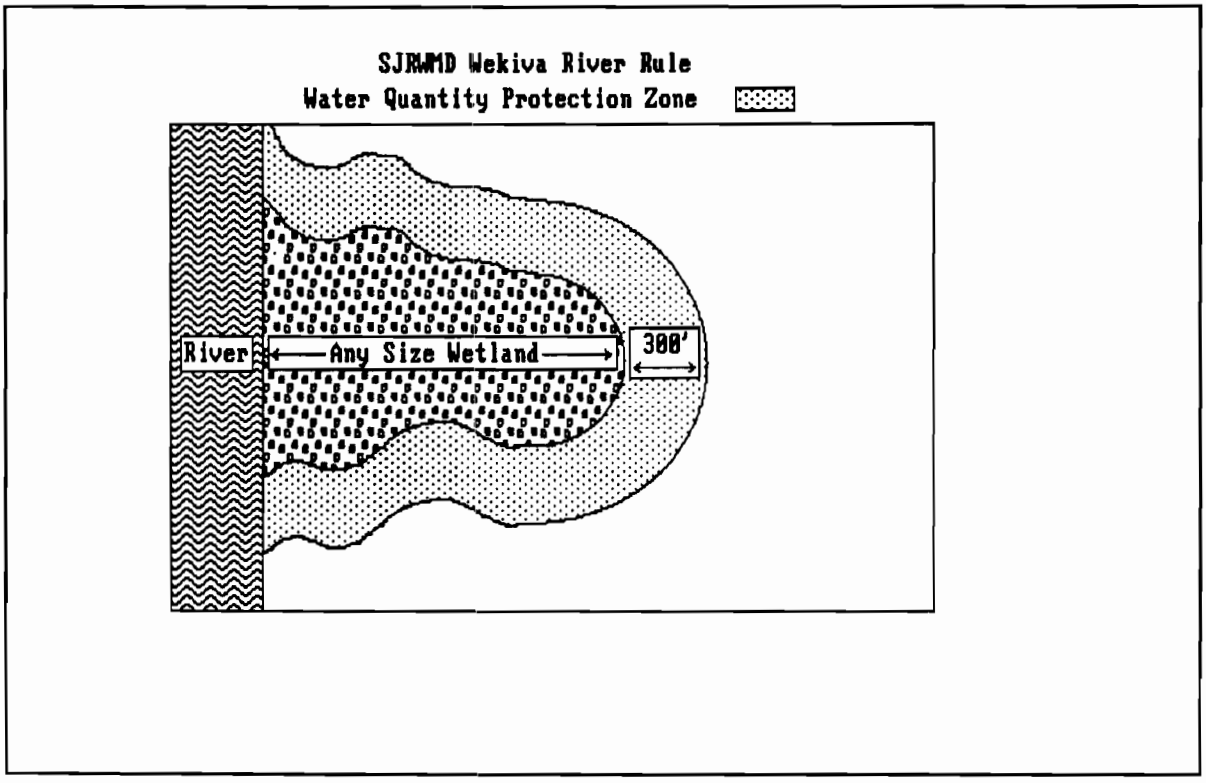
468. FLA. ADMIN. CODE Rule 40C-41.063(3)2 (August, 1989).

469. *Id.* § 40C-41.063(d).

A system is presumed to satisfy the drawdown standard if it will not cause a ground water table drawdown within the Water Quantity Protection Zone.[470] Figure 4-9 illustrates the Water Quantity Protection Zone.

FIGURE 4-9

Wekiva River Water Quantity Protection Zone



5. Riparian Wildlife Habitat Standard: The rule creates a Riparian Habitat Protection Zone which includes 1) wetlands abutting the river and its tributaries, 2) uplands within fifty feet of abutting wetlands, and 3) uplands which are within 550 feet of the river's edge.[471] Figure 4-10 illustrates the Riparian Habitat Protection Zone. An applicant must provide

> reasonable assurance that the construction or alteration of a system will not adversely affect the abundance, food sources, or habitat (including its use to satisfy nesting, breeding and resting needs) of aquatic or wetland dependent species provided by the [zone].[472]

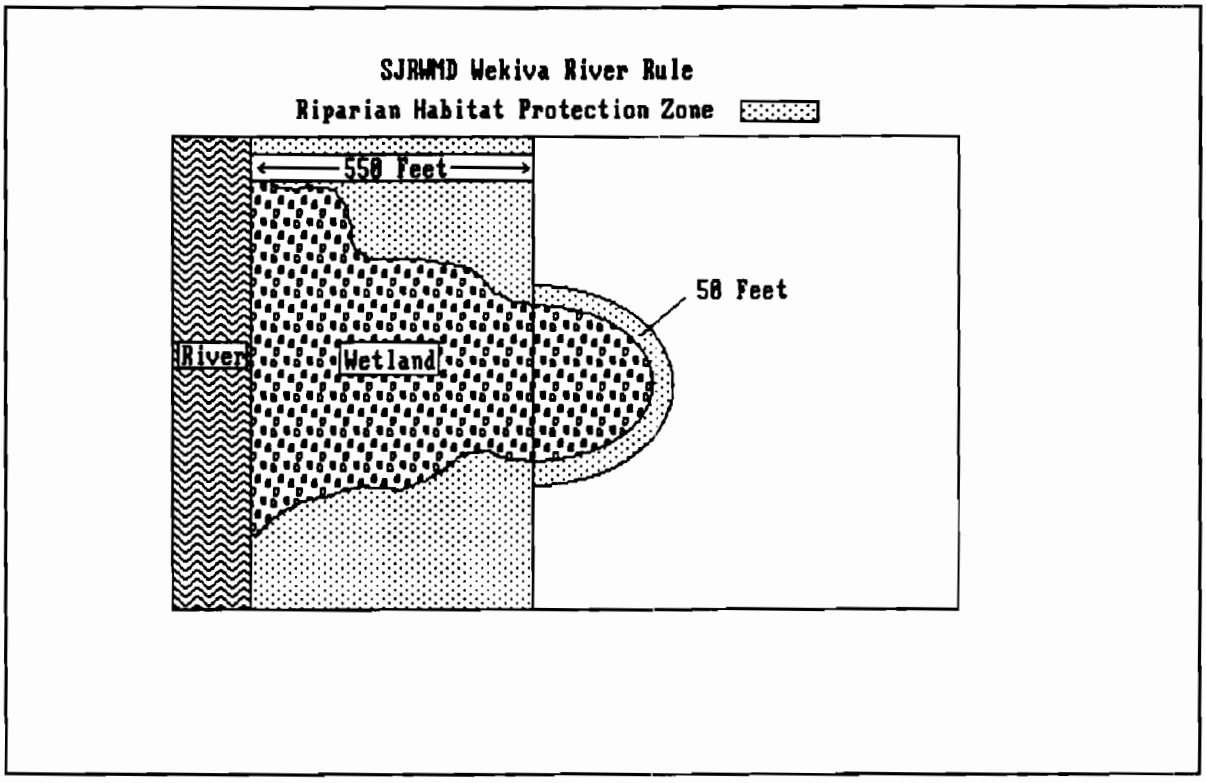
470. *Id.*

471. *Id.* § 40C-41.063(e)1.

472. *Id.* § 40C-41.063(e).

FIGURE 4-10

Wekiva River Riparian Habitat Protection Zone



Within the Riparian Habitat Protection Zone, the construction of buildings, golf courses, impoundments, roads, canals, ditches, swales, and any land clearing resulting in the creation of any system is presumed to violate the Riparian Wildlife Habitat standard.

The Wekiva River Protection Act directs the East Central Florida Regional Planning Council (Planning Council) to adopt policies to protect the natural resources in the Wekiva River Protection Area.[473] The Planning Council adopted the following policies:

> Policy 43.11: Due to its unique regional significance as an Outstanding Florida Water, Aquatic Preserve and Wild and Scenic River, the East Central Florida Regional Planning Council shall consider the Wekiva River to be a Regionally Significant Resource deserving of special attention. All activities which have the potential to adversely affect the water quality, water quantity or wildlife habitat values of the Wekiva River shall be considered by the Council as impacts to a Regionally Significant Resource and shall be reviewed accordingly.
>
> Policy 43.8: In order to protect the quality and quantity of surface waters and provide habitat for semi-aquatic or water-dependent terrestrial species of wildlife, buffer zones should be established, by appropriate federal, state and local agencies, landward of regionally significant wetlands, except where such buffers would be ineffective, inappropriate or inconsistent with the public interest. The landward extent of wetland buffer zones shall be determined based on scientific evaluation of site specific conditions, including the nature of the existing soils, vegetation, topography, hydrology, water quality, wildlife diversity and the resource protection status of the

473. See *supra* text accompanying note 500.

receiving waters. No activity should be permitted within the buffer zone unless the proposed activity can be shown to not pose a significant adverse threat to water quality, water quantity or wildlife habitat for wetland dependent species, or where it can be demonstrated that the project is clearly in the public interest consistent with Policy 56.1, 56.2, and 56.4. Buffer zones should consist of intact natural communities comprised of appropriate native species in the canopy, shrub and understory layers.

These policies provide some guidance for local governments attempting to address the requirements of the Wekiva River Protection Act. The policies are also used by the Planning Council to review Developments of Regional Impact in the Wekiva River Protection Area.

Seminole County responded to the Wekiva River Protection Act (Act) with a study which identifies existing comprehensive plan elements and regulations and recommends new provisions which address requirements of the Act.[474] Accordingly, this discussion focuses on comprehensive plan provisions and regulations adopted in response to the Act. The study was adopted by Seminole County but has not been approved by the Department of Community Affairs.

Seminole County comprehensive plan and land development regulation amendments address the requirements of the Act by:[475]

1) using conservation easements or dedication of open space areas to preserve ecologically significant communities,

2) relying on the wetland ordinance and the Planning Guidelines For Natural Resources to protect habitat for aquatic, wetland dependent, endangered, and threatened wildlife, and species of special concern,

3) coordinating with the Water Management District, the Department of Natural Resources, and the Florida Game and Fresh Water Fish Commission during development review to ensure that development orders and permits are consistent with the Act, Water Management District protection zone rules, and wildlife regulations,

4) enforcing all clearing and building setbacks along the Wekiva River imposed by the Water Management District or other agencies, and establishing a minimum 200-foot clearing and building setback measured from the ordinary high water elevation or the landward limit of conservation areas,

5) requiring all development to conform with provisions of the Act, regardless of the land use designation or zoning classification of the property,

6) designating most lands within the Wekiva River Protection Zone as conservation, general rural (maximum of 1 dwelling unit per acre), suburban estates (maximum of 1 dwelling unit per acre), recreation, or public use,[476]

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474. Seminole County, Fla., Amendments to the Elements of the Seminole County Comprehensive Plan (Feb. 28, 1989).

475. *Id.* at 38-49.

476. *Id.* at 42; Seminole County, Fla., SEMINOLE COUNTY COMPREHENSIVE PLAN VI-A37 (July 11, 1989).

7) requiring planned developments which are adjacent to the Wekiva River or adjacent wetlands to maintain the rural density and character of the area, to concentrate development on the portions of the site furthest away from waters and wetlands, and to restrict required open space uses to passive recreational uses,

8) preventing the subdividing of land from disrupting implementation of protection zones, maintenance of the rural character of the area, and water quality and quantity, and

9) encouraging the use of central sewer and discouraging the use of individual septic systems (central sewer may be required for major developments).

Orange County conducted the Wekiva River Small Area Study in response to the Wekiva River Protection Act (Act).[477] The study examined existing conditions in the Wekiva River Protection Area and created goals, objectives, and policies to address the requirements of the Act. The study has been adopted as part of the Orange County Comprehensive Plan and has been approved by the Department of Community affairs as satisfying the requirements of the Act.

The goal of the Wekiva River Small Area Study is to "preserve the water quality, hydrology, wetlands, flora and fauna, and recreational and scientific value of the Wekiva River."[478] In order to accomplish this goal, the Study directs that all new development will be low density residential, agricultural, or low intensity recreational in character.[479] The study designates state owned lands as conservation areas, and limits densities within the Rural Service Area to one dwelling per five acres.[480] Gross residential densities within the Urban Service Area are limited to two units per acre.[481] The study prohibits other types of development.[482]

The Study directs that the natural resources of the Wekiva River be protected by:[483]

1) prohibiting all activities within a buffer zone 550 feet landward from the edge of waters or the landward edge of connected wetlands, whichever is greater, unless the activity can be shown to "pose no significant threat to water quality, water quantity, or wildlife habitat for wetland dependent species,"
2) continuing to apply the Orange County Conservation Ordinance,
3) encouraging clustering of development or planned developments,
4) requiring developers to consult with the Florida Game and Fresh Water Fish Commission whenever endangered, threatened, or special concern plants or animals are present or likely to be present,

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477. Orange County, Fla., Wekiva River Small Area Study, Ordinance 88-6 (April, 18, 1988).

478. *Id.* § IV., Goal 1.

479. *Id.* § IV., Objective 1.

480. *Id.* § IIIB.

481. *Id.*

482. *Id.*

483. *Id.* § IV, objective 2, policies 2.1-2.12.

5) requiring developers of subdivisions and planned developments within the 100 year floodplain to minimize clearing of native vegetation (clearing only allowed when necessary for roads, utilities, or pedestrian access routes),
6) monitoring surface water quality in the study area,
7) requiring pre-development and post-development stormwater runoff rates to be equal,
8) prohibiting developments which may degrade groundwater quality,
9) discouraging the use of septic tanks in the 100 year floodplain and encouraging the use of public utilities (a septic tank permit may be issued if the applicant shows there will be no detriment to water quality),
10) requiring the density or intensity of development on parcels adjacent to the Wekiva River to be concentrated on portions of the parcel furthest from the river,
11) preventing subdividing of parcels which interferes with the 550 foot buffer zone, and
12) coordinating with the Water Management District to monitor groundwater quality, and to prevent saltwater contamination.

Lake County recently submitted proposed comprehensive plan amendments[484] and land development regulations[485] for review by the East Central Florida Regional Planning Council and the Department of Community Affairs. The Lake County response to the Wekiva River Protection Act includes several innovative mechanisms, such as Transferrable Development Rights (TDRs) and a Development Points Rating System, which encourage protection of sensitive lands while providing property owners with options for use of their land.

The Lake County amendments establish two overlay protection zones which limit density and intensity of land use within the Wekiva River Protection Area. District 1 corresponds with the farthest boundary established by the Water Management District's Wekiva River Hydrologic Basin Protection Zones and limits maximum density to one dwelling unit per forty net acres.[486] Net acres is defined as the total acreage of the parcel minus: 1) wetlands defined by the Water Management District or Lake County, 2) lands within the Water Management District's Wekiva River Riparian Habitat Protection Zone, 3) lands within the 100 year flood plain, and 4) road right of ways and easements for ingress and egress.[487] Alternatively, density may be increased to one dwelling unit per ten net acres through successful application of the Development Point Rating System (*infra*).[488] District 2 includes most of the remaining lands within the Wekiva River Protection Area and limits maximum density to one dwelling unit per 20 net acres.[489] Density may be increased to one dwelling unit per five net acres through successful application of the Development Point Rating System.[490]

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484. Lake County, Fla., The Wekiva River Protection Area Comprehensive Plan Amendment (March 6, 1990).

485. Lake County, Fla., Wekiva River Protection Area Amendment to Development Regulations (March 6, 1990).

486. Lake County, Fla., The Wekiva River Protection Area Comprehensive Plan Amendment 12 (March 6, 1990).

487. *Id.* at 5.

488. *Id.* at 12.

489. *Id.* at 12-13.

490. *Id.* at 13.

The amendments create a TDR system where Districts 1 and 2 are designated as sending areas.[491] Owners of land within the sending areas may sell their development rights to owners of land within designated receiving areas. Land owners within the receiving areas who purchase development rights may then increase the density of development on their lands. The amendments create two receiving areas into which Lake County wants to direct development activities. Receiving area number one allows a maximum density of one dwelling unit per twenty net acres.[492] However, density may be increased to a maximum of one dwelling unit per five net acres through the application of the Development Point Rating System,[493] and to a maximum of one dwelling unit per one net acre through application of the point system combined with the purchase of TDR's from Sending Areas 1 and 2.[494] An existing urban area is designated as Receiving Area number 2, within which land may be developed at a maximum density of five and one half dwelling units per one net acre through the purchase and use of TDR's from Sending Areas 1 and 2.[495] Figure 4-//illustrates the Lake County TDR scheme for the Wekiva River Protection Area.

491. *Id.* at 11-13.

492. *Id.* at 13.

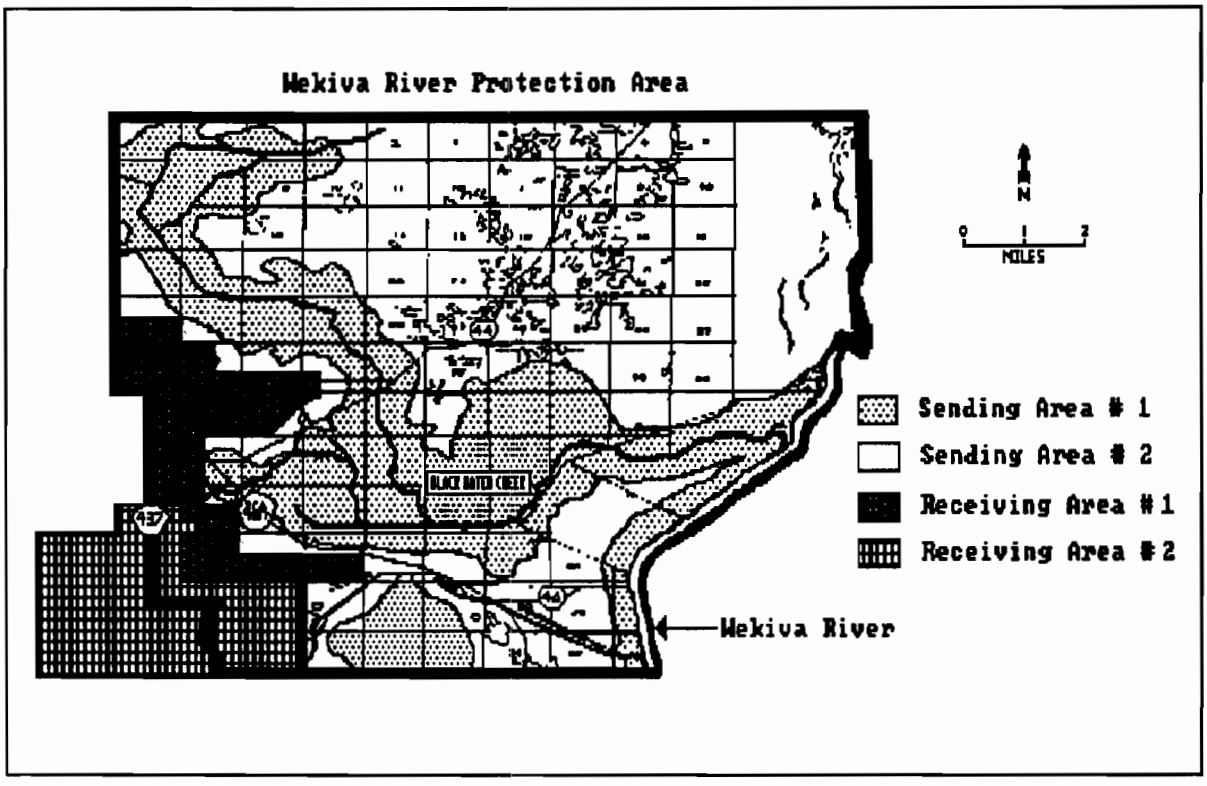
493. *Id.*

494. *Id.* at 13-14.

495. *Id.* at 16-17.

FIGURE 4-11

Lake County TDR Scheme for Wekiva River Protection



The Development Point Rating System assigns numerical values to various rating criteria. The objectives of these criteria are to

> ensure environmental protection; control urban sprawl; maximize land use efficiency; promote the efficient use of public facilities; ensure that services required by development are in place or are programmed concurrent with development impacts; and to direct appropriate growth patterns within the Wekiva River Protection Area.[496]

The Development Point Rating System awards points depending upon the degree to which the proposed development

1) is submitted as a Planned Unit Development,
2) is located within a designated TDR receiving area,
3) purchases TDR's,
4) utilizes innovative site design which protects more environmentally sensitive lands than would be protected under existing regulations (points are awarded for the use of buffers, preservation of native vegetation, dedication of preservation areas, preservation of existing hydrological patterns, and the use of clustering),

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496. *Id.* at 17.

5) is subject to pre-existing environmental constraints,
6) contributes to the expansion of an existing or proposed wildlife corridor,
7) provides sufficient habitat for species designated as threatened, endangered, or of special concern,
8) provides for affordable housing,
9) utilizes existing infrastructure (including roads, potable water supply, sanitary sewer service, irrigation water supply, fire protection, schools, and neighborhood parks.[497]

Proposed developments are awarded points depending upon the degree to which they satisfy the rating criteria. The amendments establish ranges of scores which correspond to the amount of density increase which will be allowed. Proposed developments with high scores are allowed to develop at higher densities than developments with low scores.[498] Proposed developments which score below certain threshold are prohibited from increasing density.[499] Although the point system establishes guidelines for determining whether increases in density should be granted, the amendments state explicitly that the achievement of points will not bind the county to allow an increase in density.[500]

The amendments establish minimum building and clearing setbacks from the Wekiva River and associated wetlands. In areas which are regulated by the Water Management District, the county setbacks will conform to those established by the Water Management District. In areas which are not regulated by the Water Management District, the setback will be a minimum of 200 feet from the ordinary high water mark, 50 feet from associated wetlands, or as provided by the Lake County Code, whichever is farther.[501]

Myakka River

In 1985, the Florida legislature designated a portion of the Myakka River located in Sarasota and Charlotte counties as a Florida Wild and Scenic River. The Myakka River Wild and Scenic Designation and Preservation Act (Act)[502] directs the Department of Natural Resources (DNR) and the Myakka River Management Coordinating Council (Council) to develop a plan for the management, administration, and protection of a portion of the Myakka River. The Council recently adopted the Myakka Wild and Scenic River Management Plan (Plan), which was prepared by a consultant, DNR, and the Council.[503]
The plan describes existing resources and regulations, identifies threats to the resources, and suggests management objectives and specific actions to remedy the problems. The Plan identifies development activities near the river as the primary threat to the river system. Such activities often result in the loss and degradation of wetlands, uplands, wildlife, wildlife habitat, water quality, water quantity, aesthetics, and recreation opportunities.

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497. *Id.* at 17-23.

498. *Id.* at 23-24.

499. *Id.*

500. *Id.* at 17.

501. *Id.* at 31.

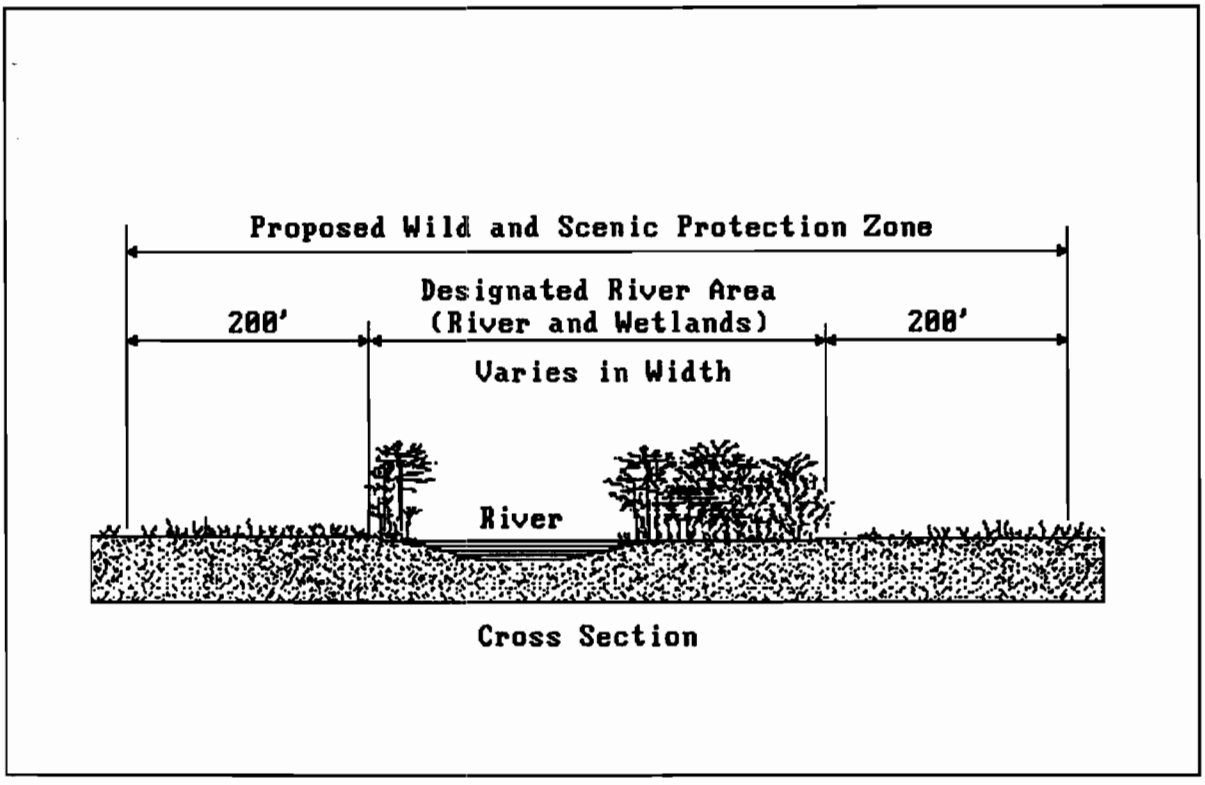
502. FLA. STAT. § 258.501 (1989).

503. Myakka Wild and Scenic River Management Plan, Prepared for the Florida Department of Natural Resources and Myakka River Management Coordinating Council by Hunter Services, Inc. (April 6, 1990).

The plan creates three geographical areas, based on proximity to the river channel, and recommends a number of specific actions to help preserve each area. The three areas are the river and adjoining wetlands (River Area), a 220 foot wide contiguous Wild and Scenic Protection Zone (Protection Zone), and the remaining watershed (Watershed). The River Area receives the highest degree of protection, the Protection Zone receives intermediate protection, and the Watershed receives the least protection. Figure 4-12 illustrates the Myakka River Area and Wild and Scenic Protection Zone.

FIGURE 4-12

Myakka River Area and Wild and Scenic Protection Zone



The Plan recommends that DNR adopt a rule and permitting system for the River Area which: 1) reviews activities which have an adverse impact on the river system; 2) identifies activities which are prohibited, such as point discharges of waste or effluent, major new activities which would adversely alter natural or historic hydrologic conditions, new marinas, and structures not related to water dependent activities; 3) identifies activities which may be conducted after obtaining a permit, such as creation or maintenance of shore protection structures, docks, decks, and roads; and 4) identifies activities which are allowed without obtaining a permit, such as commercial fishing, certain agricultural and forestry activities, and drainage and water management practices which do not have an adverse effect on water quality.

The Plan uses the average width of the river's visual corridor (the distance a person can see when standing along the river and looking landward) as its basis for determining the width of the Zone. The Plan recommends that the Legislature amend the Act to: 1) establish the Zone; 2) require local governments to amend their comprehensive plans and adopt regulations to implement the recommendations in the Plan; and 3) authorize DNR to carry out the management of the Zone if the local

governments fail to adequately manage the zone. The Plan recommends that local governments provide regulatory protection for wetland-fringing hammocks and uplands within the Zone.

The Plan states that existing regulatory authorities are adequate to manage the Watershed area, although some of the regulations should be strengthened. The Plan recommends that local governments adopt strict performance standards for reviewing new development to insure that water quality and quantity are adequately protected. The Plan recommends that the Southwest Florida Water Management District adopt special Myakka basin water management rules which strengthen review criteria for surface water management permit applications. In addition, the Plan recommends that the Act be amended to require all state and local agencies to provide DNR with notice of all requests for activities which might adversely affect the river.

In addition to the area specific recommendations, the Plan recommends the following actions for the entire basin: 1) agencies should acquire headwater lands, wetlands, tributaries, and lands bordering the Myakka River; 2) DNR should adopt a prescribed burning program; 3) the Southwest Florida Water Management District and the Department of Environmental Regulation should establish resource based water quality and quantity standards for the river; and 4) agencies should conduct studies to evaluate wildlife habitat, wildlife populations, plant communities, water quality, hydrology, and a variety of other parameters.

Suwannee River

In November of 1988, Governor Martinez created the Suwannee River Task Force (Task Force)[504] to study the effects of increasing growth on the Suwannee River system. The Task force was charged with

> analyzing and evaluating the effectiveness of current planning, regulatory, and land acquisition programs related to the Suwannee River and to develop a plan for the future protection and management of the Suwannee River and related Resources. The plan is to include recommendations on the need for administrative and legislative action to implement measures to protect and manage the resources of the Suwannee River.[505]

The Task Force limited its area of study to the natural resources associated with the 100-year floodplain of the Suwannee River, as well as any activities outside the floodplain which could have an adverse impact on the floodplain itself.[506]

The Task Force found that the Suwannee River system was in good shape and that the existing local government comprehensive planning process and the Surface Water Improvement and Management (SWIM) program should be able to adequately protect the river system. The Task Force acknowledged that these two programs were as yet unproven, but stated that with sufficient guidance the programs should be able to effectively protect the river system.

The Task Force recommended a number of guidelines for implementing local government comprehensive planning and SWIM programs. A complete list of the Task Force recommendations is contained in Appendix H. The following recommendations of are particular interest:

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504. Fla. Exec. Order No. 88-246 (Nov. 23, 1988).

505. Suwannee River Task Force, Report to Governor Bob Martinez 3 (November 15, 1989).

506. *Id.*

- Designate the floodplains of the Suwannee, Santa Fe, Alapaha and Withlacoochee Rivers as special planning areas.

- Restrict development in the special planning areas to low-density residential, forestry, low-intensity agricultural, public recreational and limited commercial uses.

- Encourage incentives to prevent conversion of forestry lands to more intensive land uses.

- Where possible, development should occur outside the 100-year floodplain and be concentrated as far from any water bodies as practicable.

- DRI thresholds for projects wholly or partially within the 100-year floodplains should be lowered by fifty percent.

- Local governments should amend their floodplain ordinances to be consistent with Suwannee River Water Management District buffer requirements. [75 feet]

- Areas should be identified where additional setbacks are necessary to ensure adequate habitat for wildlife dependent on the river system.

- There should be adequate setbacks to protect the aesthetic quality of the river.

- All development in the floodplain should comply with existing buffer requirements and with minimum standards and requirements of the FEMA model ordinance.

- Significant degradation should be defined as any unnatural variation from ambient water quality. There is to be no further degradation of water quality in the Suwannee River and its OFW tributaries.

- The Department of Environmental Regulation should implement a permitting system for high-intensity agriculture, particularly for dairies, specific to the Suwannee River basin.

- Stormwater management systems should be developed in areas of high residential density.

- Endorse the changes to septic tank rules that would prohibit septic tanks in hydric soils or where high water table is at ground level, and prohibit mounding in floodways.

- Assess whether septic tanks along the river system are operating as permitted or whether enforcement actions are necessary.

- Prohibit all septic tanks, private wells and central wastewater facilities in the ten year floodplain.

- Prepare a regional recreational development and management plan for the publicly owned lands within the study area.

- Assess wildlife needs in the Suwannee basin to determine which additional lands need to be protected for conservation purposes.[507]

The Task Force also recommended a program to monitor implementation of the recommendations. The Task Force recommended formation of a Policy Advisory Committee, composed of one representative from all affected counties and regional and state agencies.[508] The Policy Advisory Committee would be responsible for: 1) reviewing governmental actions with respect to development in the floodplain, 2) analyzing the governmental actions, identifying deficiencies, and making recommendations to correct deficiencies, and 3) preparing an annual comprehensive report to be sent to the Department of Community Affairs and all participating entities.[509] The Suwannee River Water Management District, the North Central Florida Regional Planning Council, and the Department of Community Affairs should agree to provide staff and support to the Policy Advisory Committee.[510] The Task Force recommended that the Department of Community Affairs be given responsibility for monitoring the overall success of the program and for taking actions to correct deficiencies in the program.[511]

Econlockhatchee River

In 1989, the St. Johns River Water Management District funded a study to develop a natural resources development and protection plan for the Econlockhatchee River Basin. At this time, the area surrounding the Econlockhatchee (Econ) River Basin was one of the most rapidly growing areas in the nation and was under intense development pressure. At least 40 major developments involving over 34,000 acres had recently been approved within the Econ Basin. Many proposed developments straddled or were adjacent to the Big Econ River, which was relatively undeveloped. Two such development proposals involved over 16,000 acres and 32,000 dwelling units. The Little Econ River, which is located near the eastern edge of Orlando, provided a good example of what might happen to the Big Econ River if additional regulations were not adopted soon. Much of the land adjacent to the Little Econ River had been intensely developed, thereby destroying many of the recreational and natural resource values of the river ecosystem.

The study was conducted by consultants who were charged with developing a management plan to insure no net loss of water quality, quantity, or ecological functions of the systems through acquisition, management, and land use regulations. The consultants were assisted by the District which provided insight into permitting programs and treatment methodologies. In addition to receiving continual review by the District, the study was evaluated by the Econ River Task Force, a committee with representatives from diverse interest groups. The District and the Task Force endorsed many of the consultant's recommendations, although they condensed the recommendations and modified some of the more controversial provisions.

With respect to water, the consultants found that channelization of streams, rivers and tributaries of the Basin had lowered average water table levels, decreased the residence time of stormwater within the system, and decreased flooding of natural wetlands. Stormwater management systems consisting of open water ponds and straight connecting ditches maximize runoff and do not allow for adequate filtering

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507. *Id.* at 1,2.

508. *Id.* at 32.

509. *Id.*

510. *Id.*

511. *Id.* at 32,33.

of nutrients and pollutants. An upland buffer of natural vegetation had been removed along most of the Little Econ and some areas of the Big Econ. These buffers were needed to filter out non-point source pollution and sediments that are carried by surface water flows.

With respect to wildlife, the consultants found that many habitats within the Basin had already been severely fragmented by land uses and highways. Much of the remaining relatively undisturbed habitat was along the Big Econ. The Basin provided habitat for 39 species which were endangered, threatened, or of special concern. Land uses in the area had severed historic linkages between the Econ Basin and large areas of flatwoods to the east and sandhills to the west. Conversion of native lands into pasture had benefitted common open-canopy species, such as brown-headed cowbirds and Red-tailed hawks that parasitize and compete with remaining forest dependent species. Development also had resulted in predation from dog and cats, and unnatural noises which exert additional pressures on native wildlife. The consultants also found that narrow strips of vegetation which are commonly used in landscaping are of little or no value as habitat for most species of wildlife.

The consultants found that existing local government plans and regulations did not adequately protect the natural resource values of the Econ Basin because they did not provide for protection of upland habitat adjacent to watercourses and wetlands. In addition, local governments did not protect small isolated wetlands.

Similarly, environmental regulations were determined to be inadequate, despite a complex array of regional, state, and federal regulations which pertained to natural resource values in the Econ Basin. The consultants found that the regulations did not provide for protection of upland habitat or adequate consideration of wildlife values. The regulations routinely allowed destruction of small isolated wetlands, which often provide essential habitat for certain wildlife species. In addition, the regulations did not adequately protect water quality and quantity within the Basin. Surface water management regulations allowed harmful groundwater drawdowns which could reduce the base flow of the river system. Stormwater regulations permitted inadequate treatment systems and depended on a nutrient standard that was difficult to enforce.

In developing a management plan for the Econ River, the consultants came up with the following objectives:

- Maintain or improve water quality in the Econ River.
- Approximate natural surface and groundwater table hydrologic regimes.
- Protect significant ecological communities in the Basin.
- Maintain viable populations of all existing wildlife species.

The consultants identified critical areas within the basin based on the location, ecological function, or sensitive nature of the area, and then proposed management and development guidelines for each such area. The following guidelines are of interest with regard to the Green Swamp:

> Headwaters of the Big Econ River south of the Beeline Highway. Area 2 is greater than 50% wetlands and is critical for the "health" of the Big Econ. Development of its uplands will be extremely difficult without significant augmentation of natural drainage. This will cause a loss of storage capacity, increased wet season river flows, and decreased dry season base flows. While relatively undeveloped (that is, free of urbanization), much of the natural landscape of area 2 has been altered due to agricultural and silvicultural practices. The following are management and development guidelines for area 2.

1) Require management of stormwater from any proposed developments so that pre-development and post-development discharges are equivalent in quantity, rate, quality, timing, and duration.
2) Restrict (including harvesting) silvicultural operations in wetlands.
3) Require wildlife buffers of at least 550 feet from the edge of open water, including 50 feet of uplands for all isolated wetlands greater than or equal to five acres in size.
4) Purchase as much of the headwaters south of the Beeline Highway as possible, but especially the Econlockhatchee River Swamp with adjacent uplands and the area known as Bee Tree Swamp with adjacent uplands.
5) Prohibit further highway and utility corridor construction that crosses the headwaters basin and increases fragmentation.

Xeric scrub communities of the Big Econ Basin. Most of the scrub is located within desirable locations for development and, as a result, they are endangered communities within the basin. Management and development guidelines for scrub communities are as follows:

1) Prohibit development activities within remaining scrub communities unless it does not alter essential habitat components.
2) Establish linkages with other habitat types, when setting aside scrub habitats, so they do not become isolated islands in developed landscapes.
3) Provide development credits or wetland mitigation credits when scrub communities are left intact and connected to other habitat systems.

River corridor of the Big Econ and the portion of Little Econ north of University Boulevard. A mosaic of wetlands and uplands, which lie within the 100-year floodplain, is included with area 4. Habitats within this mosaic are critically interconnected and important for wetland and upland wildlife. Wildlife access and movement along the length of the basin is greatly facilitated by the contiguous canopied corridor. A continuous corridor with few road crossings, cleared utility easements, or developed patches is essential. Loss of vegetated cover reduces wildlife habitat values and corridor functions. Development within the corridor alters surface- and groundwater hydrology and decreases surface-water storage. Continued fragmentation of the basin can be offset by preservation of a continuous riverine corridor that can connect fragmented and otherwise isolated habitats. Management and development guidelines for the river corridor are as follows:

1) Establish a conservation zone along the main stem of the Big Econ and Little Econ north of University Boulevard that corresponds to the 100-year floodplain as delimited on USGS FIRM Maps (Map 1). Such a conservation zone should be described with (2),(3),(6),(7), and (12) characteristics.
2) Limit development activities within the conservation zone to activities that do not permanently alter vegetation except for those noted below.
3) Prohibit agriculture within the conservation zone.
4) Restrict silviculture to a minimum 100-year rotation (1% per year) except for using small curs, or selective harvesting. In addition, approximately X% of land area should be preserved in old growth timber.
5) Preserve historical sites and protect them from further degradation.
6) Control passive recreation by locating nature trails along the preservation zone edge or landward edge of the area and transect the middle of the conservation zone only once per mile. Further, pavilions, nature centers, parking lots or other structures should be eliminated.
7) Recreational and nature trails should be unsurfaced, no wider than 4 feet, and prohibit motorized vehicular access except for maintenance.

8) Minimize utility and road crossings. These present major obstacles to wildlife movements and should be strictly minimized with provision of adequate wildlife underpasses wherever allowed. No more than two more should be allowed along the entire length of the Big Econ. Prohibit further highway and utility corridor construction that increase habitat fragmentation.
9) Control groundwater levels within the conservation zone to ensure no lowering of groundwater levels within the floodplain wetlands preservation zone.
10) Encourage revegetation of all cleared and previously altered lands should be allowed to revegetate with native ecological communities in the conservation zone.
11) Prohibit free-ranging domestic animals in the conservation zone.
12) Develop and implement a prescribed burning plan throughout the conservation zone where applicable.

Floodplain wetlands of the Big Econ and Little Econ. The floodplain wetlands associated with the river are essential for water quality, flood storage, and wildlife. The following are management and development guidelines for floodplain wetlands.

1) Establish a basin-wide preservation zone along the main stems and tributaries of the Big Econ and Little Econ rivers that is the greater of either 550 feet landward of the water/wetland edge, or 50 feet landward of the landward extent of the floodplain wetland.
2) Prohibit all development activities except for nature trails, boardwalks, dock, and other construction as provided for below in the preservation zone.
3) Prohibit silviculture and agriculture within the preservation zone.
4) Control passive recreation by locating nature trails only close to the waterward or landward perimeters of the preservation zone and cross the middle of the preservation zone no more than once per mile. Further, pavilions, nature centers, parking lots or other construction should be prohibited.
5) Limit boat ramps and river access points to no more than one per mile of river to preserve the connectivity of the system.
6) Minimize utility and road crossings and provide adequate wildlife underpasses wherever crossings are allowed. No more than two more should be allowed along the entire length of the Big Econ. Prohibit further highway and utility corridor crossings that increase habitat fragmentation.
7) Prohibit alteration of the hydrologic regime within the floodplain wetlands preservation zone.
8) Allow all cleared and previously altered lands to revegetate with native ecological communities.
9) Prohibit free-ranging domestic animals.
10) Develop and implement a prescribed burning plan where applicable.

Lower Reach of the Econ River adjacent to the St. Johns River. Area 6 contains numerous historical sites, an extensive mosaic of ecological communities and important wildlife habitat. Because of its pivotal location, linking the St. Johns River and the Econ River systems, and because of its landscape diversity, it is an important resource for wildlife. Management and development guidelines for the lower Econ River area as follows:

1) Proceed with acquisition under the CARL program.
2) Design development of public lands for recreational purposes outside of the conservation area to minimize fragmentation of important habitats and mosaics of habitats.
3) Leave historical sites on public lands intact and protect from further degradation.

Potential wildlands corridors connecting the Big Econ Conservation Zone with other wildlands. Area 7 consists of wildlife corridors which would connect the basin to large natural areas to the east and west. areas one mile wide have been delimited on the map. It is suggested that efforts for acquisition of parcels within these broad corridors be increased as a means of establishing contiguous corridors as wide as possible, from the Econ to the St. Johns River at several locations. The locations chosen are tributaries to the Econ that connect with relatively undeveloped lands. Management and development guidelines for these potential wildland corridors are as follows:

1) Establish a program to evaluate, select and purchase lands; establish easements, or transfer development rights to adjacent parcels.
2) Institute an overlay zoning category called "wildlands corridor" and develop performance criteria and incentives for uses of lands that are consistent with wildlife corridor functions and for the preservation of natural vegetative cover.

The consultants also indicated that it is necessary to regulate activities outside of critical areas in order to maintain the values of the critical areas. Many activities, particularly those that are intensive, can impact a critical area even if they are distant from the critical area. The consultants recommended the specific guidelines addressing the following topics:

Recommendations for maintaining habitat values of critical areas.

1) Design and construct wildlife underpasses on existing cross-basin roads similar to those implemented along Alligator Alley. These underpasses should be wide enough to substantially reduce disturbances from encroaching development along the highways.
2) Prohibit loud and sudden noises in areas adjacent to identified critical areas.
3) Develop educational programs and additional incentives that will encourage pet owners to keep their cats and dogs confined to their property.
4) Develop a prescribed burning program in areas where applicable adjacent to critical areas to protect against wild fires.

Recommendations for managing developed areas for wildlife.

1) Implement the use of the Wildlife Methodology Guidelines published by the Florida Game and Fresh Water Fish Commission for all proposed development sites.
2) Landscaping standards should be developed that include the use of native plant species and restrictions on the removal of understory vegetation so that some wildlife requirements can be provided and the landscaped areas will blend into nearby natural areas.
3) Arrange wildlife corridors and conservation areas so they connect with each other and with larger natural systems as much as possible. Construct road underpasses that allow movement of wildlife. One large conservation area usually provides more benefits to wildlife than many smaller ones. Whenever possible, conservation areas of adjacent developments should be combined into large connected areas. Recreational facilities should be provided in areas other than conservation areas.
4) Provide buffers of at least 550 feet from the center of the wetland including 50 feet of uplands for all wetlands equal to or greater than five acres. Locate upland conservation areas so they will connect as many wetlands as possible. Standards should be developed for protecting smaller permanent and ephemeral wetlands.
5) Develop standards for stormwater ponds that include the use of native emergent vegetation, littoral zones, and native vegetation along the shore so that these ponds will provide aquatic and wetland wildlife habitat values.

Recommendations for drainage.

1) Establish a maximum drawdown of feet below the average, wet season, water-table elevation throughout the Big Econ, and undeveloped portions of the Little Econ basin to minimize over-drainage, loss of existing storage and losses of wetland and terrestrial vegetation.
2) Require permits for construction of any significant additional drainage ditches by public agencies or private organizations regardless of outfall cross-sectional area. Require in the permit conditions that the net effect of the drainage structure will not lower surrounding groundwater elevations more than three feet from the average wet season elevations.
3) Construct weirs and internal dams (where practical) in existing drainage ditches that criss-cross the basin to raise water levels and therefore slow dewatering of the landscape. Re-establish groundwater levels no lower than three feet below pre-development, average, wet-season groundwater levels.
4) Require setbacks or buffers to be located between stormwater management structures and significant wetlands to ensure no significant alteration of the hydrologic regime at the wetland edge.

Recommendations for channelization.

1) Prohibit further channelization of rivers and tributaries.
2) Begin a program to restore channelized streams and tributaries. Where this is not possible, establish wetland detention basins as a means of improving water quality prior to release to the river.

Recommendations for stormwater management.

1) Require more stringent stormwater management in the Big Econ Basin, and require that pre- and post-development runoff should be similar in quality, quantity, rate, and timing.
2) Change stormwater regulations to address cumulative impacts of full development of the basin. One way to address full development may be to do a nonpoint source waste load allocation of the basin and assign waste load discharges on a per acre basis.
3) Bring retro-fit exiting, non-conforming stormwater management systems into conformance with stormwater regulations in the Big Econ Basin.

Recommendations for wetland stormwater management systems.

1) Modify existing stormwater regulations and policies to encourage construction of wetlands within wet detention systems. The more self-maintaining the community is the better it will be able to treat stormwater on a long-term basis. Forested systems are easiest to maintain over the long run, but hardest to establish. Marshes are easy to establish, but often require maintenance.
2) Encourage the construction of surface-water conveyance systems as forested or herbaceous wetland swales (or sloughs).
3) Develop performance criteria for the design and construction of all wetlands that emphasizes site analysis, engineering of hydroperiods, use of proper planting stock, etc.

Recommendations to manage waters according to their nutrient status.

1) Manage surface waters when they are nutrient rich to allow native vegetative cover and, thus, water quality improvement and nutrient removal and when they are nutrient poor,

manage as open water bodies. Discontinue aquatic weed spray programs in man-made drainage channels and allow vegetation to filter waters unless navigation is impaired or flood potential is significantly increased.

2) Suspend programs that require removal of native wetland vegetation species over long periods of time in created and restored wetlands or drainage swales because these species are considered undesirable. Instead, encourage greater planting densities higher diversity of planted species, creation of forested wetlands, and control of vegetation in construction phases.

Recommendations for construction setback for isolated wetlands.

1) To minimize impacts of heavy equipment and sedimentation in wetlands, provide a 75-foot construction setback for isolated wetlands.

The consultants recommended that Econ protection provisions be implemented through existing District regulatory programs and local government planning and land development regulation programs. Specifically, the consultants recommended that the District amend its management and storage of surface water and stormwater regulations to prevent activities which would adversely affect the natural resources of the Econ Basin. The District rules should be amended to preserve riverine wetlands, establish 550 foot buffers along each side of the river to protect water quality and aquatic and wetland-dependent species, limit groundwater drawdowns, strengthen stormwater permitting criteria, and provide for upland buffers adjacent to isolated wetlands. The consultants recommended that local governments implement additional protection measures including an additional 550 foot buffer to protect upland species. They also recommended that state environmental and growth management agencies take additional actions to protect the river, such as lowering the threshold for state and regional review of "developments of regional impact" and classifying the Econ River as an "Outstanding Florida Water."

In the spring of 1990 a bill was introduced in the Florida Legislature that directed the District, other agencies, and local governments to adopt measures to implement many of the recommendations of the Plan (S.B. 1852/H.B. 1673, 1990). The District, at the direction of its Governing Board, began preliminary rule making. Although the bill died in committee hearings, the District ultimately adopted a rule which contains many of the recommendations from the consultant's report. Despite strong developer opposition, the District developed a rule establishing development standards and review criteria similar to those adopted for the Wekiva River. In addition, the Department of Environmental Regulation is currently considering whether to designate the Econ as an "Outstanding Florida Water."

Several local governments also acted quickly. Orange County has adopted an ordinance which prohibits development in the first 550 feet from the river and limits development between 550 and 1100 feet from the river. Seminole County recently amended its comprehensive plan and adopted a river protection ordinance.[512] Osceola County adopted a temporary moratorium on the issuance of development permits within the headwaters area of the Econ River but has taken no action toward long term protection of the resource. Ultimately, successful protection of the Econ Basin depends on rapid action by all involved regulatory entities.

New Jersey Pinelands

The New Jersey Pinelands (Pinelands) regulatory program represents one of the most comprehensive efforts ever undertaken to protect a large area of predominately privately owned environmentally sensitive lands. The program has been in existence for about ten years and by most accounts has been a

512. Seminole County, Fla., Ordinance 91-9 (June 25, 1991).

resounding success. The program attempts to integrate environmental regulatory mechanisms with local government planning and land development regulation. While certainly not perfect, the program has afforded significant protection for the natural resources of the area while providing landowners with various alternatives for use of their land. The approach has withstood tremendous public, private, and legal scrutiny. Due to numerous similarities with the Green Swamp there may be potential to apply some or all of its principles to the Green Swamp.

The Pinelands experience is particularly pertinent to Green Swamp because of the numerous similarities that exist between the two ecosystems. The Pinelands, like Green Swamp, is a mosaic of different habitat types, including wetlands, uplands, rivers, and lakes, and contains a very large unpolluted aquifer. The region is an important aquifer recharge area of relatively low relief. The Pinelands was recognized early on as a resource of state and even national importance which warranted special consideration and protection. Agriculture and sand and gravel mining are important resources within the Pinelands. The Pinelands is largely rural in scope, containing large areas of relatively undisturbed natural habitat. The area, at the time of adoption of the comprehensive regulatory program, was subject to intense development pressure. There was significant local resistance to state imposed mandates and several previous regulatory efforts had failed. As with the Green Swamp, the Pinelands is a complex interdependent natural system which defies traditional regulatory approaches.

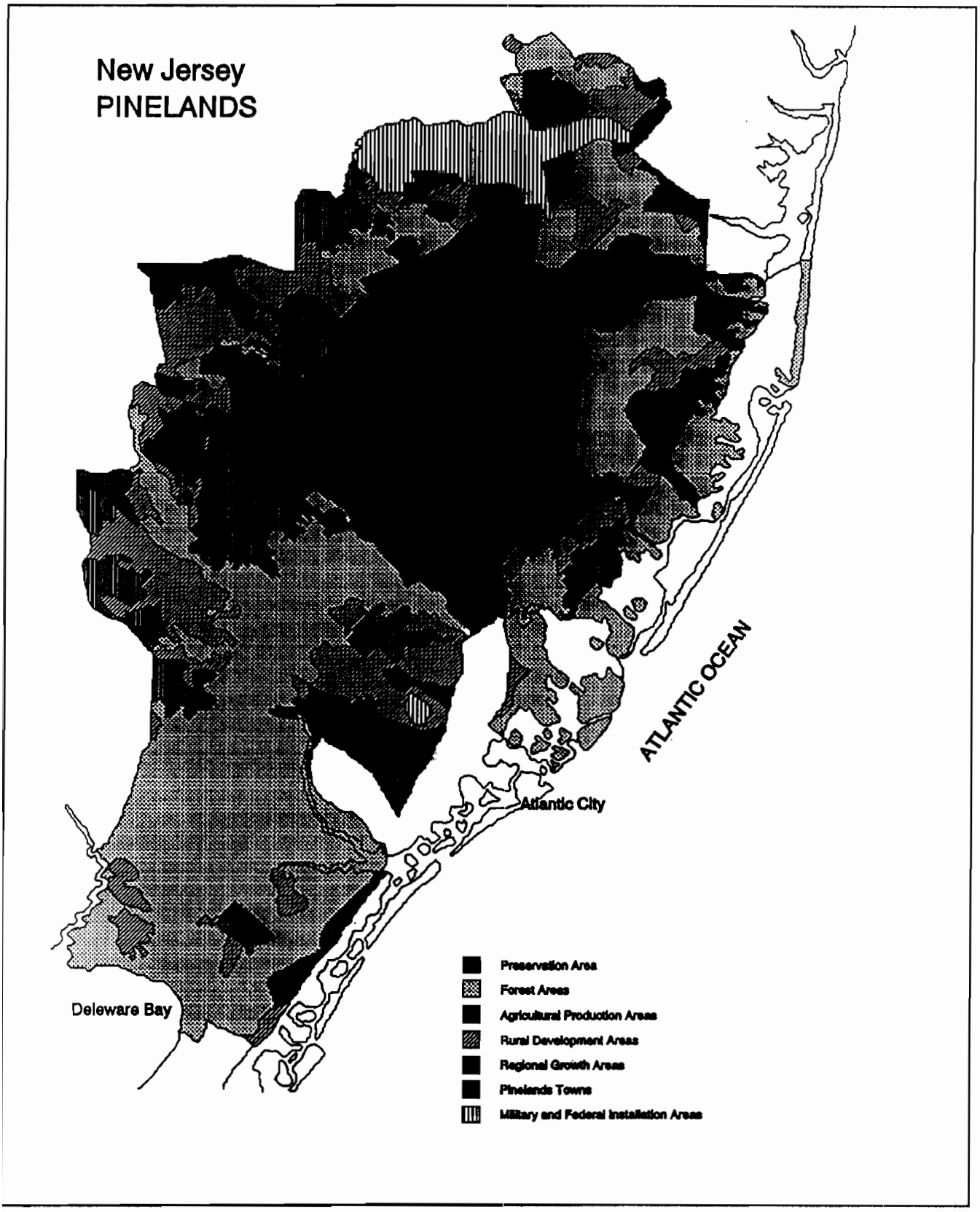
The Pinelands regulatory program was initiated in 1978 with the Congressional designation of a portion of the Pinelands as the Pinelands National Reserve (Reserve).[513] The designation, codified in Section 502 of the National Parks and Recreation Act of 1978, designated boundaries for the Reserve, requested that New Jersey develop a comprehensive management plan for the Reserve, and provided funding for development of the management plan and purchase of lands within the Reserve. Section 502 required that the comprehensive management plan be developed by a 15 member group composed of seven members appointed by the Governor, one member from each of the seven counties located within the Reserve to be appointed by the governing body of the county, and one member appointed by the U.S. Secretary of the Interior. Section 502 also provided minimum criteria for development of the management plan.

New Jersey subsequently adopted the Pinelands Protection Act of 1979 (Act) to satisfy the requirements of Section 502. The Act created the Pinelands Commission (Commission) which consists of 15 members, appointed as described in Section 502. The commissioners are appointed for three year staggered terms and are not compensated for their service. The Act established goals and provided minimum criteria and procedures for development and adoption of the comprehensive management plan. The Pinelands Commission was charged with developing a comprehensive management plan for the entire Pinelands area, and was given authority to implement the plan and review and review and overrule local land use decisions which did not comply with the requirements of the plan. A major precept that gave rise to the creation of the Commission was that the Pinelands could be protected primarily within the existing framework of governmental authority if a regional perspective could be attained.

In developing the Pinelands Comprehensive Management Plan the values and functions of the Pinelands were evaluated on a regional scale, not simply as they appeared when each local government tried to consider its case alone. Development of the plan followed many of the steps which local governments currently follow in Florida, except it was done on a regional scale. For example, development of the plan included assessment of natural resources, development of goals consistent with the statute, and development of a land use strategy. After intense research by experts, the Pinelands was divided into eight areas of different land use capability. The comprehensive plan delineates these eight areas, allocates acceptable land uses for the areas, and establishes environmental standards. The eight areas

513. Section 502, Public Law 95-625 (Nov. 10, 1978), 92 Stat. 3467.

Map 4-2 New Jersey Pinelands



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are as follows: 1) Preservation Area, 2) Protection areas 3) Forest Areas, 4) Agricultural Production Areas, 5) Rural Development Areas, 6) Regional Growth Areas, 7) Pinelands Towns, 6) Military and Federal Installation Areas, and 8) Pinelands Villages. Through the designation of these areas the plan attempts to (a) protect undisturbed, or minimally disturbed areas by directing development away from the more sensitive resources and toward areas near existing settlements, and to (b) encourage agricultural and recreational uses of appropriate lands. The plan encourages agricultural and recreational uses. Map 4-2 illustrates the eight land use areas in the New Jersey Pinelands.

Regardless of location, every development must meet a set of performance standards relating to protection of the environment. Performance standards exist for water resources, wetlands, vegetation and wildlife, fire management, air quality, scenic resources, and historic, archeological and cultural preservation.

The plan contains a program to provide for transfer of density development rights on highly restricted land in the Preservation Area and the Agricultural Production Area. The landowner retains title to the land and is entitled to use land for any use allowed by the comprehensive plan. The development rights can be purchased by developers owning land in Regional Growth Areas and used to increase the densities at which they can build. The most significant authority given to the Commission is the power to review proposed development and to disapprove projects which fail to meet its standards. However, local governments whose regulations are in compliance with the Comprehensive Management Plan have primary responsibility for approving or denying development permits. This is similar to the procedure in the ACSC except that the commission, composed of local and state officials, serves the role of the DCA.

Constitutional Limitations of Regulatory Programs

New regulatory initiatives often prompt inquiries regarding the extent to which constitutional guarantees prohibiting the uncompensated expropriation of private property may limit implementation of new regulations. Few legal issues are as difficult as determining the boundary between the rights of private property owners and regulation for the protection of the public health, safety and welfare. The difficulty is compounded by the inability of the courts to establish any set formula for making such determinations and the importance of specific facts in deciding cases. Nevertheless, several general points can be made.

1. Regulation that substantially advances legitimate public interests is valid. The public has a legitimate interest in protecting water quality, water quantity, wildlife habitat and aesthetics. Penn Central Transp. Co. v. City of New York, 438 U.S. 104 (1978); Agins v. City of Tiburon, 447 U.S. 255 (1980); Graham v. Estuary Properties, 399 So.2d 1374 (Fla. 1981); Moviematic Industries Corp. v. Dade County, 349 So.2d 667 (Fla. 3d DCA 1977).

2. Regulation that is otherwise valid may impair recognized interests in real property to such an extent as to constitute a taking. First Evangelical Lutheran Church of Glendale v. Los Angeles, 107 S.Ct. 2378 (1987); Nollan v. California Coastal Commission, 107 S.Ct. 3141 (1987).

3. A taking will not be found merely because the regulation causes substantial diminution in value or denies the highest and best use of property. Keystone Bituminous Coal Ass'n v. DeBenedictus, 107 S.Ct. 1232 (1987); Graham v. Estuary Properties, 399 So.2d 1374 (Fla. 1981).

4. An owner must prove that all reasonable or economically viable uses have been denied to show a taking. Penn Central Transp. Co. v. City of New York, 438 U.S. 104 (1978).

5. The effect of regulation on the usefulness of a parcel as a whole must be analyzed. Id.

6. Transferable development rights can mitigate the economic effects of regulation and thus avoid a taking. Id.

7. A claim for taking is not ripe until appropriate permits and variances have been requested and denied. Williamson County Regional Planning Comm'n v. Hamilton Bank, 473 U.S. 172 (1985); U.S. v. Riverside Bayview Homes, 474 U.S. 121 (1985).

A recent decision by the First District Court of Appeal, illustrates most of these points. In Glisson v. Alachua County, 15 FLW D187 (Fla. 1st DCA 1990), the county had adopted specific development guidelines to implement a special study of the Cross Creek area. The county was concerned with protecting the rural and historic character of the area, as well as its water and wildlife resources. Limited development was encouraged in or adjacent to a Village Center or in "active use" zones. Wetlands, hammocks, eagle nests and other "exceptional uplands" were given special protection. Only minor accessory uses were permitted in wetlands. One unit per five acres could be constructed on designated exceptional uplands, but only one acre of the five could be used intensively; the remainder had to remain natural. Similarly, in the Village periphery, housing was limited to one acre out of five, clustered to preserve the most sensitive or unique areas. Active use within 750 feet of an eagle nest was prohibited, and all residential density within an additional 750 feet had to be transferred to contiguous property. A Transfer of Development Rights (TDR) system was also created to allow the transfer of density to appropriate urban clusters. Finally, there were provisions for variances.

The plaintiffs, all of whom owned land in the area, claimed the plan constituted a taking of their property without compensation or due process. None of them had applied for permits or variances. In rejecting this challenge to the facial validity of the regulations, the court held that the plan substantially advanced legitimate state interests in protection of the environment and preservation of historic areas. Because the plan allowed existing uses to continue and provided mechanisms for the transfer of development rights and variances, the court held the plan, on its face, did not deprive the landowners of all beneficial uses of their property.

Although the opinion left open the possibility of finding a taking if specific development plans were denied in the future, it did not encourage the plaintiffs. Regulations that allow existing uses to continue, the court held, are subject to less stringent review under Graham v. Estuary Properties, 399 So.2d 1374 (Fla. 1981). In Graham, the Supreme Court of Florida had sustained a regulation that reduced the amount of the property to be developed by one-half. On the basis of the record before it, the court stated, "even if a proposed development plan had been pursued to a final determination, it is arguable whether under Graham, appellants could show a sufficient diminution in value or loss of investment-backed expectations, to warrant a finding that the contested land use regulations are unreasonable, hence invalid." 15 FLW D190 778

Summary and Conclusions

An examination of efforts to protect the Wekiva, Myakka, Suwannee, and Econ Rivers reveals some strengths and weaknesses of various approaches to river basin protection. Similarities exist between the four river basins and the Green Swamp, although each of the basins has distinct characteristics and each is subject to different degrees of development pressure.

The Wekiva River Protection Act assigned primary responsibility for protecting the Wekiva River to local governments and the St. Johns River Water Management District. In addition, the East Central Florida Regional Planning Council and the Department of Community Affairs play an important role in reviewing comprehensive plans, land development regulations, and proposals for Developments of Regional Impact. The approach taken in the Wekiva Basin has a number of strengths. Authorizing the St. Johns River Water Management District, a regional agency, to adopt special regulations for the Wekiva Basin ensures that enumerated values will receive consistent consideration throughout the entire Basin. The use of

protection zones of constant width by the Water Management District ensures that District permitting criteria will be applied consistently throughout the Wekiva Basin, simplifies administration because it eliminates the need to map the entire basin, and provides applicants with easily determined zones with consistent boundaries. Furthermore, the width of the protection zone is based on scientific findings.

The Act unambiguously directs the Water Management District to establish protection zones and regulations to protect wetland and wetland dependent wildlife and other important habitat values, such as hydrology and water quantity. The Act removes any uncertainty as to the District's authority to regulate riparian habitat for the benefit of wetland and wetland dependent wildlife. Although this authority can be implied from general language in Chapter 373, the District had previously been reluctant to regulate riparian habitat without additional legislative direction. The Act made it clear that the Water Management District was authorized, and in fact mandated, to regulate riparian habitat, including riparian uplands, for the benefit of wetland and wetland dependent wildlife in the Wekiva Basin.

The Act authorized the Water Management District to adopt MSSW permitting thresholds which would prevent significant adverse affects to the river system. The District responded by lowering MSSW thresholds for systems within the Wekiva River Protection Area by over 75 percent. The effect of lowering thresholds is that now almost all development within the Wekiva River Protection Area has to obtain a MSSW permit from the Water Management District, thereby ensuring comprehensive application of the District's Wekiva Regulations.

The Act requires local governments within the Wekiva River Protection Area to undertake a number of planning and regulatory initiatives. Legislative enumeration of specific values and concerns which local governments must address ensures comprehensive and consistent regulation of the Wekiva River Protection Area. Local governments are well suited to participate in regulation of river systems because they typically regulate all forms of development and can often use existing development review mechanisms to implement new regulations.

Some potential problems and weaknesses with the approach taken in the Wekiva River Protection Act can also be identified. The legislation puts significant responsibility on local governments to do an effective job of protecting the river system when they may not have the money, resources, or inclination to do so. Local governments, charged with addressing the multiple and often conflicting needs of the electorate, may not be the best entities to make decisions regarding protection of limited and unique environmental systems such as rivers.

Individual local government plans and regulations may not result in a comprehensive and uniform protection of the resource. For example, legislative requirements that local governments in the Wekiva River Protection Area adopt setbacks from the river has resulted in Lake and Seminole counties adopting setbacks of 200 feet from the river, while Orange county has adopted a much wider setback of 500 feet from the landward edge of the river or connected wetlands. Similarly, Seminole County limits density on much of the land within the Wekiva River Protection Area to a maximum of one dwelling unit per acre, Orange County to one dwelling unit per five acres, and Lake County to one dwelling unit per 20 or 40 net acres.

Local governments need considerable time to develop and implement individual local government comprehensive plans and regulations. For example, Seminole and Orange Counties were able to develop plans and regulations relatively quickly, primarily because they already had some provisions in their comprehensive plans and some regulations which helped satisfy the requirements of the Act. However, it took Seminole County about six months and Lake County about one and one half years to adopt regulations for the Wekiva Basin. DCA has not approved the plans and regulations of either county at the time of this writing. The time delays were not that critical in Seminole County because the county had

a moratorium in place since 1972.[514] Furthermore, Orange County had very little land which was within the Area, and development pressure was relatively low in Lake County. However, Lake County permitted significant amounts of development after the passage of the Wekiva River Protection Act.

The rapid enactment of protection mechanisms is critical to the preservation of the Green Swamp, where many new large scale developments have recently been proposed. Significant acreages of sensitive and irreplaceable habitat may be lost in the time it takes to develop new land development regulations and agency rules. Governmental entities could greatly reduce the amount of unsuitable development by adopting interim regulations until new land development regulations and rules are developed.

Local government staff indicate it has been difficult to administer the Wekiva regulations. Local governments find it difficult to interpret what types of projects may be allowed within the Water Management District protection zones. The Water Management District lists some activities as presumed adverse, but reviews each project on a case by case basis. Accordingly, local governments are often unable to give applicants for development permits meaningful feedback until the Water Management District has reviewed the application. Local government staff indicate that an applicant may have to make five or six submittals per development.

The Wekiva legislation requires the Water Management District and local governments to protect aquatic and wetland dependent species, and habitat of endangered, threatened, or special concern species. However, the legislation fails to require protection of upland species of wildlife within the Wekiva Basin. While low density requirements may help preserve some upland habitat, there are no assurances that adequate upland habitat will be preserved in the future.

The Wekiva legislation fails to provide for setbacks from isolated wetlands within the Wekiva Basin. Studies indicate that isolated wetlands provide important habitat for certain species of wildlife and that upland buffers are needed to protect the water quality, water quantity, and habitat value of these wetlands.

The Myakka River plan contains similar recommendations to those of the Wekiva River Task Force and shares many of the same strengths and weaknesses. The plan recommends that the legislature require local governments to amend their comprehensive plans and adopt regulations to protect the river resources and the watershed. As with the Wekiva, amendment of comprehensive plans and regulations will be time consuming. The Plan also recommends that the Southwest Florida Water Management District adopt special MSSW permitting criteria for the Myakka Basin.

There are several important differences between the Myakka recommendations and regulation of the Wekiva Basin. The Myakka plan provides for an additional set of regulations to protect the river and adjoining wetlands by recommending that the Department of Natural Resources adopt regulations in addition to local government and water management regulations. Such an approach could provide significant protection for the Myakka River and Basin depending upon the strength of each regulatory entities' regulations.

The width of the Contiguous Zone appears to be based on aesthetics or convenience rather than scientific findings. While the width (200 feet) may be appropriate for portions of the river, there are no assurances that the zone will provide adequate habitat for wildlife species.

The Suwannee River Task Force findings and recommendations differ significantly from findings for the Wekiva and Myakka Rivers. The Suwannee Task Force found that existing local government

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514. Seminole County, Fla., Amendments to the Elements of the Seminole County Comprehensive Plan, Attachment 5 (Feb. 28, 1989).

comprehensive planning processes and SWIM programs were adequate to protect the natural resources of the Suwannee River system. While the Task Force recommended a number of guidelines, they did not recommend any additional legislation to ensure that protective measures are created or implemented. Furthermore, the Task Force recommended that a number of additional studies be conducted which could take considerable time.

The approach taken for the Wekiva River Basin appears to be appropriate for portions of the Green Swamp. A grant of additional legislative authority to the Water Management District would remove any uncertainty as to the District's authority to regulate uplands for the benefit of wildlife. Basin specific MSSW criteria could provide comprehensive and consistent protection for the rivers and associated ecosystems in the Green Swamp. Legislative directives requiring local governments to modify comprehensive plans and land development regulations would ensure that these actions are completed. The approach taken for the Wekiva Basin could be improved by providing more specificity in the enabling legislation, such as establishing a minimum buffer width which all local governments must adopt, defining what constitutes "rural character," and providing the Water Management Districts with authority to consider all species of wildlife when reviewing MSSW applications. In addition, a legislative directive requiring regulatory entities to adopt interim regulations would prevent adverse development while the entities are developing permanent regulations.

The regulatory efforts pertaining to the New Jersey Pinelands are particularly pertinent to the Green Swamp because of numerous similarities that exist between the two ecosystems. The Pinelands, like the Green Swamp, is a mosaic of different habitat types, including wetlands, uplands, rivers, and lakes, and contains a very large unpolluted aquifer. The region is an important aquifer recharge area of relatively low relief. The Pinelands was recognized early on as a resource of state and even national importance which warranted special consideration and protection. Agriculture and sand and gravel mining are important resources within the Pinelands. The Pinelands is largely rural in scope, containing large areas of relatively undisturbed natural habitat. The area, at the time of adoption of the comprehensive regulatory program, was subject to intense development pressure. There was significant local resistance to state imposed mandates and several previous regulatory efforts had failed. As with the Green Swamp area, the Pinelands is a complex interdependent natural system which defies traditional regulatory approaches.

Development of a comprehensive plan for the entire Green Swamp and establishment of a regional authority to implement the plan would resolve a number of deficiencies inherent in existing regulatory approaches. First, a comprehensive plan would ensure that the Green Swamp is managed from an ecosystem perspective rather than along jurisdictional lines. This is particularly important because the Green Swamp is a multi-jurisdictional resource, with many of its natural resource functions being shared by two or more jurisdictions. A comprehensive plan would identify areas of ecological importance and designate appropriate levels of development for those areas.

Second, a regional authority could ensure consistent application of the comprehensive plan. Existing regulations are applied at varying levels depending upon the inclination and economic resources of the particular implementing jurisdiction. This often results in inconsistent and haphazard protection of natural functions. A regional authority for the entire resource would eliminate these problems because final development review authority would reside in one reviewing body.

Third, a regional plan and development review authority would enable the cumulative adverse effects of development to be assessed for the entire Green Swamp. Existing agency regulatory programs do not track the overall effects of individual development activities on the natural resources of the Green Swamp. Local government perspectives are inherently limited by jurisdictional lines. Development of a regional plan with appropriate land use designations and monitoring mechanisms would enable the cumulative impacts of development to be determined.

Fourth, development of an effective regional plan and review authority could speed the way to de-designation as an ACSC. The ACSC program was intended to provide a temporary process which would be dissolved after local governments demonstrated that they had achieved state goals for protection of the resource. An effective regional plan and review authority would probably satisfy the concerns of the state and lead to de-designation.

Fifth, development of a comprehensive regional plan would not require a totally new planning effort because much of the background information already exists in individual local government comprehensive plans and regional and state regulatory agencies. In addition, there is a good likelihood that federal assistance could be obtained to help fund a planning effort.

Sixth, the combined resources of local governments and pertinent agencies working in a concerted fashion would enable the resource to be better protected. Existing individual regulatory entities in the Green Swamp often lack the economic resources and technical expertise to adequately consider and protect the natural resource of the Green Swamp. A regional authority which received funding from local, regional, state, and federal entities would have much greater economic and technical capability than existing entities.

Seventh, development of a regional plan and authority would broaden existing local government development review authority in the ACSC. Under the existing ACSC regulatory program, local governments make initial development review decisions, which are then subject to review and reversal by DCA. Under a regional plan and authority local governments would retain initial development review authority and would gain a degree of final development review authority by virtue of their representation on the regional authority. DCA would surrender its individual development review authority to the regional authority, but would retain general oversight authority.

Eighth, a regional authority, composed of representatives from multiple jurisdictions, would be less vulnerable to political pressure from influential parties. Less-than-stringent review of development proposals, liberal issuance of variances and special exceptions, and favors all work to undercut the effectiveness of regulatory programs. Similarly, political pressure often compromises the development of appropriate regulations. A regional body is inherently less susceptible to these types of pressure than individual local jurisdictions.

Development of a regional plan and authority also has some potential disadvantages for local governments. First, there would be some loss of local government planning autonomy. While local governments would retain initial development review authority and gain final development review authority, they would lose some planning authority because they would be bound by the regional comprehensive plan. However, there would be local government representation in the development of the regional plan.

Second, the regional plan and authority approach is unlikely to work unless it is mandatory. Similar efforts which have relied on voluntary compliance by local governments have generally not been effective.

Third, a regional plan and authority approach is only as good as the content of the comprehensive plan and the manner in which it is implemented. Therefore, significant state direction and oversight are critical in the early stages of the process. Once the mechanism is in place, only periodical state review should be necessary.

In conclusion, of the regulatory approaches discussed in this section, the New Jersey approach holds the greatest promise for comprehensive protection of the natural resource functions of the Green Swamp. While many elements in the other approaches are laudable, none provide the comprehensive protection and regional perspective of the New Jersey approach.

FINDINGS AND CONCLUSIONS

There are a number of regulations in place which offer varying degrees of protection for many of the unique and important functions of the Green Swamp. However, other than for hydrologic functions within the ACSC, the level of protection for the Green Swamp is no greater than for surrounding areas. The most obvious substantive deficiency in existing regulations involves consideration and protection of wildlife. Existing regulations provide limited consideration of wetland and wetland dependent species of wildlife and little or no consideration of upland species. The Principles for Guiding Development are general and vague and provide insufficient guidance for local governments. In addition, the scope of the Principles for Guiding Development is limited to consideration of hydrologic functions. Jurisdictions which lie outside the ACSC but within the Green Swamp are required to provide no special consideration of the Green Swamp, other than that normally required by the Growth Management Act.

In addition, inadequate coordination, implementation, and enforcement of existing regulations undercut the effectiveness of existing regulatory programs. Local governments continue to designate inappropriate land uses and intensities of use for areas within the Green Swamp. There is little or no coordination of planning or regulation between local governments with jurisdiction in the Green Swamp. Local governments continue to focus primarily on relationships between entities within a county and between the county and other agencies, rather than on relationships with adjacent jurisdictions, and therefore often fail to consider how activities within their jurisdiction affect other parts of the Green Swamp ecosystem. Existing regulatory programs also fail to assess the cumulative adverse effects of activities within the Green Swamp.

Local government planning and regulation of activities within the Green Swamp should improve as a result of the recent comprehensive plan update process. DCA has objected to a number of provisions in Lake and Polk Counties' plans. However, while the intergovernmental coordination element is intended to ensure coordination of regulatory activities, it is uncertain whether that mechanism will result in sufficient coordination to protect the natural resources of the Green Swamp. To date, there is no overall plan for management of the Green Swamp and neither the Growth Management Act or Chapter 380 requires development of such a plan.

The remainder of this section lists specific regulatory initiatives which, if implemented, could remedy many of the regulatory deficiencies identified in this chapter. In addition, the section discusses potential options to implement these regulatory initiatives. The discussion of implementing options is particularly important because the ultimate effectiveness of any new regulations or approaches will be seriously undercut if they are not implemented in a comprehensive, consistent, and thorough manner.

1. Substance of Principles for Guiding Development

DCA should amend The Principles for Guiding Development in the Green Swamp ACSC (Rule 28-26.003, FLA. ADMIN. CODE), to provide more guidance for local governments. The Principles should be more specific as to what is required of local governments and should reflect current technology and treatment methodologies regarding hydrologic resource protection. Existing guidelines are vague and provide little detail.

2. Substance and Scope of Statutory Green Swamp ACSC Designation

The statutory codification of the Green Swamp ACSC (Section 380.0551, FLORIDA STATUTES) does not provide specific focus as to the resources which should be protected in the Green Swamp. The existing rules developed pursuant to Section 380.0551 are based on a 1974 study which recommended that hydrologic resources of the Green Swamp be protected. Our 1992 study finds that there are multiple resource values in the Green Swamp which are important and unique, including, but not limited to hydrology, wildlife, wildlife habitat, wildlife corridors, recreation, aesthetics, and rare or unique habitat. Amendment of the enabling statute to specifically address these values would provide stronger authority and direction for adoption of appropriate rules. Accordingly, Section 380.0551 should be amended to

require protection of all important natural resource values of the Green Swamp. DCA should take the lead in pursuing legislative changes.

3. Scope of DCA Green Swamp ACSC Rule

The DCA rule establishing minimum standards for the Green Swamp ACSC (Chapter 28-26, FLORIDA STATUTES) focuses on protection of the hydrologic resources of the Green Swamp. However, our study finds that there are multiple important and unique resource values in the Green Swamp which should be protected. DCA should amend the rule to require local governments to protect other important natural resource values of the Green Swamp, including wildlife, wildlife habitat, wildlife corridors, recreation, aesthetics, and rare or unique habitat. While the rule could probably be broadened under existing statutory authority, it would be helpful to first amend Chapter 380.0551 as discussed above.

4. Developments of Regional Impact

Developments which substantially affect the citizens of more than one county (DRIs) are reviewed by local, regional, and state agencies to determine regional impacts of the development. Proposed DRIs are reviewed for consistency with local comprehensive plans and regulations, regional policies, and state guidelines and standards.

The regional importance and uniqueness of the Green Swamp warrants lowering of DRI thresholds. The potential is great for projects located near water resources in the Green Swamp to cause adverse affects to adjacent or downstream counties. Lowering of DRI thresholds would ensure comprehensive review of a greater number of projects. The Legislature directed the Governor and Cabinet to reduce DRI thresholds by 50% for significant portions of the Wekiva Basin.[515]

The Department of Community Affairs or the regional planning councils may petition the Governor and the Cabinet to decrease thresholds for DRI review.[516] The Governor and the Cabinet may decrease thresholds by up to 50%, subject to legislative approval.[517] Alternatively, the Legislature could direct the reduction of DRI thresholds by an appropriate percentage.

5. DCA Office in the Green Swamp ACSC

A persistent problem has been the lack of rigid and consistent oversight by DCA of the ACSC program in the Green Swamp. This is partially because DCA has no personnel located in the region. A DCA office in the region specifically charged with oversight of the Green Swamp ACSC program would enable DCA to more effectively oversee development within the Green Swamp ACSC. A DCA presence in the area might also enhance local government efforts and compliance.

6. Outstanding Florida Waters

Many of the surface waters in the Green Swamp are currently classified as Class III, which allows lowering of water quality below existing levels. A substantial degree of additional protection could be achieved by designating more or all of the surface waters of the Green Swamp as an Outstanding Florida Water (OFW).[518] New direct discharges to the OFW, and new indirect discharges that "significantly degrade" water quality, would be prohibited unless they would not lower ambient water quality and are in the public interest. To the extent discharges are regulated, further lowering of water quality could be prevented.

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515. FLA. STAT. § 369.307(2) (1991).

516. FLA. STAT. § 380.06(3) (1991).

517. *Id.* §§ 380.06(3)(c),(e).

518. FLA. STAT. § 403.061(27)(a) (1991); FLA. ADMIN. CODE Rules 17-4.242 (Sept., 1990), 17-302.700 (Oct., 1991).

Designation as an OFW also increases the stringency of dredge and fill permitting. Dredge and fill projects within an OFW (or significantly degrading it) must be "clearly in the public interest," as opposed to the more lenient general standard of "not contrary to the public interest."[519] In addition, more protective dredge and fill standards could be adopted specifically for the OFW by the Florida Department of Environmental Regulation. The Wetlands Protection Act gives DER authority to adopt "stricter permitting and enforcement provisions within Outstanding Florida Waters...."[520]

OFWs must be designated by the Environmental Regulation Commission (ERC) after a lengthy administrative process. The ERC must find the candidate waters are of "exceptional recreational or ecological importance" and that the "environmental, social, and economic benefits of the action outweigh the environmental, social, and economic costs."[521] The ERC recently voted to designate the Econ River as an OFW. The legislature could probably also designate an OFW.

7. DER Permitting and Enforcement Provisions

DER could adopt stricter permitting and enforcement provisions within the Green Swamp ACSC. The Wetlands Protection Act gives DER authority to adopt "stricter permitting and enforcement provisions within ... areas of critical state concern ... which provisions are not inconsistent with the applicable rules adopted for the management of such areas ...."[522] The provision provides DER with authority to adopt stricter rules for the Green Swamp ACSC provided the rules are consistent with other applicable rules of DER and the Governor and Cabinet.

8. WMD Regulations in the Green Swamp

WMD regulations should be amended to provide greater protection for the water resources of the Green Swamp by developing resource specific regulations which would apply to the portions of the Green Swamp within their jurisdiction. Chapter 373, Florida Statutes, grants the water management districts broad rule-making authority to protect water resources of the districts. Groundwater levels, minimum flows and levels, drainage characteristics, wetlands, and aquatic and wetland dependent wildlife are considered to be water resources of the districts. Specifically, WMDs should take the following actions:

> a) The Districts should establish lower MSSW permitting thresholds for the Green Swamp. This would result in a greater number of projects coming under water management district review. WMDs have adequate authority to adopt regionally specific regulations;[523]

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519. *But see* 1800 Atlantic Developers v. Department of Environmental Regulation, 552 So.2d 946 (Nov. 9, 1989), reversing Florida Keys Citizens Coalition v. 1800 Atlantic Developers, 8 FALR 5564 (Final Order) (Oct. 17, 1986).

520. FLA. STAT. § 403.912(1) (1991). Such authority also extends to aquatic preserves, areas of critical state concern, and areas subject to chapter 380 resource management plans. *Id.* Special criteria have been adopted for the Florida Keys under this authority (FLA. ADMIN. CODE Rule 17-312.400 - 17-312.470 (Oct., 1991).

521. FLA. ADMIN. CODE Rule 17-3.041(3),(5) (Oct., 1991).

522. FLA. STAT. § 403.912(1) (1991). The statute also provides authority for DER to adopt stricter permitting and enforcement provisions within "areas subject to chapter 380 resource management plans adopted by rule by the Administration Commission, when the plans for an area include waters that are partially identified as needing additional protection ..." *Id.*

523. St. Johns River Water Management District rules expressly state that the "Governing Board [of the District] may designate specific geographic areas within which [MSSW]...threshold volumes and areas [are] different from those [adopted for the entire regulatory area of the District]... (FLA.

b) The Districts should limit lowering of average wet season water tables and maintain pre-development runoff characteristics;

c) The Districts should provide for consideration of effects of stormwater treatment systems on wildlife;

d) By a certain time, the Districts should establish minimum flows for rivers and tributaries of the Green Swamp, taking into consideration effects on vegetation and wildlife. Chapter 373 mandates that the districts establish:

> (1) Minimum flow for all surface watercourses in the area. The minimum flow for a given watercourse shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area.
>
> (2) Minimum water level. The minimum water level shall be the level of ground water in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area.[524]

e) The Districts should establish buffer zones around rivers, lakes, and wetlands. Lands adjacent to the rivers, lakes, and wetlands of the Green Swamp are particularly critical for the preservation of water quality, water quantity, and wildlife. Creation of buffer zones around these areas could protect their resource value and enhance recreational and aesthetic opportunities.

Several alternatives exist for establishing and managing these buffer areas. Authority for the Districts to regulate riparian areas which provide habitat for aquatic and wetland dependent species can be implied from Chapter 373. Accordingly, under existing authority, the districts could create rules specific to the Green Swamp which establish buffer criteria under existing permitting programs. The St. Johns River Water Management District recently did this for the Econlockhatchee River in Central Florida.[525]

The districts could probably not regulate lands for the benefit of strictly upland species of wildlife without an additional grant of legislative authority. Although uplands and non-aquatic and non-wetland dependent species of wildlife within the 100-year floodplain are arguably related to the water resources of the district, the connection is tenuous. The legislature could probably grant the district authority to regulate for the benefit of certain upland species.

9. Agriculture and Silviculture

Agriculture and silviculture uses should continue to be regulated. These uses should be limited in certain areas and be required to follow new BMPs developed specifically for the Green Swamp. Specific statutory authorization to regulate agricultural and silvicultural activities within the Green Swamp would remove any uncertainty stemming from exemptions contained in Chapter 373, Florida Statutes. Agriculture and silviculture are discussed in greater detail in Chapter 3 of this report.

ADMIN. CODE Rule 40C-4.041(3)(a) (Oct., 1991)).

524. FLA. STAT. § 373.042 (1991); *See generally*, J. Wade & J. Tucker, *Legal and Policy Options to Minimize Adverse Effects of Mosquito Control and Surface Water Management Practices on Florida's Saltwater Fisheries* 136-146 (Final Report to Florida Sea Grant) (Sept. 6, 1991).

525. However, the St. Johns River Water Management District had previously declined to adopt similar regulations for the Wekiva Basin without an additional grant of legislative authority.

10. Local Government Regulation of Environmentally Sensitive Areas

Local governments should designate sensitive areas, not just wetlands, based on consideration of wildlife habitat value, wildlife corridor value, recreational value, scenic value, and unique or rare ecosystem value. Generally, undisturbed, or minimally disturbed areas should be protected by directing development away from the more sensitive areas and toward areas near existing development. A core area of the most sensitive land should be designated and protected. The core area recommended by this report crosses local government jurisdictional lines. The core area should be surrounded by appropriate uses which would not effect the integrity of the core area. The most intensive and environmentally detrimental uses should be directed toward existing development and away from the core area. Uses which cause significant adverse environmental effects should be entirely prohibited from the Green Swamp. Map 4-3 illustrates a conceptual core area for the Green Swamp.

Appropriate policies and laws to protect sensitive lands could be adopted and implemented through comprehensive plans and land development regulations. Local governments should utilize innovative devices to preserve sensitive areas such as clustering on non-sensitive portions of sites and Transferrable Development Rights (TDRs). Local governments should adopt ordinances to support and supplement WMD buffer zones along water bodies outside of the core area. Existing regulatory mechanisms could only provide adequate protection for the core area if local governments become much more active and cooperative in the planning and implementation of protective regulations. An alternative method would be to create one comprehensive management plan as discussed later in this section under Implementation Options.

11. Land Use Intensity in the Green Swamp ACSC

Local government future land use elements are required to designate appropriate uses and intensities of use for all areas within their jurisdiction. Many of the uses and intensities of use currently designated by local governments within the Green Swamp ACSC are inappropriate for protection of the Green Swamp. For example, local government residential densities of 1 dwelling unit per 5 acres are inappropriate for protection of many wildlife values. Local governments should designate lower densities and prohibit uses from the Green Swamp which would degrade the character and integrity of the natural resources of the area. High intensity industrial and commercial uses, and mid- and high-density residential uses, are generally not considered appropriate for environmentally sensitive areas.

12. Intergovernmental Coordination

Protection of a complex interconnected ecosystem such as the Green Swamp requires coordination of planning and regulation between all levels and jurisdictions of government. The intergovernmental coordination element in each local government's comprehensive plan is designed to ensure coordinated planning and regulation. Local governments within or adjacent to an ACSC are required to address how planning and development is consolidated between jurisdictions in the ACSC. However, currently, local governments and agencies are not meeting the requirements of this element. The requirements and enforcement of this element must be greatly strengthened. Alternatively, a new approach could be adopted. Rather than rely on each individual entity of government to plan and coordinate with all other individual entities of government, a better approach might be to have all of the entities cooperatively develop one comprehensive management plan for the entire Green Swamp. This approach is discussed later in this section under Implementation Options.

13. Local Governments outside the ACSC but within the Green Swamp

If the ACSC boundaries are not broadened to match the boundaries of the hydrologic Green Swamp, then local governments within or adjacent to the Green Swamp, but outside the ACSC, should amend their comprehensive plans to identify the Green Swamp as an environmentally sensitive area and should plan and regulate accordingly. Specifically, local governments should prevent all but very low intensity uses in the Green Swamp. Growth should be directed away from the Green Swamp. Management suggestions contained in Chapters 1 and 2 of this report should be implemented. Acquisition of appropriate areas should be pursued as discussed in Chapters 2 and 3 of this report. If a comprehensive

management plan is developed for the Green Swamp these local governments should be included in its development and implementation.

14. Interim Development Controls

Development pressure in the Green Swamp has increased dramatically within the past two years and there is a substantial likelihood that significant portions of the Green Swamp could be committed to development before necessary regulatory changes are made. Accordingly, interim development controls should be considered until new regulations are implemented.

Moratoria or "interim development controls" are generally considered to be valid, provided certain conditions are met.[526] First, the purpose must be valid. Allowing a local government to revise comprehensive plans or land development regulations is generally considered a valid purpose. Second, the local government must be acting in good faith to protect the effectiveness of its regulatory scheme and not merely to delay, and thus discourage development. The local government must be able to show that it is actively working to make the necessary revisions and expeditiously adopt them. Third, the local government must have been delegated the necessary authority and must follow the required procedures. In Florida, local governmental authority may be implied from home rule powers and the Local Government Comprehensive Planning and Land Development Regulation Act.[527] Finally, the ordinance cannot infringe upon such constitutional rights as due process, equal protection, and the "taking" clause.

There are several options for implementing interim development controls. A moratorium on the issuance of all development approvals within the Green Swamp could be instituted. This would be controversial and, unless necessary, should probably be avoided. A more limited option would be to adopt relatively general interim development regulations based on this report that would be applied on a case by case basis, pending the adoption of more detailed regulations. These regulations could be adopted by each individual local government within the Green Swamp, and could be incorporated into The Principles for Guiding Development. Certain regulations could be applicable to all development approvals within the Green Swamp, while others would only apply to developments within the core area. Such standards could probably be drafted and adopted as quickly as a comprehensive moratorium.

Consideration should also be given to the adoption of interim regulations by the Water Management Districts. The authority to adopt interim regulations could be implied from the general authority of the district to require MSSW permits.

Whether local governments or the district adopt interim controls, they may be challenged in judicial and administrative proceedings. Legislation authorizing interim regulations to be enforced pending the disposition of such challenges would be helpful.

15. Acquisition in the Green Swamp

In addition to development guidelines and suggestions for the reform of permitting programs, effective ecosystem management should include a program of acquisition. Candidate lands should be those that because of their location are important to the ecology of the area, or represent relatively intact examples of associations of ecosystems. Chapters 2 and 3 of this report discuss acquisition in greater detail.

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526. *See generally*, T. Roberts, *Interim Development Controls*, Ch. 22, 3 ROHAN, ZONING AND LAND USE CONTROLS (July 1989); P. Gougelman & T. Taub, *Moratoria and Interim Growth Management*, Ch. 5, FLORIDA BAR, ENVIRONMENTAL AND LAND USE LAW SECTION, FLORIDA ENVIRONMENTAL AND LAND USE LAW, Vol. II (July, 1989).

527. FLA. STAT. § 163.3202 (1991).

16. Regional Planning Council (RPC) Comprehensive Regional Policy Plans

RPCs should develop common management goals, policies, and objectives specific to the entire Green Swamp. These goals policies, and objectives should be included in the RPC's Comprehensive Regional Policy Plans. If a comprehensive plan approach is adopted for the Green Swamp, then the RPCs should have an active role in development of the plan.

17. Funding and Development of a Comprehensive Management Plan for the Green Swamp

Individual jurisdictions have compiled a significant amount of information regarding specific portions of the Green Swamp. To develop a comprehensive management plan for the entire Green Swamp, this information needs to be synthesized into one plan. In addition, there remains the need for additional information gathering, analysis, and planning. There are several federal programs which could assist in the development of a plan for the Green Swamp. An appropriate state agency (DER, DCA, WMD) should apply to EPA to obtain a watershed planning grant. Also, EPA's Advanced Identification of Wetlands program should be considered.

Implementation Options

The following options should be considered for implementation of the specific recommendations contained in this chapter.

1. Retain existing regulatory structure with an enhanced DCA presence. DCA has requested funding to open an office with two staff members dedicated to the Green Swamp ACSC. This could result in strengthened state oversight of local government implementation and enforcement of existing regulations. However, this option would not provide a comprehensive management program for the entire ecosystem.

2. Retain existing regulatory structure and recommend that local governments and state agencies adopt additional regulatory requirements. This approach could provide additional protection but would not provide a comprehensive management program for the entire ecosystem. This approach was used for the Econ River (discussed previously in this report) and could provide significant additional protection, but only if local government political will currently exists. The approach relies on the willingness of local governments and state agencies to voluntarily undertake new regulatory initiatives. For example, the St. Johns River Water Management District rule for the Econ was affected by the philosophy of the previous governor's administration. The current governor has requested that this rule be strengthened. A similar approach has been followed for the Suwannee River (discussed previously in this report) and to date little has happened.

3. Retain existing regulatory structure but place additional statutorily mandated requirements on local governments and state agencies. This is the approach followed for the Wekiva and Myakka Rivers (discussed previously in this report). This approach would require amendment of Chapters 373 and 380, or creation of a special act. Again, this approach could provide additional protection but would not provide a comprehensive management program for the entire ecosystem.

4. Make large bond issues and try to buy significant parts or all of the region. Public acquisition of lands can ensure that they are not developed in the future.

5. A final alternative for the Green Swamp is to provide for establishment of a regional authority or commission composed of representatives from local government and state agencies. The Commission would use existing comprehensive plans and land development regulations as the basis for development of a comprehensive management plan for the entire Green Swamp. The plan would provide for varying levels of regulation throughout the Green Swamp depending upon the sensitivity and public value of the natural resource involved.

A regional authority or commission with broad powers could be of great value in protecting the Green Swamp. Such an authority could develop a comprehensive management plan for the entire Green Swamp based on its values and functions as viewed on a regional scale, not simply as they appear to each individual local government considering its case alone. Natural resource features in the Green Swamp do not conform to political boundaries. Most regulatory programs in the Green Swamp do not consider how development in one area affects adjacent or nearby areas. For example, one jurisdiction might restrict development in an upland strand it has identified as an important wildlife corridor while an adjacent jurisdiction might allow more intensive uses in the same area, thereby diminishing the corridor value of the entire area. Similarly, most regulatory programs do not consider the cumulative effects of individual projects on the overall function and integrity of the ecosystem.

These problems could be remedied through development of one comprehensive plan for the entire Green Swamp which carefully evaluates natural resources and provides for appropriate levels of regulation depending upon the sensitivity and public value of the natural resource involved. Much of the background information needed to develop such a plan already exists in individual local government comprehensive plans. The plan should be developed by a balanced regional authority composed of representatives from each affected local government and state agency. Implementation of the plan could be through existing local government growth management programs. Oversight of local government implementation could be conducted by the regional authority or by DCA. Development and effective implementation of a comprehensive plan could provide the basis for de-designation of the Green Swamp as an ACSC. Authority for development of a comprehensive plan probably already exists in Chapter 380, although DCA might need to amend its rules. Amendment of Chapter 380 or creation of a new statute would probably be required if local government compliance with the plan was to be mandatory or if a regional authority was established with oversight authority.

Creation of a regional authority, a comprehensive management plan, and a mechanism to implement the plan, could be achieved in a number of ways:

a) The existing Resource Planning and Management Committee (RPMC) under ACSC chapter 380 could create a comprehensive management plan, or amend the legislation to provide for a Green Swamp Planning Authority. Local governments within the Green Swamp could then establish interlocal agreements that they will use the comprehensive management plan in reviewing development proposals within the Green Swamp. DCA would serve its current role;

b) The planning authority could be created as described above, and DCA could delegate its authority to review local government development permits to the authority. The legality of such a delegation would have to be assessed;

c) Chapter 380 could be amended to provide for creation of the planning authority, creation of a comprehensive management plan, and provide the planning authority with authority to review development permits within the Green Swamp Area;

d) A new statute could be adopted which creates a planning authority with authority to plan and review development, as was done in the New Jersey Pinelands.

The regional plan and authority approach has numerous advantages over the other implementing options discussed above. Most importantly, the approach would provide for comprehensive and consistent protection of the natural resources of the Green Swamp. Cumulative impacts of development in the Green Swamp could be evaluated and considered. Local governments would retain significant planning and regulatory authority while regional and state agencies would also play a prominent role. All of the important natural functions of the Green Swamp could be considered and protected. The approach could provide the impetus for de-designation of the Green Swamp ACSC and removal of individual permit review by DCA. The combined resources of the entities participating in the regional authority would provide

greater funding capability and technical expertise, so as to better protect the resource. The regional authority, composed of representatives from multiple jurisdictions, would be less vulnerable to political pressure from influential interests. The advantages and some disadvantages of a regional plan and authority approach are discussed in greater detail in the section of this chapter addressing the New Jersey Pinelands.

APPENDIX A

DESCRIPTIONS OF PLANT COMMUNITIES FOR LANDSAT HABITAT MAPPING

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Introduction

The purpose of this narrative is to define the plant communities or associations of community types that are being mapped statewide as part of the Florida Game and Freshwater Fish Commission's project to develop a comprehensive statewide habitat system for Florida. The mapping phase is a three-year effort that is being accomplished by the Office of Environmental Services Nongame Wildlife Section in cooperation with the Florida Department of Transportation.

The communities were grouped into categories following Hartman (1978), Kautz (1986), and various other sources listed in the bibliography. The final selection of plant community types or associations being mapped are based on: (1) their overall habitat importance to wildlife in the state; (2) the ability to accurately map these particular communities using digital image classification techniques associated with the Landsat thematic mapper; and (3) the ability to accomplish a statewide vegetation mapping effort as a three-year project. Appendix I contains an outline of the native plant communities together with their corresponding Landsat class numbers, and number order for color table construction.

A. Upland Plant Communities

1. Coastal Strand: The coastal strand occurs on well drained sandy soils and includes the typically zoned vegetation of the upper beach, nearby dunes, or coastal rock formations. This community generally occurs in a long, narrow band parallel to the open waters of the Atlantic Ocean or Gulf of Mexico, and along the shores of some saline bays or sounds in both north and south Florida. This community occupies areas formed along high energy shorelines, and is strongly affected by wind, waves, and salt spray. Vegetation within this community typically consists of low growing vines, grasses, and herbaceous plants with very few small trees or large shrubs. Pioneer or early successional herbaceous vegetation characterizes the foredune and upper beach, while a gradual change to woody plant species occurs in more protected areas landward. Typical plant species include beach morning glory, railroad vine, sea oats, saw palmetto, spanish bayonet, yaupon holly, wax myrtle, along with sea grape,cocoplum, and other tropicals in southern Florida. The coastal strand community only includes the zone of early successional vegetation which lies between the upper beach, and more highly developed communities landward. Adjacent or contiguous community types such as xeric oak scrubs, pinelands, or hardwood forests would therefore be classified and mapped respectively.

2. Dry Prairies: Dry prairies are large native grass and shrublands occurring on very flat terrain interspersed with scattered cypress domes and strands, bayheads, isolated freshwater marshes, and hardwood hammocks. This community is characterized by many species of grasses, sedges, herbs, and shrubs, including saw palmetto, fetterbush, staggerbush, tar flower, gallberry, blueberry, wiregrass, carpet grasses, and various bluestems. The largest areas of these treeless plains historically occurred just north of Lake Okeechobee, and they were subject to annual or frequent fires. Many of these areas have been converted to improved pasture. In central and south Florida, palmetto prairies, which consist of former pine flatwoods where the overstory trees have been thinned or removed, are also included in this category. These sites contain highly scattered pines which cover less than 10 to 15 percent of an area.

3. Pinelands: The pinelands category includes north and south Florida pine flatwoods, south Florida Pine rocklands, and commercial pine plantations. Pine flatwoods occur on flat sandy terrain where the overstory is characterized by longleaf pine, slash pine, or pond pine. Generally, flatwoods dominated by longleaf pine occur on well-drained sites, while pond pine is found in poorly drained areas, and slash pine occupies intermediate or moderately moist areas. The understory and groundcover within these three communities are somewhat similar and include several common species such as saw

palmetto, gallberry, wax myrtle, and a wide variety of grasses and herbs. Generally wiregrass and runner oak dominate longleaf pine sites, fetterbush and bay trees are found in pond pine areas, while saw palmetto, gallberry, and rusty lyonia occupy slash pine flatwoods sites. Cypress domes, bayheads, titi swamps, and freshwater marshes are commonly interspersed in isolated depressions throughout this community type, and fire is a major disturbance factor. An additional pine flatwoods forest type occurs in extreme south Florida on rocklands where the overstory is the south Florida variety of slash pine, and tropical hardwood species occur in the understory. Scrubby flatwoods is another pineland type which occurs on drier ridges, and on or near old coastal dunes. Longleaf pine or slash pine dominate the overstory, while the groundcover is similar to the xeric oak scrub community. Commercial pine plantations are also reluctantly included in the pinelands association. This class includes predominately planted slash pine, although longleaf pine and loblolly pine tracts also occur. Sandpine plantations, which have been planted on severely site prepared sandhill sites in the north Florida pandhandle, are also included in this category. An acceptable accurate separation of areas of densely stocked native flatwoods and older planted pine stands with a closed canopy was not consistently possible.

4.Sand Pine Scrub: Sand pine scrub occurs on extremely well-drained, sorted, sterile sands deposited along former shorelines and islands of ancient seas. This xeric plant community is dominated by an overstory of sand pine and has an understory of myrtle oak, Chapman's oak, sand-live oak, and scrub holly. Ground cover is usually sparse to absent, especially in mature stands, and rosemary and lichens occur in some open areas. Sites within the Ocala National Forest which have an overstory of direct seeded sand pine, and an intact understory of characteristic xeric scrub oaks, are also included in this category. Fire is an important ecological management tool, and commonly results in even-aged stands within regenerated sites. The distribution of this community type is almost entirely restricted to within the state of Florida.

5.Sandhill: Sandhill communities occur in areas of rolling terrain on deep, well-drained, white to yellow, sterile sands. This xeric community is dominated by an overstory of scattered longleaf pine, along with an understory of turkey oak and bluejack oak. The park-like ground cover consists of various grasses and herbs, including wiregrass, partridge pea, beggars tick, milk pea, queen's delight, and others. Fire is an important factor in controlling hardwood competition and other aspects of sandhill ecology. Although many of these sites throughout the state have been modified through the selective or severe cutting of longleaf pine, these areas are still included in the sandhill category.

6.Xeric Oak Scrub: Xeric oak scrub is a xeric hardwood community typically consisting of clumped patches of low growing oaks interspersed with bare areas of white sand. This community occurs on areas of deep, well-washed, sterile sands, and it is the same understory complex of scrubby oaks and other ground cover species that occurs in the sand pine scrub community. This condition frequently occurs when the short time periods between severe fires results in the complete removal of sand pine as an overstory species. Also included in this category are sites within the Ocala National Forest which have been clearcut, and are sometimes dominated during the first one to five years by the xeric oak scrub association. The xeric oak scrub community is dominated by myrtle oak, Chapman's oak, sand-live oak, scrub holly, scrub plum, scrub hickory, rosemary, and saw palmetto. Fire is important in setting back plant succession and maintaining viable oak scrubs.

7. Mixed Hardwood Pine Forests: This community is the southern extension of the Piedmont southern mixed hardwoods, and occurs mainly on the clay soils on the northern Pandhandle. Younger stands may be predominantly pines, while a complex of various hardwoods become co-dominants as the system matures over time through plant succession. The overstory consists of shortleaf and loblolly pine, American beech, mockernut hickory, southern red oak, water oak, American holly, and dogwood.

Also included in this category are other upland forests that occur statewide which contain a mixture of conifers and hardwoods as the co-dominant overstory component. These communities contain longleaf pine, slash pine, and loblolly pine in mixed association with live oak, laurel oak, and water oak, together with other hardwood species characteristic of the upland hardwood hammocks and forests class.

8. Hardwood Hammocks and Forests: This class includes the major upland hardwood associations that occur statewide on fairly rich sandy soils. Variations in species composition, and the local or spatial distributions of these communities are due in part to differences in soil moisture regimes, soil type, and geographic location within the state. The major variations within this association are mesic hammocks, xeric hammocks, coastal and hydric hammocks, and live oak or cabbage palm hammocks.

The mesic hammock community represents the climax vegetation type within many areas of northern and central Florida. Characteristic species in the extreme north include American beech, southern magnolia, Shumard oak, white oak, mockernut hickory, pignut hickory, sourgum, basswood, white ash, mulberry, and spruce pine. Mesic hammocks of the peninsula are less diverse due to the absence of hardwood species which are adapted to more northerly climates, and are characterized by laurel oak, hop hornbeam, blue beech, sweetgum, cabbage palm, American holly, and southern magnolia.

Xeric hammocks occur on deep, well-drained, sandy soils where fire has been absent for long periods of time. These open, dry hammocks contain live oak, sand-live oak, bluejack oak, blackjack oak, southern red oak, sand-post oak, and pignut hickory.

Coastal and hydric hammocks are relatively wet hardwood forests that are found between uplands and true wetlands. These sometimes seasonally wet forests are associated with some non-alluvial peninsula streams, scattered broad lowlands, and are also found in a narrow band along parts of the Gulf and Atlantic coasts where they often extend to the edge of coastal salt marshes. These communities contain water oak, red maple, Florida elm, cabbage palm, red cedar, blue-beech, and sweetgum. Live oak and cabbage palm hammocks are often found bordering large lakes and rivers, and are distributed throughout the prairie region of south central Florida and extend northward in the St. John's River basin. These communities may occur as mixed stands of oak and palm, or one of these species can completely dominate an area.

9. Tropical Hardwood Hammock: These upland hardwood forests occur in extreme south Florida and are characterized by tree and shrub species on the northern edge of a range which extends southward into the Caribbean. These communities are sparsely distributed along coastal uplands south of a line from about Vero Beach on the Atlantic coast to Sarasota on the Gulf coast. They occur on many tree islands in the Everglades and on uplands throughout the Florida Keys. This cold-intolerant tropical community has very high plant species diversity, sometimes containing over 35 species of trees and about 65 species of shrubs. Characteristic tropical plants include strangler fig, gumbo-limbo, mastic, bustic, lancewood, ironwoods, poisonwood, pigeon plum, Jamaica dogwood, and Bahama lysiloma. Live oak and cabbage palm are also sometimes found within this community. Tropical hammocks in the Florida keys may also contain several plants, including lignum vitae, mahogany, thatch palms, and manchineel, which are extremely rare within the United States.

B. Wetland Plant Communities

10. Coastal Salt Marshes: These herbaceous and shrubby wetland communities occur statewide in brackish waters along protected low energy estuarine shorelines of the Atlantic and Gulf coasts. The largest continuous areas of salt marsh occur north of the range of mangroves, and border tidal creeks, bays and sounds. Salt marshes are sometimes interspersed within mangrove areas, and also occur as a transition zone between freshwater marshes and mangrove forests such as in the Ten Thousand Islands area along the southwest Florida coast. Plant distribution within salt marshes is largely dependent on the degree of tidal inundation, and many large areas are completely dominated by one species. Generally, smooth cordgrass typically occupies the lowest elevations immediately adjacent to tidal creeks and pools, while black needlerush dominates less frequently inundated zones. The highest elevations form transitional areas characterized by glasswort, saltwort, saltgrass, sea ox-eye daisy, marsh elder, and saltbush. For the purposes of this project, cordgrass, needlerush, and transitional or high salt marshes are collectively mapped as this single category.

11. Freshwater Marsh and Wet Prairie: These wetland communities are dominated by a wide assortment of herbaceous plant species growing on sand, clay, marl, and organic soils in areas of variable water depths and inundation regimes. Generally, freshwater marshes occur in deeper, more strongly inundated situations and are characterized by tall emergents, and floating leafed species. Freshwater marshes occur within depressions, along broad, shallow lake and river shorelines, and are scattered in open areas within hardwood and cypress swamps. Also, other portions of freshwater lakes, rivers,

and canals which are dominated by floating-leaved plants such as lotus, spatterdock, duck weed, and water hyancinths are included in this category. Wet prairies commonly occur in shallow, periodically inundated areas and are usually dominated by aquatic grasses, sedges, and their associates. Wet prairies occur as scattered, shallow depressions within dry prairie areas and on marl prairie areas in south Florida. Also included in this category are areas in Southwest Florida with scattered dwarf cypress having less than 20 percent canopy coverage, and a dense groundcover of freshwater marsh plants. Marshes and wet prairies are dominated by various combinations of pickerel weed, sawgrass, maidencane, arrowhead, fire flag, cattail, spike rush, bulrush, white water lily, water shield, and various sedges. Many marsh or wet prairie types, such as sawgrass marsh or maidencane prairie, have been described and so-named based on their dominant plant species.

12. Cypress Swamp: These regularly inundated wetlands form a forested border along large rivers, creeks, and lakes, or occur in depressions as circular domes or linear strands. These communities are strongly dominated by either bald cypress or pond cypress, with very low numbers of scattered black gum, red maple, and sweetbay. Understory and ground cover are usually sparse due to frequent flooding but sometimes include such species as buttonbush, lizard's-tail, and various ferns.

13. Hardwood Swamp: These wooded wetland communities are composed of either pure stands of hardwoods, or occur as a mixture of hardwoods and cypress. This association of wetland-adapted trees occurs throughout the state on organic soils and forms the forested floodplains of non-alluvial rivers, creeks, and broad lake basins. Tree species include a mixed overstory containing black gum, water tupelo, bald cypress, dahoon holly, red maple, swamp ash, cabbage palm, and sweetbay.

14. Bottomland Hardwoods: These wetland forests are composed of a diverse assortment of hydric hardwoods which occur on the rich alluvial soils of silt and clay deposited along several Pandhandle rivers including the Apalachicola. These communities are characterized by an overstory that includes water hickory, overcup oak, swamp chestnut oak, river birch, American sycamore, red maple, Florida elm, bald cypress, blue beech, and swamp ash.

15. Bay Swamp: These hardwood swamps contain broadleaf evergreen trees that occur in shallow, stagnant drainages or depressions often found within pine flatwoods, or at the base of sandy ridges where seepage maintains constantly wet soils. The soils, which are usually covered by an abundant layer of leaf litter, are mostly acidic peat or muck which remain saturated for long periods but over which little water level fluctuation occurs. Overstory trees within bayheads are dominated by sweetbay, swamp bay, and loblolly bay. Depending on the location within the state, other species including pond pine, slash pine, blackgum, cypress, and Atlantic white cedar can occur as scattered individuals, but bay trees dominate the canopy and characterize the community. Understory and groundcover species may include dahoon holly, wax myrtle, fetterbush, greenbriar, royal fern, cinnamon fern, and sphagnum moss.

16. Shrub Swamp: Shrub swamps are wetland communities dominated by dense, low-growing, woody shrubs or small trees. Shrub swamps are usually characteristic of wetland areas that are experiencing environmental change, and are early to mid-successional in species complement and structure. These changes are a result of natural or man-induced perturbations due to increased or decreased hydroperiod, fire, clear cutting or land clearing, and siltation. Shrub swamps statewide may be dominated by one species, such as willow, or an array of opportunistic plants may form a dense, low canopy. Common species include willow, wax myrtle, primrose willow, buttonbush, and saplings of red maple, sweetbay, black gum, and other hydric tree species indicative of wooded wetlands. In northern Florida, some shrub swamps are a fire-maintained subclimax of bay swamps. These dense shrubby areas are dominated by black titi, swamp cyrilla, fetterbush, sweet pepperbush, doghhobble, large gallberry, and myrtle-leaf holly.

17. Mangrove Swamp: These dense, brackish water swamps occur along low-energy shorelines and in protected, tidally influenced bays of southern Florida. This community is composed of freeze-intolerant tree species that are distributed south of a line from Cedar Key on the Gulf coast to St. Augustine on the Atlantic coast. These swamp communities are usually dominated by red, black, and white mangroves that progress in a sere from seaward to landward areas, respectively, while buttonwood trees occur in areas above high tide. Openings and transitional areas in mangrove

swamps sometimes contain glasswort, saltwort, and other salt marsh species. All three major species of mangroves are mapped as a single class with no effort made to differentiate these species into separate zones.

C. Aquatic

18. Aquatic: This community is comprised of the open water areas of inland freshwater lakes, ponds, rivers and creeks, and the brackish and saline waters of estuaries, bays, tidal creeks, the Gulf of Mexico, and the Atlantic Ocean.

D. Disturbed Communities

19. Grassland: These are upland communities where the predominant vegetative cover is very low growing grasses and forbs on intensively managed sites such as improved pastures, lawns, golf courses, road shoulders, cemeteries, or weedy, fallow agricultural fields, etc. This very early successional category includes all sites with herbaceous vegetation during the time period between bare ground, and the shrub and brush stage.

20. Shrub and Brushland: This association includes a variety of situations where natural upland community types have been recently disturbed through clear-cutting commercial pinelands, land clearing, or fire, and are recovering through natural successional processes. This type could be characterized as an early condition of old field succession, and the community is dominated by various shrubs, tree saplings, and lesser amounts of grasses and herbs. Common species include wax myrtle, saltbush, sumac, elderberry, saw palmetto, blackberry, gallberry, fetterbush, staggerbush, broomsedge, dog fennel, together with oak, pine and other tree seedlings or saplings.

21. Exotic Plant Communities: Upland and wetland areas dominated by non-native trees that were planted or have escaped and invaded native plant communities. These exotics include melaleuca, Australian pine, Brazilian pepper, and eucalyptus.

22. Barren: This class includes highly reflective unvegetated areas such as roads, beaches, active strip mines, tilled agricultural sites, and cleared land on sandy soils. Unvegetated sites in urban areas which include rooftops of buildings, athletic fields, landfills, and parking lots, etc., are also included in this category. Vegetated tracts within urban areas are classified and mapped according to their predominate vegetation cover or plant community type.

Appendix I. Outline of plant communities for Landsat habitat mapping showing Landsat class numbers, and color table values.

	Landsat Class Number	Color Table Values (R-G-B)
A. Upland Plant Communities		
1. Coastal strand.....(CS)	1-10	255 190 190
2. Dry prairie.....(DP)	11-20	255 200 255
3. Pinelands.....(PL)	21-40	36 170 0
4. Sand pine scrub.....(SPS)	41-50	255 160 0
5. Sandhill.....(SH)	51-60	165 210 75
6. Xeric oak scrub.....(XOS)	61-70	255 0 0
7. Mixed hardwood pine forests.....(MHPF)	71-80	190 95 0
8. Hardwood hammocks and forests.....(UHF)	81-100	0 255 255
9. Tropical hardwood hammock.....(THH)	101-110	255 100 255
B. Wetland Plant Communities		
10. Coastal salt marshes.....(CSM)	111-130	30 170 220
11. Freshwater marsh and wet prairie...(FWM)	131-150	128 240 160
12. Cypress swamp.....(CSWP)	151-160	162 22 32
13. Hardwood swamp.....(HS)	161-170	195 165 110
14. Bay swamp.....(BS)	171-175	20 20 180
15. Shrub swamp.....(SS)	176-185	130 150 100
16. Mangrove swamp.....(MS)	186-195	131 131 45
17. Bottomland hardwoods.....(BHW)	196-205	255 100 110
C. Aquatic		
18. Open water.....(W)	206-215	0 0 0
D. Disturbed		
19. Grassland.....(G)	216-225	255 255 50
20. Shrub and brushland.....(SB)	226-235	185 185 185
21. Exotic plant communities.....(EXPC)	236-245	110 60 130
22. Barren.....(B)	246-255	255 255 255

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13. Hardwood swamp.....(HS)	161-170	195 165 110
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15. Shrub swamp.....(SS)	176-185	130 150 100
16. Mangrove swamp.....(MS)	186-195	131 131 45
17. Bottomland hardwoods.....(BHW)	196-205	255 100 110
C. Aquatic		
18. Open water.....(W)	206-215	0 0 0
D. Disturbed		
19. Grassland.....(G)	216-225	255 255 50
20. Shrub and brushland.....(SB)	226-235	185 185 185
21. Exotic plant communities.....(EXPC)	236-245	110 60 130
22. Barren.....(B)	246-255	255 255 255

APPENDIX B

Table B-1. Native fish species reported, or likely to be found, within the Green Swamp region.

FAMILY Scientific Name	Common Name
GARS	
Lepisisteus osseus	longnose gar
Lepisosteus platyrhincus	Florida gar
BOWFIN	
Amia calva	bowfin
EEL	
Anguilla rostrata	American eel
HERRING	
Dorosoma cepedianum	gizzard shad
Dorosoma petenense	threadfin shad
PIKES	
Esox americanus americanus	redfin pickerel
Esox niger	chain pickerel
CARPS AND MINNOWS	
Notemigonus crysoleucas	golden shiner
Notropis hypselopterus	sailfin shiner
Notropis chalybaeus	ironcolor shiner
Notropis petersoni	coastal shiner
Notropis maculatus	taillight shiner
SUCKERS	
Erimyzon sucetta	lake chubsucker
BULLHEAD CATFISHES	
Ictalurus catus	white catfish
Ictalurus natalis	yellow bullhead
Ictalurus nebulosus marmoratus	brown bullhead
Ictalurus punctatus	channel catfish
Noturus gyrinus	tadpole madtom
PIRATE PERCHES	
Aphredoderus sayanus	pirate perch

Table B-1. Fish species (continued).

FAMILY Scientific Name	Common Name
KILLIFISHES	
Lucania goodei	bluefin killifish
Leptolucania ommata	pygmy killifish
Fundulus seminolis	Seminole killifish
Fundulus chrysotus	golden topminnow
Fundulus lineolatus	lined topminnow
Jordanella floridae	flagfish
LIVEBEARERS	
Gambusia affinis holbrooki	eastern mosquitofish
Heterandria formosa	least killifish
Poecilia latipinna	sailfin molly
SILVERSIDES	
Labidesthes sicculus vanhyningi	Florida brook silverside
SUNFISHES	
Micropterus salmoides floridanus	Florida largemouth bass
Lepomis gulosus	warmouth
Lepomis punctatus punctatus	eastern spotted sunfish
Lepomis microlophus microlophus	eastern redear sunfish
Lepomis auritus	redbreast sunfish
Lepomis marginatus	dollar sunfish
Lepomis macrochirus purpurescens	eastern bluegill
Enneacanthus gloriosus	bluespotted sunfish
Pomoxis nigromaculatus	black crappie
Elassoma evergladei	Everglades pygmy sunfish
Elassoma okefenokee	Okefenokee pygmy sunfish
PERCHES	
Etheostoma fusiforme barratti	Florida swamp darter
CICHLIDS	
Tilapia aurea	blue tilapia

Sources: SWFWMD, 1985.
Barnett, 1972.

Table B-2. Native amphibians reported, or likely to be found, in the Green Swamp region.

Scientific Name	Common Name
FROGS AND TOADS	
Acris gryllus dorsalis	Florida cricket frog
Bufo quercicus	oak toad
Bufo terrestris	southern toad
Gastrophyrne carolinensis	eastern narrowmouth toad
Hyla chrysoscleis [a]	Cope's gray treefrog
Hyla cinerea	green treefrog
Hyla femoralis	pinewoods treefrog
Hyla gratiosa	barking treefrog
Hyla squirella	squirrel treefrog
Pseudacris crucifer bartramiana [a]	southern spring peeper
Pseudacris nigrita verrucosa	southern chorus frog
Pseudacris ocularis	little grass frog
Pseudacris ornata [a]	ornate chorus frog
Scaphiopus holbrookii holbrookii	eastern spadefoot toad
Rana areolata aesopus	Florida gopher frog
Rana catesbeiana	bullfrog
Rana grylio	pig frog
Rana utricularia	southern leopard frog
SALAMANDERS	
Amphiuma means	two-toed amphiuma
Desmognathus auriculatus	southern dusky salamander
Eurycea quadridigitata	dwarf salamander
Notophthalmus viridescens	spotted newt
Plethodon grobmani	Florida slimy salamander
Pseudobranchus axanthus	narrow-striped dwarf siren
Pseudobranchus striatus spheniscus [b]	slender dwarf siren
Siren intermedia intermedia	eastern lesser siren
Siren lacertina	greater siren

Table B-3. Native reptiles reported, or likely to be found, in the Green Swamp region.

Scientific Name	Common Name
CROCODILIANS	
Alligator mississippiensis	American alligator
TURTLES	
Apalone (=Trionyx) ferox	Florida softshell
Chelydra serpentina osceola	Florida snapping turtle
Clemmys guttata	spotted turtle
Deirochelys reticularia chrysea	Florida chicken turtle
Gopherus polyphemus	gopher tortoise
Kinosternon baurii	striped mud turtle
Kinosternon subrubrum steindachneri	Florida mud turtle
Pseudemys concinna suwanniensis	Suwannee cooter
Pseudemys floridana peninsularis	Florida cooter
Pseudemys nelsoni	Florida redbelly turtle
Sternotherus minor minor [a]	loggerhead musk turtle
Sternotherus odoratus	stinkpot
Terrapene carolina bauri	Florida box turtle
WORM LIZARDS	
Rhineura floridana	Florida worm lizard
LIZARDS	
Anolis carolinensis	green anole
Cnemidophorus sexlineatus sexlineatus	six-lined racerunner
Eumeces egregius onocrepis	peninsula mole skink
Eumeces fasciatus [a]	five-lined skink
Eumeces inexpectatus	southern five-lined skink
Eumeces laticeps	broadhead skink
Ophiosuarus attenuatus longicaudus	eastern slender glass lizard
Ophiosaurus compressus	island glass lizard
Ophiosaurus ventralis	eastern glass lizard
Sceloporus undulatus undulatus	southern fence lizard
Sceloporus woodi	Florida scrub lizard
Scinella laterale	ground skink

Table B-3. Reptiles (continued).

Scientific Name	Common Name
SNAKES	
Agkistrodon piscivorus conanti	Florida cottonmouth
Cemophora coccinea coccinea	Florida scarlet snake
Coluber constrictor priapus	southern black racer
Crotalus adamanteus	E. diamondback rattlesnake
Diadophis punctatus punctatus	southern ringneck snake
Drymarchon corais couperi	eastern indigo snake
Elaphe guttata guttata	corn snake
Elaphe obsoleta quadrivittata	yellow rat snake
Farancia abacura abacura	eastern mud snake
Heterodon platyrhinos	eastern hognose snake
Heterodon simus [a]	southern hognose snake
Lampropeltis getula	kingsnake
Lampropeltis triangulum elapsoides	scarlet kingsnake
Masticophis flagellum flagellum	eastern coachwhip
Micrurus fulvius fulvius	eastern coral snake
Nerodia fasciata pictiventris	Florida banded water snake
Nerodia floridana	Florida green water snake
Nerodia taxispilota	brown water snake
Opheodrys aestivus	rough green snake
Pituophis melanoleucus melanoleucas	Florida pine snake
Regina alleni	striped crayfish snake
Regina rigida rigida [a]	glossy crayfish snake
Rhadinaea flavilata	pine woods snake
Seminatrix pygaea	swamp snake
Sistrurus miliarus barbouri	dusky pygmy rattlesnake
Stilosoma extenuatum	short-tailed snake
Storeria dekayi victa	Florida brown snake
Storeria occipitomaculata obscura [a]	Florida redbelly snake
Thamnophis sauritus sackeni	peninsula ribbon snake
Thamnophis sirtalis sirtalis	eastern garter snake

[a] May occur in Green Swamp region, but confirmation is needed.
[b] Known from Green Swamp region, but occurrence in Polk County is unconfirmed.

Sources: SWFWMD 1985.
GFC, unpublished data. List covers area bounded generally by I-4 to the south, US 27 to the east, SR 50 to the north, and Dade City to the west.

Table B-4. Native bird species reported, or likely to be found, in the Green Swamp region.

Scientific Name	Common Name
GREBES	
Podilymbus podiceps	pied-billed grebe
CORMORANTS AND ANHINGAS	
Phalacrocorax auritus	double-crested cormorant
Anhinga anhinga	anhinga
LONG-LEGGED WADING BIRDS	
Botaurus lentiginosus	American bittern
Ixobrychus exilis	least bittern
Ardea herodias	great blue heron
Casmerodius albus	great egret
Egretta thula	snowy egret
Egretta caerulea	little blue heron
Egretta tricolor	tricolored heron
Bulbucus ibis	cattle egret
Butorides striatus	green-backed heron
Nycticorax nycticorax	black-crowned night heron
Nycticorax violaceus	yellow-crowned night heron
Eudocimus albus	white ibis
Plegadis falcinellus	glossy ibis
Mycteria americana	wood stork
DUCKS	
Aix sponsa[a]	wood duck
Anas crecca	green-winged teal
Anas fulvigula	mottled duck
Anas platyrhynchos	mallard
Anas discors[a]	blue-winged teal
Aythya collaris	ring-necked duck
Lophodytes cucullatus[a]	hooded merganser
Oxyura jamaicensis[a]	ruddy duck

Table B-4. Bird species (continued).

Scientific Name	Common Name
VULTURES, EAGLES, HAWKS, AND FALCONS	
Coragyps atratus	black vulture
Cathartes aura	turkey vulture
Pandion haliaetus	osprey
Elanoides forficatus	American swallow-tailed kite
Haliaeetus leucocephalus	bald eagle
Circus cyaneus	northern harrier
Accipiter striatus	sharp-shinned hawk
Accipiter cooperii	Cooper's hawk
Buteo lineatus	red-shouldered hawk
Buteo jamaicensis	red-tailed hawk
Buteo brachyurus	Short-tailed hawk
Falco sparverius sparverius[a]	American kestrel (migratory)
Falco sparverius paulus	southeastern American kestrel
Falco columbarius[a]	merlin
TURKEYS AND QUAIL	
Meleagris gallapavo	wild turkey
Colinus virginianus	northern bobwhite
RAILS AND CRANES	
Rallus elegans	king rail
Porphyrula martinica	purple gallinule
Gallinula choropus	common moorhen
Fulica americana	American coot
Aramus guarauna	limpkin
Grus canadensis[a]	sandhill crane (migratory)
Grus canadensis pratensis	Florida sandhill crane

Table B-4. Bird species (continued).

Scientific Name	Common Name
SHOREBIRDS	
Charadrius vociferus	killdeer
Himantopus mexicanus	black-necked stilt
Tringa melanoleuca[a]	greater yellowlegs
Tringa flavipes[a]	lesser yellowlegs
Tringa solitaria[a]	solitary sandpiper
Actitis macularia[a]	spotted sandpiper
Calidris mauri[a]	western sandpiper
Calidris minutella[a]	least sandpiper
Calidris melanotos[a]	pectoral sandpiper
Gallinago gallinago[a]	common snipe
Scolopax minor[a]	American woodcock
Sterna antillarum	least tern
Rhynchops niger	black skimmer
DOVES	
Zenaida asiatica	white-winged dove
Zenaida macroura	mourning dove
Columbina passerina	common ground dove
CUCKOOS	
Coccyzus americanus	yellow-billed cuckoo
OWLS	
Tyto alba	common barn owl
Otus asio	eastern screech owl
Bubo virginianus	great horned owl
[illegible]thene cunicularia	burrowing owl
[illegible]rix varia	barred owl
SUCKERS	
Chordeiles minor	common nighthawk
Caprimulgus carolinensis	chuck-will's widow
Caprimulgus vociferus[a]	whip-poor-will

Table B-4. Bird species (continued).

Scientific Name	Common Name
SWIFTS AND HUMMINGBIRDS	
Chaetura pelogica	chimney swift
Archilochus colubris	ruby-throated hummingbird
KINGFISHERS	
Ceryle alcyon	belted kingfisher
WOODPECKERS	
Melanerpes erythrocephalus	red-headed woodpecker
Melanerpes carolinus	red-bellied woodpecker
Sphyrapicus varius[a]	yellow-bellied sapsucker
Picoides pubescens	downy woodpecker
Picoides villosus	hairy woodpecker
Colaptus auratus	northern flicker
Dryocopus pileatus	pileated woodpecker
PASSERINE (PERCHING) BIRDS	
Contopus virens[a]	eastern wood-pewee
Epidonax virescens	Acadian flycatcher
Sayornis phoebe[a]	eastern phoebe
Myiarchus crinitus	great crested flycatcher
Tyrannus tyrannus	eastern kingbird
Tyrannus vericalis[a]	western kingbird
Progne subis	purple martin
Tachycineta bicolor[a]	tree swallow
Stelgidopteryx serripennis	northern rough-winged swallow
Riparia riparia[a]	bank swallow
Hirundo rustica[a]	barn swallow
Cyanocitta cristata	blue jay
Aphelocoma coerulescens coerulescens	Florida scrub jay
Corvus brachyrhynchos	American crow
Corvus ossifragus	fish crow
Parus carolinensis	Carolina chickadee
Parus bicolor	tufted titmouse
Sitta pusilla	brown-headed nuthatch
Thyrothorus ludovicianus	Carolina wren
Troglodytes aedon[a]	house wren
Cistothorus platensis[a]	sedge wren
Regulus calendula[a]	ruby-crowned kinglet

Table B-4. Bird species (continued).

Scientific Name	Common Name
PASSERINE (PERCHING) BIRDS (continued)	
Polioptila caerula	blue-gray gnatcatcher
Sialia sialis	eastern bluebird
Catharus fuscescens[a]	veery
Catharus ustulatus[a]	Swainson's thrush
Catharus guttatus[a]	hermit thrush
Hylocichla mustelina[a]	wood thrush
Turdus migratorius[a]	American robin
Dumetella carolinensis[a]	gray catbird
Mimus polyglottos	northern mockingbird
Toxostoma rufum	brown thrasher
Anthus spinoletta[a]	water pipit
Bombycilla cedrorum[a]	cedar waxwing
Lanius ludovicianus	loggerhead shrike
Vireo griseus	white-eyed vireo
Vireo solitarius[a]	solitary vireo
Vireo flavifrons	yellow-throated vireo
Vireo olivaceus	red-eyed vireo
Vermivora pinus[a]	blue-winged warbler
Vermivora chrysoptera[a]	golden-winged warbler
Vermivora peregrina[a]	Tennessee warbler
Parula americana	northern parula
Dendroica pennsylvanica[a]	chestnut-sided warbler
Dendroica coronata[a]	yellow-rumped warbler
Dendroica fusca[a]	Blackburnian warbler
Dendroica dominica[a]	yellow-throated warbler
Dendroica pinus	pine warbler
Dendroica discolor	prairie warbler
Dendroica palmarum[a]	palm warbler
Dendroica cerulea[a]	cerulean warbler
Mniotilta varia[a]	black-and-white warbler
Setophaga ruticilla[a]	American redstart
Prothonotaria citrea	prothonotary warbler
Seiurus aurocapillus[a]	ovenbird
Seiurus motacilla[a]	Louisiana waterthrush
Oporornis formosus[a]	Kentucky warbler
Oporornis agilis[a]	Connecticut warbler
Geothlypis trichas	common yellowthroat
Wilsonia citrina	hooded warbler

Table B-4. Bird species (continued).

Scientific Name	Common Name
PASSERINE (PERCHING) BIRDS (continued)	
Piranga rubra	summer tanager
Cardinalis cardinalis	northern cardinal
Guiraca caerulea	blue grosbeak
Pipilo erythrophthalmus	rufous-sided towhee
Aimophila aestivalis	Bachman's sparrow
Spizella passerina[a]	chipping sparrow
Spizella pusilla[a]	field sparrow
Pooecetes gramineus[a]	vesper sparrow
Passerculus sandwichensis[a]	savannah sparrow
Ammodramus savannarum	grasshopper sparrow
Melospiza georgiana[a]	swamp sparrow
Agelaius phoeniceus	red-winged blackbird
Sturnella magna	eastern meadowlark
Euphagus carolinus[a]	rusty blackbird
Quiscalus major	boat-tailed grackle
Quiscalus quiscalus	common grackle
Molothrus ater	brown-headed cowbird
Carduelis tristis[a]	American goldfinch

[a] Winter migrants, do not nest in the Green Swamp.

Sources: SWFWMD, 1985.
Breeding Bird Atlas data, 1990-1991.

Table B-5. Native mammal species reported, or likely to be found, within the Green Swamp region.

Scientific Name	Common Name
MARSUPIALS	
Didelphis marsupialis	Virginia opossum
INSECTIVORES	
Sorex longirostris	southeastern shrew
Blarina carolinensis [a]	southern short-tailed shrew
Cryptotis parv [a]	least shrew
Scalopus aquaticus	eastern mole
BATS	
Myotis austroriparius [a]	southeastern bat
Pipistrellus subflavus [a]	eastern pipistrelle
Plecotus rafinesquii	southeastern (Rafinesque's) big-eared bat
Eptesicus fuscus [a]	big brown bat
Lasiurus borealis [a]	red bat
Lasiurus seminolus [a]	Seminole bat
Lasiurus intermedius [a]	yellow bat
Nycticeius humeralis [a]	evening bat
Tadarida brasiliensis [a]	Brazilian free-tailed bat
EDENTATES	
Dasypus novemcinctus	nine-banded armadillo
LAGOMORPHS	
Sylvilagus floridanus	eastern cottontail
Sylvilagus palustris	marsh rabbit

Table B-5. Mammal species (continued).

Scientific Name	Common Name
RODENTS	
Sciurus carolinensis	gray squirrel
Sciurus niger shermani	Sherman's fox squirrel
Glaucomys volans	southern flying squirrel
Geomys pinetis	southeastern pocket gopher
Neotoma floridana	eastern wood rat
Sigmodon hispidus	hispid cotton rat
Reithrodontomys humulis [a]	eastern harvest mouse
Oryzomys palustris	marsh rice rat
Podomys floridanus	Florida mouse
Peromyscus polionotus [a]	oldfield mouse
Peromyscus gossypinus	cotton mouse
Ochrotomys nuttalli	golden mouse
Neofiber alleni	round-tailed muskrat
CARNIVORES	
Ursus americanus	black bear
Procyon lotor	raccoon
Mustula frenata	long-tailed weasel
Mephitis mephitis [a]	striped skunk
Spilogale putorius [a]	eastern spotted skunk
Lutra canadensis	river otter
Urocyon cinereoargenteus	gray fox
Vulpes vulpes	red fox
Canis latrans	coyote
Lynx rufus	bobcat
UNGULATES	
Sus scrofa	wild pig
Odocoileus virginianus	white-tailed deer

[a] Occurrence in Green Swamp region possible, but unconfirmed by available sources.

Sources: SWFWMD, 1985.
GFC, 1987.
Layne, 1978.
Wooding and Hardisky, 1990.

APPENDIX C

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Table D-1. Wildlife species' use of feeding and breeding zones (guilds) within the **XERIC SCRUB** habitats in the Green Swamp area. Migratory species that do not breed in the Green Swamp are excluded.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Tree canopy	
		Cooper's Hawk
		American Swallow-tailed Kite
		Yellow-billed Cuckoo
		Blue Jay
		Eastern Kingbird
		Pine Warbler
		Evening Bat
		Eastern Pipistrelle Bat
		Refineque's Big-eared Bat
		Brazilian Free-tailed Bat
Tree canopy	Tree bole	
		Tufted Titmouse
		Chimney Swift
		Great Crested Flycatcher
Tree canopy	Ground surface	
		Chuck-will's-widow
		Common Nighthawk
		Northern Rough-winged Swallow
Tree bole	Tree bole	
		Red-bellied Woodpecker
		Red-headed Woodpecker
		Downy Woodpecker
		Hairy Woodpecker
Tree bole	Breeds in other habitat	
		Squirrel Treefrog
		Pinewoods Treefrog
		Barking Treefrog
		Pileated Woodpecker
Shrubs or grasses	Tree bole	
		Carolina Chickadee
Shrubs or grasses	Shrubs or grasses	
		White-eyed Vireo
		Palm Warbler

Shrubs or grasses	Ground surface	Rough Green Snake Green Anole Southern Fence Lizard
Ground surface	Tree canopy	Loggerhead Shrike American Crow Mourning Dove Great horned Owl Red-tailed Hawk
Ground surface	Tree bole	Eastern Screech Owl Common Flicker Southeastern American Kestrel Southern Flying Squirrel Gray Squirrel Sherman's Fox Squirrel Opossum Raccoon Gray Fox
Ground surface	Shrubs or grasses	Florida Scrub Jay Northern Mockingbird Northern Cardinal
Ground surface	Ground surface	Florida Worm Lizard Peninsula Mole Skink Six-lined Racerunner Short-tailed Snake Killdeer Wild Turkey Burrowing owl Common Ground Dove Rufus-sided Towhee Northern Bobwhite Eastern Coral Snake Cotton Mouse Florida Mouse Hispid Cotton Rat Eastern Mole Eastern Slender Glass Lizard Ground Skink SE Five-lined Skink Gopher Tortoise SE Pocket Gopher Nine-banded Armadillo Eastern Hognose Snake Striped Skunk

Ground surface	Ground surface (continued)	
		Long-tailed Weasel
		Scarlet Kingsnake
		Florida Scarlet Snake
		Southern Black Racer
		Eastern Coachwhip
		Corn Snake
		Florida Pine Snake
		Pine woods Snake
		Kingsnake
		Eastern Diamondback Rattlesnake
		Eastern Indigo Snake
		Florida Box Turtle
		Eastern Spotted Skunk
		Bobcat
		White-tailed Deer
		Wild Boar
		Red Fox
Ground surface	Breeds in other habitat	
		Oak Toad
		Southern Toad
		Florida Gopher Frog
		Eastern Narrowmouth Toad
		Eastern Spadefoot Toad
		Cattle Egret
		Turkey Vulture
		Black Vulture
		Sandhill Crane
Feeds in other habitat	Tree canopy	
		Bald Eagle
Feeds in other habitat	Tree bole	
		Purple Martin Swallow
Feeds in other habitat	Ground surface	
		Florida Chicken Turtle
		Peninsula Cooter
		Florida Redbelly Turtle
		Striped Mud Turtle
		Florida Mud Turtle
		Loggerhead Musk Turtle
		Stinkpot
		Florida Softshell Turtle
		Belted Kingfisher

Table D-2. Wildlife species' use of feeding and breeding zones (guilds) within the **FLATWOODS** habitats in the Green Swamp area. Migratory species that do not breed in the Green Swamp are excluded.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Tree canopy	
		Yellow-billed Cuckoo
		Summer Tanager
		American Swallow-tailed Kite
		Cooper's Hawk
		Yellow-throated Warbler
		Blue Jay
		Eastern Kingbird
		Pine Warbler
		Eastern Pipistrelle Bat
		Big Brown Bat
		Brazilian Free-tailed Bat
		Evening Bat
		Refinesque's Big-eared Bat
Tree canopy	Tree bole	
		Chimney Swift
		Tufted Titmouse
		Brown-headed nuthatch
		Great Crested Flycatcher
Tree canopy	Ground surface	
		Chuck-will's-widow
		Common Nighthawk
		Northern Rough-winged Swallow
Tree bole	Tree bole	
		Red-bellied Woodpecker
		Red-headed Woodpecker
		Downy Woodpecker
		Hairy Woodpecker
Tree bole	Ground surface	
		Yellow Rat Snake

Tree bole	Breeds in other habitat	
		Green Treefrog
		Pinewoods Treefrog
		Squirrel Treefrog
		Pileated Woodpecker
Shrubs or grasses	Tree canopy	
		Blue-gray Gnatcatcher
Shrubs or grasses	Tree bole	
		Carolina Chickadee
		Carolina Wren
Shrubs or grasses	Shrubs or grasses	
		Blue Gosbeak
		Palm Warbler
		White-eyed Vireo
		Ruby-throated Hummingbird
Shrubs or grasses	Ground surface	
		Common Yellowthroat
		Bachman's Sparrow
		Rough Green Snake
		Green Anole
Shrubs or grasses	Breeds in other habitat	
		Little Grass Frog
		Florida Chorus Frog
Ground surface	Tree canopy	
		Loggerhead Shrike
		Short-tailed Hawk
		Barred Owl
		Boat-tailed Grackle
		Fish Crow
		Cattle Egret
		American Crow
		Common Grackle
		Mourning Dove
		Great horned Owl
		Red-tailed Hawk

Ground surface	Tree bole	Common Flicker
		Common Barn Owl
		Eastern Screech Owl
		Eastern Bluebird
		Southeastern American Kestrel
		Gray Squirrel
		Southern Flying Squirrel
		Sherman's Fox Squirrel
		Opossum
		Raccoon
		Gray Fox
Ground surface	Shrubs or grasses	Northern Mockingbird
		Brown Thrasher
		Brown-headed Cowbird
		Northern Cardinal
Ground surface	Ground surface	Six-lined Racerunner
		Short-tailed Snake
		Wild Turkey
		Black Vulture
		Turkey Vulture
		Common Ground Dove
		Rufus-sided Towhee
		Northern Bobwhite
		Eastern Coral Snake
		Florida Brown Snake
		Cotton Mouse
		Eastern Mole
		Ground Skink
		SE Five-lined Skink
		Gopher Tortoise
		Eastern Cottontail Rabbit
		Nine-banded Armadillo
		Eastern Hognose Snake
		Striped Skunk
		Long-tailed Weasel
		Scarlet Kingsnake
		Florida Scarlet Snake
		Southern Black Racer
		Southern Ringneck Snake
		Eastern Coachwhip
		Corn Snake
		Florida Pine Snake
		Pine woods Snake
		Kingsnake
		Dusky Pigmy Rattlesnake
		Eastern Diamondback Rattlesnake
		Eastern Indigo Snake

Ground surface	Ground surface (continued)	
		Florida Box Turtle
		Killdeer
		Burrowing Owl
		Eastern Meadowlark
		Bobcat
		Least Shrew
		White-tailed Deer
		Florida Mouse
		Hispid Cotton Rat
		Eastern Spotted Skunk
		Wild Boar
		Red Fox
Ground surface	Breeds in other habitat	
		Oak Toad
		Southern Toad
		Eastern Narrowmouth Toad
		Eastern Spadefoot Toad
		Florida Gopher Frog
		Southern Leopard Frog
		Southern Dusky Salamander
		Dwarf Salamander
		Slimy Salamander
		Red-shouldered Hawk
		Sandhill Crane
Feeds in other habitat	Tree canopy	
		Great Blue Heron
		Great Egret
		Little Blue Heron
		Snowy Egret
		Tricolored Heron
		Black-crowned Night Heron
		Yellow-crowned Night Heron
		White Ibis
		Wood Stork
		Bald Eagle
		Osprey
Feeds in other habitat	Tree bole	
		Wood Duck
		Purple Martin Swallow

Feeds in other habitat	Ground surface	Florida Snapping Turtle Florida Chicken Turtle Peninsula Cooter Florida Redbelly Turtle Striped Mud Turtle Florida Mud Turtle Loggerhead Musk Turtle Stinkpot Florida Softshell Turtle Eastern Mud Snake South Florida Swamp Snake Peninsula Ribbon Snake Florida Cottonmouth Belted Kingfisher

Table D-3. Wildlife species' use of feeding and breeding zones (guilds) within the **HARDWOOD HAMMOCK** habitats in the Econlockhatchee River Basin. Migratory species that do not breed in the Green Swamp are excluded.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Tree canopy	Cooper's Hawk American Swallow-tailed Kite Summer Tanager Yellow-billed Cuckoo Yellow-throated Warbler Red-eyed Vireo Acadian Flycatcher Yellow-throated Vireo Blue Jay Northern Parula Warbler Eastern Pipistrelle Bat Big Brown Bat Brazilian Free-tailed Bat Evening Bat Red Bat Refinewque's Big-eared Bat Yellow Bat
Tree canopy	Tree bole	Tufted Titmouse Chimney Swift Great Crested Flycatcher
Tree canopy	Ground surface	Chuck-will's-widow Common Nighthawk Northern Rough-winged Swallow
Tree bole	Tree bole	Red-bellied Woodpecker Red-headed Woodpecker Downy Woodpecker Hairy Woodpecker
Tree bole	Ground surface	Yellow Rat Snake

Tree bole	Breeds in other habitat	
		Green Treefrog
		Pinewoods Treefrog
		Squirrel Treefrog
		Pileated Woodpecker
Shrubs or grasses	Tree canopy	
		Blue-gray Gnatcatcher
Shrubs or grasses	Tree bole	
		Carolina Chickadee
		Carolina Wren
Shrubs or grasses	Shrubs or grasses	
		Blue Gosbeak
		Palm Warbler
		White-eyed Vireo
		Ruby-throated Hummingbird
Shrubs or grasses	Ground surface	
		Common Yellow-throat
		Rough Green Snake
		Green Anole
		Southern Fence Lizard
Shrubs or grasses	Breeds in other habitat	
		Southern Spring Peeper
		Little Grass Frog
		Florida Chorus Frog
Ground surface	Tree canopy	
		Short-tailed Hawk
		Fish Crow
		Cattle Egret
		American Crow
		Common Grackle
		Mourning Dove
		Great Horned Owl
		Red-tailed Hawk
Ground surface	Tree bole	
		Common Flicker
		Eastern Screech Owl
		Common Barn Owl
		Barred Owl
		Eastern Bluebird
		Southern Flying Squirrel
		Gray Squirrel
		Opossum
		Raccoon
		Gray Fox

Ground surface	Shrubs or grasses	Northern Mockingbird Brown Thrasher Northern Cardinal
Ground surface	Ground surface	Florida Worm Lizard Short-tailed Snake Eastern Slender Glass Lizard Broadhead Skink Six-lined Racerunner Wild Turkey Black Vulture Turkey Vulture Common Ground Dove Rufus-sided Towhee Northern Bobwhite Eastern Coral Snake Florida Brown Snake Cotton Mouse Eastern Mole Ground Skink Slimy Salamander SE Five-lined Skink Gopher Tortoise SE Shrew Eastern Cottontail Rabbit Nine-banded Armadillo Eastern Hognose Snake Striped Skunk Long-tailed Weasel Eastern Garter Snake Scarlet Kingsnake Southern Black Racer Southern Ringneck Snake Corn Snake Kingsnake Eastern Diamondback Rattlesnake Eastern Indigo Snake Florida Box Turtle Bobcat Eastern Spotted Skunk White-tailed Deer Wild Boar Red Fox

Ground surface	Breeds in other habitat	
		Southern Toad
		Eastern Narrowmouth Toad
		Eastern Spadefoot Toad
		Southern Leopard Frog
		Southern Dusky Salamander
		Dwarf Salamander
		Peninsula Newt
		Red-shouldered Hawk
Feeds in other habitat	Tree canopy	
		Great Blue Heron
		Great Egret
		Little Blue Heron
		Snowy Egret
		Tricolored Heron
		Black-crowned Night Heron
		Yellow-crowned Night Heron
		White Ibis
		Wood Stork
		Bald Eagle
		Osprey
Feeds in other habitat	Tree bole	
		Wood Duck
		Purple Martin Swallow
Feeds in other habitat	Shrubs or grasses	
		Brown-headed Cowbird
Feeds in other habitat	Ground surface	
		American Alligator
		Florida Snapping Turtle
		Florida Chicken Turtle
		Peninsula Cooter
		Florida Redbelly Turtle
		Striped Mud Turtle
		Florida Mud Turtle
		Loggerhead Musk Turtle
		Stinkpot
		Florida Softshell Turtle
		Eastern Mud Snake
		South Florida Swamp Snake
		Peninsula Ribbon Snake
		Florida Cottonmouth
		Belted Kingfisher

Table D-4. Wildlife species' use of feeding and breeding zones (guilds) within the **CYPRESS SWAMP** habitats in the Green Swamp area. Migratory species that do not breed in the Green Swamp are excluded.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Tree canopy	Acadian Flycatcher Broad-winged Hawk American Swallow-tailed Kite Blue Jay Yellow-billed Cuckoo Blue-gray Gnatcatcher Yellow-throated Vireo Big Brown Bat Red Bat Yellow Bat Evening Bat Eastern Pipstrelle Bat Rafinesque's Big-eared Bat Brazilian Free-tailed Bat
Tree canopy	Tree bole	Chimney Swift Great Crested Flycatcher Purple Martin Swallow Tufted Titmouse
Tree canopy	Ground surface	Northern Rough-winged Swallow
Tree bole	Tree bole	Pileated Woodpecker Red-bellied Woodpecker Downy Woodpecker Hairy Woodpecker
Tree bole	Water column	Green Treefrog
Tree bole	Breeds in other habitat	Pinewoods Treefrog Barking Treefrog Squirrel Treefrog

Shrubs or grasses	Tree bole	Prothonotary Warbler Carolina Chickadee Carolina Wren
Shrubs or grasses	Shrubs or grasses	Hooded Warbler Ruby-throated Hummingbird White-eyed Vireo Palm Warbler
Shrubs or grasses	Ground surface	Common Yellowthroat
Shrubs or grasses	Water column	Southern Spring Peeper Florida Chorus Frog
Shrubs or grasses	Breeds in other habitat	Little Grass Frog Green Anole
Ground surface	Tree canopy	Red-shouldered Hawk
Ground surface	Tree bole	Barred Owl Eastern Screech Owl Opossum Southern Flying Squirrel Gray Squirrel Raccoon Gray Fox
Ground surface	Shrubs or grasses	Northern Cardinal
Ground surface	Ground surface	Eastern Garter Snake Southeastern Shrew
Ground surface	Water column	Southern Toad Florida Cricket Frog Bullfrog Southern Leopard Frog Southern Dusky Salamander Dwarf Salamander Peninsula Newt

Ground surface	Breeds in other habitat	
		Oak Toad
		Eastern Narrowmouth Toad
		Eastern Spadefoot Toad
		Florida Gopher Frog
		Florida Scarlet Snake
		Southern Ringneck Snake
		Yellow Rat Snake
		Eastern Mud Snake
		Kingsnake
		South Florida Swamp Snake
		Florida Brown Snake
		Central Florida Crowned Snake
		Peninsula Ribbon Snake
		Dusky Pigmy Rattlesnake
		Nine-banded Armadillo
		Long-tailed Weasel
		Bobcat
		White-tailed Deer
Water surface	Tree bole	
		Wood Duck
Water column	Tree canopy	
		Great Egret
		Snowy Egret
		White Ibis
		Little Blue Heron
		Great Blue Heron
		Tricolored Heron
		Black-crowned Night Heron
		Yellow-crowned Night Heron
		Wood Stork
Water column	Shrubs or grasses	
		Limpkin
		Green-backed Heron
		Anhinga
		Double-crested Cormorant
Water column	Ground surface	
		American Alligator
		Green Water Snake
		Brown Water Snake
		Striped Crayfish Snake
		River Otter

Water column	Water column	Two-toed Amphiuma Narrow-striped Dwarf Siren Eastern Lesser Siren Greater Siren
Water column	Breeds in other habitat	Florida Snapping Turtle Florida Chicken Turtle Peninsula Cooter Florida Redbelly Turtle Striped Mud Turtle Florida Mud Turtle Loggerhead Musk Turtle Stinkpot Florida Softshell Florida Cottonmouth Belted Kingfisher
Feeds in other habitat	Tree canopy	Cattle Egret Short-tailed Hawk Bald Eagle Osprey
Feeds in other habitat	Tree bole	Common Flicker
Feeds in other habitat	Shrubs or grasses	Brown-headed Cowbird

Table D-5. Wildlife species' use of feeding and breeding zones (guilds) within the **SWAMP HARDWOODS** habitats in the Green Swamp area. Migratory species that do not breed in the Green Swamp are excluded.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Tree canopy	Acadian Flycatcher American Swallow-tailed Kite Yellow-billed Cuckoo Northern Parula Warbler Red-eyed Vireo Blue-gray Gnatcatcher Yellow-throated Vireo Blue Jay Big Brown Bat Red Bat Yellow Bat Evening Bat Eastern Pipstrelle Bat Rafinesque's Big-eared Bat Brazilian Free-tailed Bat
Tree canopy	Tree bole	Chimney Swift Great Crested Flycatcher Purple Martin Swallow Tufted Titmouse
Tree canopy	Ground surface	Northern Rough-winged Swallow
Tree bole	Tree bole	Pileated Woodpecker Red-bellied Woodpecker Downy Woodpecker Hairy Woodpecker
Tree bole	Water column	Green Treefrog
Tree bole	Breeds in other habitat	Pinewoods Treefrog Barking Treefrog Squirrel Treefrog

Shrubs or grasses	Tree bole	Prothonotary Warbler Carolina Chickadee Carolina Wren
Shrubs or grasses	Shrubs or grasses	Hooded Warbler Ruby-throated Hummingbird White-eyed Vireo Palm Warbler
Shrubs or grasses	Water column	Southern Spring Peeper Florida Chorus Frog
Shrubs or grasses	Breeds in other habitat	Little Grass Frog Green Anole Rough Green Snake
Ground surface	Tree canopy	Red-shouldered Hawk Great Horned Owl Boat-tailed Grackle
Ground surface	Tree bole	Barred Owl Eastern Screech Owl Opossum Southern Flying Squirrel Gray Squirrel Raccoon Gray Fox
Ground surface	Shrubs or grasses	Northern Cardinal
Ground surface	Ground surface	Eastern Garter Snake Southeastern Shrew Slimy Salamander
Ground surface	Water column	Southern Toad Florida Cricket Frog Bullfrog Southern Leopard Frog Southern Dusky Salamander Dwarf Salamander Peninsula Newt Pig Frog

Ground surface	Breeds in other habitat	
		Oak Toad
		Eastern Narrowmouth Toad
		Broadhead Skink
		Ground Skink
		Florida Scarlet Snake
		Southern Black Racer
		Eastern Indigo Snake
		Southern Ringneck Snake
		Yellow Rat Snake
		Eastern Mud Snake
		Kingsnake
		South Florida Swamp Snake
		Florida Brown Snake
		Peninsula Ribbon Snake
		Eastern Coral Snake
		Dusky Pigmy Rattlesnake
		Wild Turkey
		Nine-banded Armadillo
		Long-tailed Weasel
		Bobcat
		White-tailed Deer
		Wild Boar
Water surface	Tree bole	
		Wood Duck
Water column	Tree canopy	
		Great Egret
		Snowy Egret
		White Ibis
		Little Blue Heron
		Great Blue Heron
		Tricolored Heron
		Black-crowned Night Heron
		Yellow-crowned Night Heron
		Wood Stork
Water column	Shrubs or grasses	
		Limpkin
		Green-backed Heron
		Anhinga
		Double-crested Cormorant
Water column	Ground surface	
		American Alligator
		Green Water Snake
		Brown Water Snake
		Striped Crayfish Snake
		River Otter

Water column	Water column	Two-toed Amphiuma Narrow-striped Dwarf Siren Eastern Lesser Siren Greater Siren
Water column	Breeds in other habitat	Florida Snapping Turtle Florida Chicken Turtle Peninsula Cooter Florida Redbelly Turtle Striped Mud Turtle Florida Mud Turtle Stinkpot Florida Softshell Florida Cottonmouth
Feeds in other habitat	Tree canopy	Cattle Egret Short-tailed Hawk Bald Eagle Osprey
Feeds in other habitat	Tree bole	Common Flicker
Feeds in other habitat	Shrubs or grasses	Brown-headed Cowbird

Table D-6. Wildlife species' use of feeding and breeding zones (guilds) within the **FRESHWATER MARSH AND RIVER** habitats in the Green Swamp area. Migratory species that do not breed in the Green Swamp are excluded.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Breeds in other habitat	American Swallow-tailed Kite Purple Martin Swallow Northern Rough-winged Swallow Big Brown Bat Red Bat Yellow Bat Evening Bat Eastern Pipstrelle Bat Rafinesque's Big-eared Bat Brazilian Free-tailed Bat
Tree bole	Breeds in other habitat	Pinewoods Treefrog Barking Treefrog Squirrel Treefrog
Shrubs or grasses	Shrubs or grasses	Palm Warbler Red-winged Blackbird
Shrubs or grasses	Ground surface	Common Yellowthroat
Ground surface	Tree bole	Opossum
Ground surface	Ground surface	Least Shrew Florida Box Turtle Northern Harrier Marsh Rabbit
Ground surface	Water surface	Sandhill Crane

Ground surface	Water column	
		Southern Toad
		Florida Cricket Frog
		Bullfrog
		Southern Leopard Frog
		Southern Dusky Salamander
		Dwarf Salamander
		Peninsula Newt
		Pig Frog
Ground surface	Breeds in other habitat	
		Oak Toad
		Eastern Mud Snake
		South Florida Swamp Snake
		Florida Brown Snake
		Peninsula Ribbon Snake
		Dusky Pigmy Rattlesnake
		Wild Boar
		Killdeer
		Fish Crow
		Raccoon
Water surface	Water surface	
		American Bittern
		Eastern Least Bittern
		American Coot
		Common Moorhen
		Purple Gallinule
		King Rail
		Round-tailed Muskrat
		Marsh Rice Rat
Water column	Tree canopy	
		Great Egret
		Snowy Egret
		White Ibis
		Little Blue Heron
		Great Blue Heron
		Tricolored Heron
		Black-crowned Night Heron
		Yellow-crowned Night Heron
Water column	Shrubs or grasses	
		Limpkin
		Green-backed Heron
		Doubel-crested Cormorant
		Anhinga

Water column	Ground surface	
		American Alligator
		Green Water Snake
		Brown Water Snake
		Florida Water Snake
		Striped Crayfish Snake
		River Otter
		Mottled Duck
		Mallard Duck
		Ring-necked Duck
		Black-necked Stilt
Water column	Water surface	
		Pied-billed Grebe
Water column	Water column	
		Two-toed Amphiuma
		Narrow-striped Dwarf Siren
		Eastern Lesser Siren
		Greater Siren
Water column	Breeds in other habitat	
		Florida Snapping Turtle
		Florida Chicken Turtle
		Peninsula Cooter
		Florida Redbelly Turtle
		Striped Mud Turtle
		Loggerhead Musk Turtle
		Florida Mud Turtle
		Stinkpot
		Florida Cottonmouth
		Wood Stork
		Wood Duck
		Bald Eagle
		Osprey
		Belted Kingfisher
Water bottom	Ground surface	
		Limpkin
Feeds in other habitat	Tree canopy	
		Cattle Egret
Feeds in other habitat	Water Column	
		Green Treefrog

APPENDIX E

January 10, 1992

WEST COAST REGIONAL WATER SUPPLY AUTHORITY

Ms. Ellen Hemmert, Manager
Green Swamp Task Force
330 W. Church Street
Bartow, FL 33830

Re: Proposed Cone Ranch Wellfield

Dear Ms. Hemmert:

As requested, the following information provides a brief description of the Cone Ranch property and its proposed use as a wellfield. As currently planned, Hillsborough County will continue to own and manage the Cone Ranch Wellfield property and the West Coast Regional Water Supply Authority (Authority) will own and operate the wellfield facilities.

The Cone Ranch property consists of 12,700 acres of land located in northeastern unincorporated Hillsborough County, north of SR 582 (Knights-Griffin Road), east of SR 39. The ranch was purchased by the Authority and transferred to Hillsborough County by interlocal agreement on February 17, 1988.

The agreement envisions development of the wellfield sometime after the year 2000, providing additional sufficient potable water resources for Hillsborough County residents well into the 21st century. No specific development schedule has been decided upon. The wellfield can potentially provide 30-35 million gallons per day (mgd) average day and 45-50 mgd maximum day from 25 wells, according to a 1987 report prepared by Leggette, Brashears and Graham, Inc. for the Authority entitled, Cone Ranch Property - Preliminary Assessment of Water-Supply Potential. Exact withdrawal amounts will be determined upon issuance of a Water Use Permit for the wellfield by the Southwest Florida Water Management District.

Ecological, water quality and water quantity monitoring are currently ongoing in order to obtain baseline, pre-wellfield production data.

Please contact me should you require any further information.

Sincerely,

Doug Currier II
Resource Planner

DC:gml108cr

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Pinellas
813 884 2835
Hillsborough

LAKELAND
ELECTRIC & WATER

(813) 499-6558

Excellence Is Our Goal, Service Is Our Job

C. Wayne Compe
DIRECTOR WATER OPERATIONS

February 11, 1992

Ms. Ellen Hemmert
Green Swamp Task Force
Polk County Administration Building
330 West Church St.
Bartow, FL 33830

Subject: City of Lakeland Northeast Wellfield Status

Dear Ms. Hemmert:

On June 16, 1989 the City of Lakeland entered into a contract for the purchase of approximately 770 acres of land in northeast Lakeland for a public supply wellfield. An additional 93 acres to the east of the original parcel were acquired in 1990, bring the total wellfield property to 863 acres.

This wellfield property, located north of Old Polk City Road and east of Bryant Road, was identified in our 1987 Water Master Plan as the area best suited for water supply to meet Lakeland's future needs.

To assure that the City would be in the best position to utilize this property for water resources, the City applied for the Water Use Permit, which was approved on December 20, 1989, prior to final acquisition of the property. The Water Use Permit to meet Lakeland's projected need was approved for 9 million gallons per day (mgd) average daily flow with 16 mgd peak day flow. The permit is a six year permit which expires in December of 1995.

As part of the permit acquisition, the City of Lakeland has performed extensive computer modeling based on actual data from well pump test to determine the impacts both to ground and surface waters in the area.

Although too numerous to mention in this letter, there are many conditions with this Water Use Permit. One of the more important issues is the wellfield monitoring and mitigation plan submitted to the Water Management District. This plan was submitted per their requirements and we are waiting for response. This plan is one of the most comprehensive plans currently being mandated on a water utility within the State of Florida. It is estimated this monitoring plan will cost the City approximately $35,000 per year in monitoring and reporting services.

City of Lakeland

In addition the City is required to mitigate ground water impacts caused by pumping from this wellfield within one mile of our property boundary. Every May and September, the City is taking infra-red aerial photographs of the property to establish background data which may show any potential impacts to wetland areas as a result of the City of Lakeland water withdrawals.

To date, the City has completed drilling five production wells and four monitor wells. Upon receipt of the approved monitoring plan, we anticipate several other wells will be needed to properly monitor the wellfield drawdowns.

As far as the status of construction of the facility and putting the wellfield into production, the City is taking a yearly look at the needs required to serve its system. Based on current growth patterns, additional water supply requirements will not be needed until approximately 1998 or 1999. Although our decision will not be based solely on additional capacity, a decision may be made much sooner to put a second plant into service for a backup supply as well as meet any unforeseen growth capacity expansion requirements.

The City of Lakeland's existing water supply is from the Thomas B. Williams Water Treatment Plant located at Interstate-4 and Kathleen Road. This plant is a 51 mgd water treatment plant with a current average daily flow of 24 million gallons.

We feel the location of the northeast wellfield will meet all the requirements as established by the Water Management District and DER and will create very minimal impact to the northeast Lakeland area, while providing the needed resources for the next 20 to 30 years.

If you have any additional questions regarding this issued, please don't hesitate to call.

Yours very truly,

C. Wayne Combee

C. Wayne Combee, Director
Water Operations

CWC/lwt

Department of Geology
University of South Florida
4202 East Fowler Avenue, SCA 202
Tampa, Florida 33620-5200
(813) 974-2236
FAX (813) 974-2668

January 13, 1992

Ms. Ellen Hemmert
Green Swamp Task Force Manager
Polk County Administration
330 West Church Street
O.O. Box 1969
Bartow, Florida 33830

Dear Ms. Hemmert:

I appreciate the opportunity to appear before the Task Force meeting last Monday. The questions were stimulating and helpful to me in terms of understanding public needs.

This letter is in response to the request of Mr. Jacobs for suggestions of things that can be done to effectively control on-site treatment (OST) facilities in the Green Swamp. Many of these things were discussed at the meeting, but here is a brief list off the top of my head.

1. Increase setbacks. The options mentioned by Kevin Atkins would greatly lower risks to adjacent property owners.

2. Increase design capacity of OSTs. I would double the design capacities (tank and sorption field). It might be appropriate to require dual sorption fields in order to rest one, while the other is operative.

3. Require cleaning of the tanks on a regular schedule. It would be good if one could base the schedule on size of the system, disposal use, etc. This is impractical, so a two-year schedule regardless of size, use, etc. might be best. This leads to another problem that should be addressed first. Where is the septage to be disinfected and disposed of? I am leery of some of the disinfection practices and would want to know how, and where, this occurs. It certainly shouldn't be disposed of in a way that increases the threat to the swamp ecosystem.

4. Require serious training and licensure of septic-tank installers or, better yet, require that a P.E. or P.G. sign off on any septic tank system to be installed in poorly-drained soils or otherwise risky sites. This is especially needed where mounded OSTs are required. I suggest this so that liability and recourse are available to OST purchases who have systems that fail because of poor design.

5. Fund a study to test designs of mounded OSTs in order to improve the design and reduce the failure rate. Require the best design on future OST installations and upon renovation of existing systems.

6. Develop a set of maps (see below) to assist the county permitting agency in specifying which OST system is best for a site, and the limitations to OST use on sites. Coupled with this can be variable limitations on development density, multiple options for OST designs, and variable requirements for design responsibility. I visualize that some areas could be set at 1/4 to 1/2 acre density with use of standard OSTs without certification of design. Other areas might have 5 acre minima, requirements for design by a qualified P.E. or P.G.. Still others might be prohibited from development without first proving feasibility. To me, this is the best, most sophisticated option, but the data do not yet exist to implement such a plan.

7. Offer tax or land use incentives to users who opt for good alternative OST designs.

8. Monitor the cumulative effects of OSTs. The first OST would be easier to permit than later ones on a limited capacity area.

9. Develop options for "gray-water" disposal to reduce the loading on OSTs. This must be in consideration of two constraints. First, the gray water cannot drain directly into surface waters or other systems where adverse consequences will result. Second, the separation of gray and brown water must be carefully done so that no hazardous chemicals or microbes enter the gray-water system. Also, the function of the OST with the reduced loading must be considered. I would hate to see an increase in OST failures because there is less dilution from the gray waters. The design of the OST must account for the change in composition of the waste water.

10. An assessment of the impact of existing OSTs on water quality in the Green Swamp is critically needed. Control of future installations may be closing the barn door after the horse is out!

It is important to note that no one of these options will work. They must be implemented as a group, if possible.

The map option is desirable in my mind. It is essentially a risk assessment study that delimits carrying capacity in terms of OSTs. In order to prepare the map(s), several pieces of information are necessary. With existing data underlined, these are:

1. A good, accurate soils map.

2. A map showing potentiometry and flow systems in the Floridan aquifer.

3. A map showing flood plains, flood-prone areas, flooding soils.

4. A map showing sorption potentials for the soils (can be derived from the soils map

and from IFAS/SCS data, with a few, on-site tests for confirm and fine-tune the more general data).

5. A map showing the distribution of and depth to surficial, and near surficial, clays.

6. A map of the thickness and distribution of the Surficial aquifer, where it is locally present.

7. A map showing the degree of interconnectivity of surface water and the Surficial and Floridan aquifers.

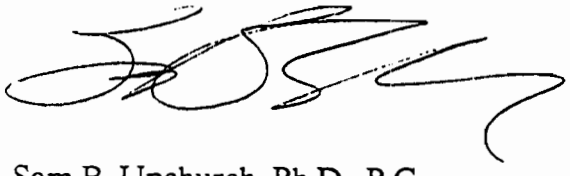
8. A map of sinkholes, other karst features, and fractures.

9. A map (or maps) showing existing population, land use, water-well (and drainage well?) locations, and OST density. While not in the best format, some of these data exist in county tax roles, remote sensing data, etc. The well and OST data probably do not exist in a useable format. Field checking would be required.

These maps would be reinterpreted and combined into a single map that shows categories of site specifications. OST densities, design requirements, and site suitability would be presented on this map. I estimate that combining the existing data into a first cut map would cost on the order of $30,000 to 50,000 depending on how much help can be obtained from S.W.F.W.M.D., and how good the existing data bases really are. To collect the additional data and prepare a good, defensible map would cost about $100,000. The first-cut map would take about 18 person-months, and could probably be done in less than a year. The better map would take an estimated 36 to 48 person months and 18 months to complete.

I hope that these observations will be of help to you. Needless to say, I like to work with the Task Force in completing the project.

Sincerely yours,



Sam B. Upchurch, Ph.D., P.G.
Professor

APPENDIX F

This description is an excerpt from The Green Swamp Project: Environmental Report 1985 SWFWMD.

2.8 Archaeology

Archaeological surveys of selected portions of the Green Swamp and Upper Hillsborough Flood Detention Areas have recently been completed and over 200 sites have been recorded (Piper and Piper, 1980; Piper 1980; Piper et al, 1982; Wharton, 1979; 1984). The UHFDA results, the subject of a separate detailed report (Wharton, 1984), will only be briefly treated here. The GSFDA results will be afforded more coverage as a significant part of its resource base was assessed very recently.

Surveys within the Green Swamp Flood Detention Area disclosed 54 archaeological sites of which 10 are judged significant. The sites were predominantly composed of surficial or shallowly buried scatters of chert waste flakes and spalls, occasional chert tools, and infrequent ceramic potsherds, shell and bone remains. Most sites are currently undatable, containing only non-diagnostic flakes and spalls.

The chronicle of human presence in the Green Swamp Flood Detention Area extends back to the Early Archaic period (6500-5000 B.C.), possibly to the preceding Paleo-Indian Period (12000-6500 B.C.). There was apparently considerable cultural activity throughout the entire preceramic Archaic Period (6500-2000 B.C.). The absence of fiber-tempered pottery suggests a possible occupational gap during the Orange (fiber-tempered pottery) Period (2000-1000 B.C.). The ensuing Transitional (1000-500 B.C.), Deptford (500 B.C.-A.D. 300), Weedon Island (A.D. 300-1200), and possible Safety Harbor (A.D. 1200-1700), periods witnessed more-or-less continuous occupation by small groups of people. During the Seminole Period (1767-1842) the Green Swamp served both as a hunting ground and, during at least the war period (1835-1842), a refuge and limited farming area. Euro-American Period (1842 to present) activity in and about the Green Swamp Flood Detention Area was chiefly limited to cattle raising and forest products harvesting, although short-lived farmsteads once dotted the landscape, especially during economic booms of the 1880's through 1890's and the 1920's.

Throughout prehistory and history, the vast forested wetlands of the Green Swamp Flood Detention Area, particularly the major ones associated with the Withlacoochee River, Little Withlacoochee River, and Devil's Creek Swamp, have been the focus of human activities. During aboriginal times, these wetlands and associated low hammocks, with their rich array of plant and animal resources, extensive chert exposures, and reliable water sources, were preferred areas for habitation. Chert procurement and tool manufacture and use seemed the dominant activities during this period. Post-Archaic inhabitants subsequently added small villages and scattered residential sites. Archaeologically, the aboriginal occupation has left behind a bewildering number of small to large sites.

The wetlands of the GSFDA also attracted post-aboriginal activity. The Seminoles, hoping to elude capture and forced emigration, penetrated the tract and established small temporary camps, raised a few crops at small, well-hidden clearings, and hunted and collected food. General Land Office survey records (1842-1848) for the townships of the Green Swamp Flood Detention Area documented at least two "Indian Fields" and a network of trails and footpaths, clear indications of Seminole presence in these swamplands.

Extensive logging of the Green Swamp Flood Detention Area wetlands began in 1928 (Cummer Company) and continued through the 1960's. Several miles of main and lateral tram grades, once laid with narrow gage tracks over which operated log trams transporting timber to the Cummer mill at Lacoochee, are conspicuous landscape features attesting to this once-thriving enterprise. Forest products harvesting (pine timber and resin) of the pinelands also occurred during this period.

Historic (mid-19th to mid-20th century) period homesteads are present throughout the various hammocks associated with the stream systems and scattered over the pinelands, usually confined to localized rises. These sites are expressed today as a surficial and shallowly-buried, variably dense scatter of modern ceramicware sherds, and fragments of glass, metal and terra cotta brick material.

The values of the Green Swamp Flood Detention Area archaeological resource base can vary from highly significant (i.e., National Register-listed or -eligible) to insignificant. These differential values are based on a professional evaluation of a site's informational potential, integrity, rarity, and other criteria. Significant sites are those whose loss can greatly distort or diminish the interpretability of the resource base of which it forms a part. Impacts threatening such sites should be either avoided outright or at least minimized.

2.8.2 Upper Hillsborough

A total of 55 prehistoric and historic period sites were recorded of which seven were judged significant. The sites are predominantly lithic (flaked chert) and lithic/ceramic (potsherd) scatters which range between 10,000 to 500 years in age, and are generally low to moderate in cultural material frequency. Two cultural eras are represented, a pre-ceramic Archaic hunter-gatherer era (well represented archaeologically) and a post ceramic farming era (poorly represented). The sites appear to represent former temporary encampments and lithic workshop areas; no major central camps or villages were discovered. Stone implements attributable to chert quarrying and tool manufacturing activities and to hunting and butchering practices were most frequent from those sites containing recognizable implements. The UHFDA, during pre-ceramic times, was probably used seasonally by hunter-gatherer bands. During the ceramic era, however, activity on the tract appeared to have greatly diminished, probably reflecting the rise of farming groups and the subsequent reduction in home range size.

Historic period sites include two Seminole Period camps, and several pottery/glass/metal scatters attributable to the turn-of-the-century timber and naval store-based settlements of Millard and Flatford. Other historic activities documented across the tract include cattle grazing, timber cutting and milling, turpentine gum extraction, and scattered general farming and citrus production.

Map of Archealogical Sites in Polk County

Source: Polk County Comp. Plan.

QUADRANGLE #01
BRANCH BOROUGH, FL.

QUADRANGLE #09
GUM LAKE, FLA.

QUADRANGLE #02
ROCKRIDGE, FL.

QUADRANGLE #13
LAKELAND, FLA.

QUADRANGLE #06
SOUTHOM, FLA.

2010 RESOURCE-PROTECTION DISTRICTS

POLK COUNTY, FLORIDA

LEGEND

AIRPORT-BUFFER DISTRICTS
NATURAL RESOURCE-PROTECTION DISTRICTS
CREST-TAT DISTRICTS
REDEVELOPMENT DISTRICTS
WELLFIELD-PROTECTION DISTRICTS
HISTORIC-PRESERVATION SITES
ARCHAEOLOGICAL SITE
HISTORICAL SITE
COUNTY BOUNDARY
MUNICIPAL LIMITS
LAKES/WATER
INTERSTATE HIGHWAY
U.S. HIGHWAY
STATE HIGHWAY
COUNTY ROAD
PAVED COUNTY ROAD
RAILROAD
SECTION LINE
SECTION NUMBER
AIRPORT RUNWAYS

APPENDIX G

380.0551 Green Swamp Area; designation as area of critical state concern.—

(1) The Green Swamp Area, the boundaries of which are described in chapter 22F-5, Florida Administrative Code, is hereby designated an area of critical state concern effective July 1, 1979. The state land planning agency, in conjunction with the applicable local governments, shall review suggested changes to the existing boundary in the area immediately to the south of the southern boundary of the City of Clermont in Lake County and the area along the existing southern boundary around Lake Juliana and the City of Polk City in Polk County for possible deletion from the area of critical state concern. The state land planning agency shall report to, and shall make specific recommendations to, the commission relative to any proposed deletion by August 1, 1979. The commission shall take action on the recommendations of the state planning agency no later than October 1, 1979. [1]Chapters 22F-5, 22F-6, and 22F-7, Florida Administrative Code, are hereby adopted and incorporated herein by reference. The boundaries described in [1]chapter 22F-5, Florida Administrative Code, shall be modified pursuant to s. 380.05(12). There shall be appointed a resource planning and management committee as provided in s. 380.045.

(2) The land development regulations contained in [1]chapters 22F-6 and 22F-7, Florida Administrative Code, shall be the land development regulations for the applicable local government's portion of the area of critical state concern until either:

(a) An applicable local government complies with the provisions of s. 380.05(10); or

(b) Such regulations are repealed pursuant to subsection (3).

(3) [1]Chapters 22F-5, 22F-6, and 22F-7, Florida Administrative Code, shall be repealed by the commission no earlier than July 1, 1980, and no later than July 1, 1982. Upon recommendation by the state land planning agency to the commission, any repeal of such rules pursuant to this subsection may be effective only for one local government's portion of the Green Swamp Area. Such repeal shall be contingent upon approval by the state land planning agency of local land development regulations pursuant to s. 380.05(6) or (10), upon such regulations being effective for a period of 12 months, and upon adoption or modification by the applicable local government of a local government comprehensive plan pursuant to s. 380.05(14).

History.—s. 5, ch. 79-73.

[1]Note.—Amended provisions of former chapters 22F-5, 22F-6, and 22F-7 are currently found in chapters 28-26, 28-27, and 28-28 of the Florida Administrative Code.

CHAPTER 28-26
LAND PLANNING — PART V BOUNDARY AND PRINCIPLES FOR GUIDING DEVELOPMENT FOR THE GREEN SWAMP AREA OF CRITICAL STATE CONCERN

28-26.001 Purpose. Pursuant to Section 7, Article II, of the Florida Constitution, and Section 380.05, Florida Statutes, it is the purpose of these rules to define the boundary of the Green Swamp Area of Critical State Concern and to provide principles for guiding development within the critical area in order to conserve and protect the natural environmental and economic resources and public facilities within the Green Swamp Critical Area and ecologically linked areas.

Specific Authority 380.05(1) FS. Law Implemented 380.05 FS. History—New 7-25-74, Formerly 22F-5.01, Formerly 27F-5.01, Transferred from 27F-5.001.

28-26.002 Boundary. The following area is hereby designated as the Green Swamp Area of Critical State Concern:

All that certain lot, piece or parcel of land situated, lying and being in Lake and Polk Counties in the State of Florida being more particularly bounded and described as follows:

Beginning at a point in Polk County in Section 12, Township 27 South, Range 23 East, which point is the point of intersection of the south boundary line of the northernmost quarter-section of said Section 12 and the east, right-of-way line of United States Route 98 (State Road 700), and running thence:

(1) In a northerly direction along the easterly right-of-way line of United States Route 98, a distance of approximately 7.65 miles, to the point of intersection of United States Route 98 with the west boundary line of Section 16 in Township 26 South, Range 23 East; thence

(2) North along the west boundary of Sections 16, 9 and 4 in Township 26 South, Range 23 East a distance of 2.75 miles more or less; thence

(3) North along the west boundary of Sections 33, 28, 21, 16 and 9 in Township 25 South, Range 23 East to a point in the thread of the Withlacoochee River, which point is the boundary between Polk County and Sumter County, a distance of 4.5 miles more or less; thence

(4) In an easterly direction along the thread of the Withlacoochee River to a point, which point is the point of intersection of the thread of the Withlacoochee River and the north boundary line of Section 18, Township 25 South, Range 24 East; thence

(5) East along the north boundary line of Sections 18, 17 and 16 in Township 25 South, Range 24 East, a distance of 2.75 miles more or less; thence

(6) North along the west boundary line of Sections 10 and 3 in Township 25 South, Range 24 East, a distance of two miles, to a point of intersection of the north boundary of Polk County and the south boundary of Lake County; thence

(7) In Lake County, still north along the west boundary line of Sections 34, 27 and 22 in Township 24 South, Range 24 East, a distance of three (3) miles; thence

(8) Turning and running east along the north boundary line of Section 22 in Township 24 South, Range 24 East, to the point of intersection of the north boundary line of said Section 22 and the westerly right-of-way line of the Seaboard Coast Line Railroad; thence

(9) Northwesterly along the westerly right-of-way line of the Seabord Coast Line Railroad to a point in the north boundary line of Section 4, in Township 24 South, Range 24 East, a distance of 3.5 miles, more or less; thence

(10) Turning and running west along the boundary between Townships 23 and 24 South, which boundary is the south boundary line of Sections 33 and 32 in Township 23 South, Range 24 East; thence

(11) Turning and running north along the west boundary of Section 32 in Township 23 South, Range 24 East, a distance of one mile; thence

(12) Turning and running east along the north boundary line of Sections 32 and 33 in Township 23 South, Range 24 East to a point in the westerly right-of-way line of the Seabord Coast Line Railroad; thence

(13) Turning and running northwesterly along the westerly right-of-way line of Seaboard Coast Line Railroad to a point, which point is in the boundary between Ranges 23 East and 24 East, which point is also in the west boundary of Section 31 in Township 22 South, Range 24 East, a distance of six miles more or less; thence

(14) Turning and running north along the boundary between Range 23 East and Range 24 East to a point in the southerly right-of-way line of the Seabord Coast Line Railroad, a distance of 3.25 miles, more or less; thence

(15) Turning and running east along the south right-of-way line of said Seaboard Coast Line Railroad to a point in the east boundary line of Section 16 in Township 22 South, Range 24 East; thence

(16) Turning and running south along the east boundary line of Section 16, in Township 22 South, Range 24 East, a distance of one-half mile, more or less; thence

(17) Turning and running east along the north boundary line of Section 22 in Township 22 South, Range 24 East, a distance of one mile; thence

(18) Turning and running south along the east boundary line of Section 22 in Township 22 South, Range 24 East, a distance of one mile; thence

(19) Turning and running east along the north

boundary line of Sections 26 and 25 in Township 22 South, Range 24 East and Section 30 in Township 22 South, Range 25 East, a distance of three miles; thence

(20) Turning and running north along the west boundary of Section 20, Township 22 South, Range 25 East to a point in the south right-of-way line of State Road 50, a distance of one-half mile, more or less; thence

(21) Turning and running east along the south right-of-way line of State Road 50 to a point in Section 23, Township 22 South, Range 25 East, which point is the point of intersection of State Road 50 and the east boundary of the canal which connects Lake Minnehaha and Lake Minneola; thence

(22) Turning and running south along the eastern bank of said canal and continuing south along the eastern shore of Lake Palatlakaha to a point in the westerly right-of-way line of State Road 561, a distance of one-half mile, more or less; thence

(23) Southerly along the westerly right-of-way line of State Road 561 to a point in Section 11, Township 23 South, Range 25 East, which point is the point of intersection of State Road 561 and State Road 565B, a distance of 3.5 miles more or less; thence

(24) Turning and running west along the north right-of-way line of State Road 565B to a point in the west boundary line of Section 11 in Township 23 South, Range 25 East, a distance of one-quarter mile, more or less; thence

(25) South along the west boundary line of Sections 11 and 14 Township 23 South, Range 25 East, a distance of 1.5 miles, more or less; thence

(26) East along the south boundary line of Sections 14 and 13 in Township 23 South, Range 25 East, a distance of two miles; thence

(27) North along the west boundary line of Sections 18 and 7 in Township 23 South, Range 26 East, to a point in the north right-of-way line of Hull Road, which is depicted on the February 1969 edition of the Florida State Road Department General Highway Map of Lake County as a graded and drained road skirting the south end of Lake Susan while running approximately along the north boundary line of Section 12 in Township 23 South, Range 25 East; thence

(28) Turning and running west along the north right-of-way line of Hull Road a distance of one-half mile, more or less, to a point in Section 12, Township 23 South, Range 25 East, which point is the intersection of the north right-of-way line of Hull Road with the East right-of-way line of Lake Shore Road, which is depicted on the February 1969 edition of the Florida State Road Department General Highway map of Lake County as a paved road running west and then north of Lake Susan; thence

(29) Turning and running north, then easterly, along the easterly, then southerly, right-of-way line of Lake Shore Road a distance of 1.5 miles, more or less, to a point in Section 6, Township 23 South, Range 26 East, which point is the intersection of the southerly right-of-way line of Lake Shore Road with the west right-of-way line of Lake Louisa Road, which is depicted on the February 1969 edition of the Florida State Road Department General Highway Map of Lake County as a bituminous road running in a north-south direction to the east of Lake Susan and skirting the northeast shoreline of Lake Louisa; thence

(30) Turning and running south, then southeasterly, along the westerly right-of-way line of Lake Louisa Road to a point in Section 16, Township 23 South, Range 26 East, which point is the intersection of the westerly right-of-way line of Lake Louisa Road with the west right-of-way line of United States Route 27 (State Road 25), a distance of four miles, more or less; thence

(31) South along the west right-of-way line of United States Route 27 in Lake and Polk Counties to a point in the south boundary line of Section 8 in Township 27 South, Range 27 East, a distance of approximately 26 miles; thence

(32) Turning and running west along the south boundary line of Sections 8 and 7 in Township 27 South, Range 27 East, a distance of 1.25 miles, more or less; thence

(33) West along the south boundary line of Section 12 in Township 27 South, Range 26 East, to a point, which point is the southwest corner of the aforesaid Section 12; thence

(34) Turning and running south along the west boundary line of Section 13 in Township 27 South, Range 26 East, to the point of intersection of the west boundary line of Section 13 in Township 27 South, Range 26 East and the north shoreline of Lake Lowery; thence

(35) Turning and running east, south and west along the shoreline of Lake Lowery to its point of intersection with the east boundary line of Section 23 in Township 27 South, Range 26 East; thence

(36) Turning and running south along the east boundary line of Section 23 in Township 27 South, Range 26 East to the southeast corner of the aforesaid Section 23; thence

(37) Turning and running west from the southeast corner of Section 23 in Township 27 South, Range 26 East, along the south boundary lines of Sections 23, 22, 21, 20 and 19 and continuing to a point on the southern boundary line of Section 24 in Township 27 South, Range 25 East, which is one-half mile west of the southeastern corner of said Section 24, a distance of 5.5 miles; thence

(38) North along the west boundary line of the east half-section of Section 24 in Township 27 South, Range 25 East, a distance of one-half mile; thence.

(39) West along the north boundary line of the south half-section of Section 24 in Township 27 South, Range 25 East, a distance of one-half mile; thence

(40) North along the west boundary line of Section 24 in Township 27 South, Range 25 East, a distance of one-half mile; thence

(41) West along the north boundary line of

Sections 23 and 22 in Township 27 South, Range 25 East, to a point where said boundary line intersects the northeasterly right-of-way line of State Road 559, a distance of 1.2 miles, more or less; thence

(42) West, then north, along the north, then east, right-of-way line of State Road 559 to a point in Section 10, Township 27 South, Range 25 East, which point is the intersection of the east right-of-way line of State Road 559 and the east right-of-way line of State Road 559A, a distance of 1.6 miles, more or less; thence

(43) Northerly along the east right-of-way line of State Road 559A to a point in Section 3, Township 27 South, Range 25 East, which point is the intersection of the east right-of-way line of State Road 559A and the north right-of-way line of Interstate Highway 4 (State Road 400), a distance of one mile, more or less; thence

(44) Turning and running west, then southwesterly, along the north right-of-way line of Interstate Highway 4 to a point where said right-of-way intersects the south boundary line of Section 10 in Township 27 South, Range 24 East, a distance of 5.8 miles, more or less; thence

(45) West along the south boundary line of Sections 10, 9, and 8, in Township 27 South, Range 24 East, a distance of 2.7 miles, more or less; thence

(46) South along the east boundary line of Section 18 in Township 27 South, Range 24 East, a distance of one mile; thence

(47) West along the south boundary line of Section 18 in Township 27 South, Range 24 East, a distance of one mile; thence

(48) North along the east boundary line of Sections 13 and 12 in Township 27 South, Range 23 East, to the southeastern corner of the northern one-half of the northeastern quarter-section of said Section 12, a distance of 1.75 miles; thence

(49) West along the south boundary line of the northern halves of the northeastern and northwestern quarter-sections of Section 12 in Township 27 South, Range 23 East, to the point of beginning.

Specifically excluding and exempting herefrom the following:

(1) Lake Louisa State Park

(2) The south half of Sections 28 and 29 and all of Sections 32 and 33 in Township 26 South, Range 25 East.

Specific Authority 380.05(1), (12), 380.055(1) FS. Law Implemented 380.05 FS. History—New 7-25-74, Formerly 22F-5.02, Amended 11-18-79, Formerly 27F-5.02, Transferred from 27F-5.002.

28-26.003 Principles for Guiding Development.

(1) Objectives to Be Achieved

(a) Minimize the adverse in of development on resources of the Florid ifer, wetlands, and flood-detention areas.

(b) Protect the normal quantity nity and flow of ground water and surface wa which are necessary for the protection of resources of state and regional concern.

(c) Protect the water available for aquifer recharge.

(d) Protect the functions of the Green Swamp Potentiometric High of the Floridan Aquifer.

(e) Protect the normal supply of ground and surface water.

(f) Prevent further salt-water intrusion into the Floridan Aquifer.

(g) Protect or improve existing ground and surface-water quality.

(h) Protect the water-retention capabilities of wetlands.

(i) Protect the biological-filtering capabilities of wetlands.

(j) Protect the natural flow regime of drainage basins.

(k) Protect the design capacity of flood-detention areas and the water-management objectives of these areas through the maintenance of hydrologic characteristics of drainage basins.

(2) Elements

Requiring Regulation	Regulatory Guidelines
(a) Site Platting	The platting of land should be permitted only when such platting commits development to a pattern which will not result in the alteration of the natural surface water flow regime and which will not reduce the natural recharge rate of the platted site.
(b) Site Alteration	Site alteration should be permitted only when such alteration will not adversely affect the natural surface-water flow regime or natural recharge capabilities of the site. Site alteration should be permitted only when such alteration will not cause siltation of wetlands or reduce the natural retention and filtering capabilities of wetlands. All site alteration activities should provide for water retention and settling facilities; should maintain an overall site runoff equivalent to the natural flow regime prior to alteration and should

	maintain a runoff rate which does not cause erosion.
(c) Soils	All soil exposed as a result of site alteration or development activities should be located and stabilized in a manner to prevent the alteration of the natural flow regime. All soil exposed as a result of site alteration or development activities should be restored with suitable vegetation.
(d) Ground Water	Ground water withdrawal should not exceed the safe yield per acre as determined by the Southwest Florida Water Management District, or its successor agency.
(e) Storm-Water	Storm-water runoff should be released into the wetlands in a manner approximating the natural flow regime.
(f) Solid Waste	Solid waste disposal facilities should be located in areas and operated in a manner that will not adversely affect the ground-water system.
(g) Structures	Structures should be placed in a manner that will not adversely affect the natural flow regime and which will not reduce the recharge capabilities. Placement of structures should be consistent with sound flood plain management practices such as compliance with the Flood Disaster Protection Act of 1973.

Specific Authority 380 FS. Law Implemented 380.05 FS. History—New 7-25-74, Formerly 22F-5.03, Formerly 27F-5.03, Transferred from 27F-5.003.

28-26.004 Administration.

(1) All land-development regulations adopted pursuant to these guidelines should be administered by the local government.

(2) To the extent possible, local regulations, as required by Subsection 380.505(5), Florida Statutes, should be performance oriented, and should differentiate between the natural development suitability of the wetlands, flatwoods and uplands.

Specific Authority 380.05(1) FS. Law Implemented 380.05 FS. History—New 7-25-74, Formerly 22F-5.04, Formerly 27F-5.04, Transferred from 27F-5.004.

28-26.005 Technical Assistance. In developing appropriate regulations for the Green Swamp Critical Area, pursuant to Subsection 380.05(5), Florida Statutes, the Southwest Florida Water Management District and the Bureau of Land and Water Management, Department of Community Affairs are hereby directed to assist the counties of Lake and Polk.

Specific Authority 380.05(1) FS. Law Implemented 380.05 FS. History—New 7-25-74, Formerly 22F-5.05, Formerly 27F-5.05, Transferred from 27F-5.005.

28-26.006 Effective Date. Commencing fifteen (15) days after adoption by the Administration Commission, the principles for guiding development contained herein shall apply to all development undertaken in the critical area.

Specific Authority 380.05(1) FS. Law Implemented 380.05 FS. History—New 7-25-74, Formerly 22F-5.06, Formerly 27F-5.06, Transferred from 27F-5.006.

CHAPTER 28-27
LAND PLANNING — PART VI
BOUNDARY AND REGULATIONS FOR THE GREEN SWAMP AREA OF CRITICAL STATE CONCERN — POLK COUNTY

28-27.001 Short Title. This chapter shall be known as the Polk County Green Swamp Development Code.
Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.01, Formerly 27F-6.01, Transferred from 27F-6.001.

28-27.002 Purpose and Intent. Pursuant to Section 7, Article II, of the Florida Constitution and Section 380.05, Florida Statutes, it is the purpose of these regulations to conserve and protect the environmental and economic resources of the Green Swamp Area of Critical State concern and to provide a land and water management system to protect such resources and facilitate orderly and well planned growth. To effectively and equitably accomplish such purposes, these regulations should be implemented by the local government through existing administrative procedures and pursuant to Chapter 27F-5, Florida Administrative Code, to achieve the following objectives:

(1) Minimize the adverse impacts of development on resources of the Floridan Aquifer, wetlands and flood-detention areas.

(2) Protect the normal quantity, quality and flow of ground water and surface water which are necessary for the protection of resources of state and regional concern.

(3) Protect the water available for aquifer recharge.

(4) Protect the functions of the Green Swamp Potentiometric High of the Floridan Aquifer.

(5) Protect the normal supply of ground and surface water.

(6) Prevent further salt-water intrusion into the Floridan Aquifer.

(7) Protect or improve existing ground and surface-water quality.

(8) Protect the water-retention capabilities of wetlands.

(9) Protect the biological-filtering capabilities of wetlands.

(10) Protect the natural flow regime of drainage basins.

(11) Protect the design capacity of flood-detention areas and the water-management objectives of these areas through the maintenance of hydrological characteristics of drainage basins.
Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.02, Formerly 27F-6.02, Transferred from 27F-6.002.

28-27.003 Agricultural Exemption. The use of any land for the purpose of growing plants, crops, trees, and other agricultural or forestry products; raising livestock; or for other purposes directly related to all such uses are exempt from these regulations, for example, but not limited to, wells, access roads, utilities, and utility lines. Lands lying fallow are deemed to be used for agricultural purposes. However, whenever any person carries out any activity defined herein, as development or applies for a development permit, as defined herein, to develop exempted land, these regulations shall apply to such application and to such land.
Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05 FS. History—New 7-20-75, Formerly 22F-6.03, Formerly 27F-6.03, Transferred from 27F-6.003.

28-27.004 Vested Rights in Property. Where vested rights in property exist pursuant to Subsection 380.05(15), Florida Statutes, these regulations shall not abridge them. Any person whose rights may have vested pursuant to Subsection 380.05(15), F. S., may seek a determination from the local government having jurisdiction over development or the Bureau of Land and Water Management, Department of Community Affairs. Request for vested rights determination from the Bureau of Land and Water Management, Department of Community Affairs shall be submitted as a petition for a declaratory statement pursuant to Subsection 120.56, F. S., and upon a form as prescribed by the Bureau.
Specific Authority 380.05, 120.56 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.04, Formerly 27F-6.04, Transferred from 27F-6.004.

28-27.005 Definitions.

(1) "Administration commission" or "commission" means the Governor and the Cabinet, and for purposes of this chapter, the commission shall act on a simple majority.

(2) "Aquifer" means an underground formation, or group of formations, or part of a formation, that is permeable enough to transmit and store usable quantities of water.

(3) "Artesian Aquifer" means an aquifer that contains artesian water.

(4) "Artesian Water" means ground water that is under sufficient pressure to rise above the level at which it is encountered by a well, but which does not necessarily rise to or above the surface of the ground.

(5) "Board" means the Polk County Board of County Commissioners.

(6) "Development," see definition (46)

(7) "Development order" means any order granting, denying, or granting with conditions an application for a development permit.

(8) A "development permit" includes any building permit, zoning permit, plat approval, or rezoning, certification, variance, or other action having the effect of permitting development as defined in this chapter.

(9) "Developer" means any person, including a governmental agency, undertaking any development as defined in this chapter.

(10) "Discharge" means the outflow of water from a site, aquifer, or drainage basin.

(11) "Drainage Facilities" means any canal, ditch, culvert, dike or other facility which lowers the surface or ground water table, acts as a conduit, diverts or directs the flow of water or otherwise affects the natural flow regime.

(12) "Effective Precipitation" means that part of the precipitation (rainfall) which contributes to direct surface runoff.

(13) "Flood Frequency" means the statistically determined average for how often a specific flood level of discharge may be equaled or exceeded.

(14) "Floridan Aquifer" means the aquifer which consists of a series of limestone formations which range from middle Eocene to Miocene in age and that underlies most of Florida and is a major source of ground water for the state.

(15) "Governmental agency" means:

(a) The United States or any department, commission, agency, or other instrumentality thereof;

(b) This state or any department, commission, agency, or other instrumentality thereof;

(c) Any local government, as defined in this chapter, or any department, commission, agency, or other instrumentality thereof;

(d) Any school board or other special district, authority, or other governmental entity.

(16) "Green Swamp" means those lands within Polk County which lie within the boundaries delineated by the legal description in 28-26.002, Florida Administrative Code.

(17) "Ground Water" means water beneath the surface of the ground, whether or not flowing through known and definite channels.

(18) "Hydroperiod" means that portion of the hydrologic cycle during which water is at or on the soil surface.

(19) "Land" means the earth, water, and air, above, below, or on the surface, and includes any improvements or structures customarily regarded as land.

(20) "Land development regulations" include local zoning, subdivision, building, and other regulations controlling the development of land.

(21) "Land use" means the development that has occurred on land.

(22) "Local government" means any county or municipality and, where relevant, any joint airport zoning board.

(23) "Major public facility" means any publicly owned facility of more than local significance.

(24) "Natural Flow Regime" means the velocity, volume, and direction of the surface or ground water flow presently occurring for any given portion of the Area of Critical State Concern.

(25) "Parcel of land" means any quantity of land capable of being described with such definiteness that its location and boundaries may be established, which is designated by its owner or developer as land to be used or developed as a unit, or which has been used or developed as a unit.

(26) "Peak Surface — Water Discharge" means the maximum discharge rate subsequent to an occurrence of effective precipitation.

(27) "Person" means an individual, corporation, governmental agency, business trust, estate, trust, partnership, association, two or more persons having a joint or common interest, or any other legal entity.

(28) "Pine Flatwoods" means those discrete areas which have one or more of the following naturally occurring soils, or any other soil classified by the U. S. Soil Conservation Service as indicative of a pine flatwood:

Bushnell	Broward
Immokalee	Eureka
Ona	Myakka (Leon)
Scranton	Panasoffkee
Wabasso (Leon loamy substrata)	St. Johns
Pompano Sand, acid	Wauchula (Leon, heavy substrata)
Placid sand; slightly wet	

(29) "Potentiometric Surface" means the imaginary surface coinciding with levels of artesian pressure.

(30) "Recharge" means the downward percolation of surface water into any underground formation.

(31) "Regional planning agency" means the agency designated by the state land planning agency to exercise responsibilities under this chapter in a particular region of the state.

(32) "Regulatory Flood Level" means the level of the flood which is representative of large floods known to have occurred generally in the area and reasonably characteristic of what can be expected to occur on a particular stream. The Regulatory Flood generally has a flood frequency of approximately 100 years as determined from an analysis of floods in a particular area.

(33) "Rule" means a rule adopted under Chapter 120.

(34) "Rural Residence" means a single family residence which is to be a dwelling for the property owner.

(35) "Site Alteration" means a development including, but not limited to, removal of, or damage to, vegetation; by filling, ditching, dredging, draining, excavation, earth moving, water containment and changes in the natural flow regime, or the effects of such actions.

(36) "State land development plan" means a comprehensive statewide plan or any portion

thereof setting forth state land development policies.

(37) "State land planning agency" means the agency designated by law to undertake statewide comprehensive planning.

(38) "Structure" means anything constructed, installed, or portable, the use of which requires a location on a parcel of land. It includes a movable structure while it is located on land which can be used for housing, business, commercial, agricultural, or office purposes either temporarily or permanently. Structure also includes fences, billboards, swimming pools, poles, pipelines, transmission lines, tracks, and advertising signs.

(39) "Surface Water" means water upon the surface of the earth, whether contained in bounds created naturally or artificially or diffused. Water from natural springs or wells shall be classified as surface water when it exits from the spring or well onto the earth's surface.

(40) "Total Site" means land which is part of common plan of development, rental, advertising or sale.

(41) "Total Surface-Water Discharge" means the total volume of surface water discharged subsequent to the occurrence of effective precipitation.

(42) "Underground Formation" means any geological unit, part of a unit, or group of units lying beneath the surface of the ground.

(43) "Uplands" means discrete areas which have one or more of the following naturally occurring soils, or any other soil classified by the U. S. Soil Conservation Service as indicative.

Lake	Astatula (Lakeland)
Apopka (Blanton)	Cassia
Lucy	Orlando
Paola (Lakewood)	Pomello
St. Lucie	Tavares
Vaucluse	

(44) "Water Quality" means the chemical, physical and bacteriological composition of water determined by the measurements of appropriate tests as cited in 40 Code of Federal Regulations 136, and Chapter 17-19, Florida Administrative Code.

(45) "Wetlands" means discrete areas which have one or more of the following naturally occurring soils, or any other soil classified by the U. S. Soil Conservation Service as indicative of a wetland:

Anclote	Pamlica
Basinger (Plummer)	Placid (Rutlege)
Iberia	Iberia & Manatee
Oklawaha	Fellowship
Pelham	Emeralda
Pompano	Feldo
Anclote & Myakka	Ocoee
Placid & Myakka	Peace River Soils
Brighton	Swamp
Manatee	Myakka & Placid

(46)(a) "Development" means the carrying out of any building or mining operation or the making of any material change in the use or appearance of any structure or land and the dividing of land into three or more parcels.

(b) The following activities or uses shall be taken for the purposes of this chapter to involve development, as defined in this section:

1. A reconstruction, alteration of the size, or material change in the external appearance, of a structure on land.

2. A change in the intensity of use of land, such as an increase in the number of dwelling units in a structure or on land or a material increase in the number of businesses, manufacturing establishments, offices, of dwelling units in a structure or on land.

3. Alteration of a shore or bank of a seacoast, river, stream, lake, pond, or canal, including any coastal construction as defined in Subsection 161.021.

4. Commencement of drilling (except to obtain soil samples) mining, or excavation on a parcel of land.

5. Demolition of a structure.

6. Clearing of land as an adjunct of construction.

7. Deposit of refuse, solid or liquid waste, or fill on a parcel of land.

(c) The following operations or uses shall not be taken for the purpose of this chapter to involve development as defined in this section:

1. Work by a highway or road agency or railroad company for the maintenance or improvement of a road or railroad track, if the work is carried out on land within the boundaries of the rights-of-way.

2. Work by any utility and other persons engaged in the distribution or transmission of gas or water, for the purpose of inspecting, repairing, renewing, or constructing on established rights-of-way any sewers, mains, pipes, cables, utility tunnels, power lines, towers, poles, tracks, or the like.

3. Work for the maintenance, renewal, improvement, or alteration of any structure, if the work affects only the interior or the color of the structure or the decoration of the exterior of the structure.

4. The use of any structure or land devoted to dwelling uses for any purpose customarily incidental to enjoyment of the dwelling.

5. The use of any land for the purpose of growing plants, crops, trees, and other agricultural or forestry products; raising livestock; or for other agricultural purposes.

6. A change in use of land or structure from a use within a class specified in an ordinance or rule to another use in the same class.

7. A change in the ownership or form of ownership of any parcel or structure.

8. The creation or termination of rights of access, riparian rights, easements, covenants concerning development of land or other rights in land.

(d) "Development," as designated in an ordinance, rule, or development permit includes all other development customarily associated with it unless otherwise specified. When appropriate to the context, development refers to the act of developing or to the result of development. Reference to any specific operation is not intended to mean that the

operation or activity, when part of other operations or activities, is not development. Reference to particular operations is not intended to limit the generality of subsection (1).

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.05, Formerly 27F-6.05, Transferred from 27F-6.005.

28-27.006 Boundary. These rules shall apply to the Polk County portion of the Green Swamp Area of Critical State Concern as designated by Rule 28-26.002, Florida Administrative Code.

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.06, Formerly 27F-6.06, Transferred from 27F-6.006.

28-27.007 Applicability. The regulations set forth in this Code shall only apply to that portion of Polk County within the Green Swamp Area of Critical State Concern. These regulations shall be construed as being supplementary and complementary to the regulations imposed on the same lands by Polk County or any other governmental jurisdiction.

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.07, Formerly 27F-6.07, Transferred from 27F-6.007.

28-27.008 General Minimum Standards. All development within the Green Swamp Area of Critical State Concern shall meet the following standards and criteria:

(1) The developer shall provide for the release of surface water runoff, collected or uncollected, in a manner approximating the natural, surface water flow regime of the area.

(2) The first floor or basement floor of all structures shall be constructed at least one (1) foot above the Regulatory Flood Level for the particular area.

(3) Treatment of storm-water runoff shall be provided by settling ponds, soil fixatives, control of non-point chemical pollutants, or the performance equivalent structures or systems when such runoff may contaminate surface or ground water resources.

(4)(a) Except as provided for in paragraph (b) of this standard, site alternation shall be limited in accordance with the natural drainage capabilities of the major soil associations. The amount of site alteration shall be limited to the following percentages of the area of each association within any given total site:

Upland association	60%
Pine Flatwood association	25%
Wetland association	10%

The installation of non-permeable surfaces shall be limited to 50% of any altered site. However, a minimum of 2,500 square feet may be covered with non-permeable surfaces on any permitted site.

(b) For the public and quasi-public uses listed below the site alteration shall be limited to 60% of the total site size provided the site is located on an upland or a pine flatwood soil association. Except for recreational purposes, these uses shall be excluded from the wetlands:

1. Public education facilities;
2. Governmental structures which provide tax-supported services to the residents of Polk County;
3. Public utilities or municipal or other governmental agencies' generation systems for gas, electricity, or steam..

(c) It shall be the responsibility of the developer to provide the information which will allow satisfactory determination of whether such lands lie within the uplands associations, pine flatwood associations, wetland associations, or any combination thereof. This determination shall be made in accordance with Section 28-27.009(2)(b), Florida Administrative Code.

(5) Except for roads, any nonpermeable surface greater than 20,000 square feet shall provide for release of surface runoff, collected or uncollected, in a manner approximating the natural surface water flow regime of the area.

(6) Soils exposed during site alteration shall be stabilized and retention ponds or performance equivalent structures or systems maintained in order to retain runoff and siltation on the construction site.

(7) Any altered site shall be revegetated and such revegetation shall be subsequently completed within 180 days following completion of a development. Revegetation shall be accomplished with pre-existing species or other suitable species except that undesirable exotic species shall not be replanted or propagated.

(8) Fill areas and related dredge or borrow ponds shall be aligned substantially in the direction of local surface water flows and shall be separated from other fill areas and ponds by areas of vegetation of comparable size. Dredge or borrow ponds shall provide for the release of storm waters as sheet flow from their downstream end and into areas of vegetation. Access roads to and between fill areas shall provide for the passage of water in a manner approximating the natural flow regime and designed to accommodate the 50 year storm. Fill areas and related ponds shall not substantially retain or divert the total flow.

(9) Man-made lakes, ponds, or other containment works shall be constructed with a maximum slope of 30 degrees to a depth of six feet of water. Whenever mineral extraction is completed in new quarries, shoreline sloping, revegetation, and contouring of soils or tailings shall be completed before abandonment. Existing quarry lakes shall be exempt from this provision, except that whenever any person carries out any activity defined as development or applies for a development permit, as defined herein, to develop any existing quarry lake area, these regulations shall apply.

(10) Development shall not detrimentally change the quantity of ground and surface water available for recharge to the Floridan Aquifer. A

developer shall not cause storm water from the site to discharge or runoff into an existing sinkhole.

(11) The development shall not impair the water retention and filtering capacity of wetlands soils or vegetation.

(12) New drainage facilities shall release water in a manner approximating the natural local surface flow regime, through a spreader pond or performance equivalent structure or system, either on site or to a natural retention or natural filtration and flow area. New drainage facilities shall also maintain a ground water level sufficient to protect wetland vegetation through the use of weirs or performance equivalent structures or systems. Said facilities shall not retain, divert, or otherwise block or channel the naturally occurring flows in a strand or slough.

(13) Solid waste disposal sites shall meet all the requirements of this Code.

(14) Site alteration shall be permitted only when such alteration will not cause siltation of wetlands or reduce the natural retention and filtering capabilities of wetlands.

(15) Ground water withdrawal shall comply with the standards and regulations of the Southwest Florida Water Management District or its successor agency.

(16) Placement of structures shall be consistent with sound floodplain management practices such as compliance with Flood District Disaster Protection Act of 1973.

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.08, Formerly 27F-6.08, Transferred from 27F-6.008.

28-27.009 Permit Requirements.

(1) Any development as defined herein undertaken in the Green Swamp Area of Critical State Concern shall require a development permit. Development permits for any change in zoning, plat approvals or vacancies shall be issued in the form of a development order as defined in these regulations. An application for a development permit shall be submitted to the Polk County Planning Department, or the Polk County Building and Zoning Codes Department, whichever shall be designated by the Board, together with any reasonable fee set by the Board.

(2) Prior to issuance of any development permit, an applicant shall submit a development plan to the county agency designated by the Board pursuant to subsection (1) of this rule. The development plan shall affirmatively demonstrate that the proposed development meets or exceeds the requirements of this Code. No permit shall be issued until the requirements of this Code are met. The development plan shall include the description and scope of the proposed project in report form. The development plan shall include, but not be limited to, the following documents and information:

(a) A certified survey of the site showing topography in no more than one (1) foot contours in the wetlands and the pine flatwoods and two (2) foot contours in the uplands by a land surveyor registered in the State of Florida.

(b) A soil analysis prepared by a registered professional engineer or the U. S. Soil Conservation Service which will be detailed and accurate enough to allow for the soils determination required in Section 28-27.008(4)(a), of this Code.

(c) A statement by a registered professional engineer indicating expected changes in surface and ground water quality discharge, and artesian aquifer recharge characteristics of the site before, during, and after development and specifying any measures necessary to approximate existing quality and quantity in surface and ground waters.

(d) A vegetation map of the site.

(e) A development implementation schedule.

(f) A site plan indicating any proposed alteration or development.

(g) A Impact Assessment Statement as required by zoning change procedures.

(3) A development plan shall not be required in the following three (3) instances unless specifically requested by a county agency:

(a) The modification of any single-family residential structure for the uses of a single family.

(b) The construction of any rural residence, as referred to in this Code, shall require only the site plan and certified soil analysis.

(c) The four laning of U. S. 98 by the Florida Department of Transportation between I-4 and the Polk County Line, and any construction or alteration caused by acquiring the right-of-way needed for this facility.

(4) A development permit shall not be required by this chapter in the following two (2) instances unless otherwise required by these applicable county ordinances or regulations:

(a) The modification of any existing residential structure that does not exceed ten (10) percent of the square footage of its original structure.

(b) One residential accessory structure may be added, not to exceed six hundred (600) square feet, provided such structure does not exceed the site coverage stipulated in 28-27.008(4)(a) of this chapter.

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Amended 4-19-77, Formerly 22F-6.09, Formerly 27F-6.09, Transferred from 27F-6.009.

28-27.010 Minimum Requirements. The provisions of this Code shall be considered to be minimum requirements for the protection and promotion of the public health, safety, or general welfare. Whenever the requirements of this Code are at variance with the requirements of any other rules, regulations or codes, which are a proper exercise of authority of a governmental jurisdiction, the more restrictive standards shall govern.

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.10, Formerly 27F-6.10, Transferred from 27F-6.010.

28-27.011 Appeals and Notification. Appeals from a local government's decision on development orders in the Green Swamp Area of Critical State Concern shall be made to the Florida Land and Water Adjudicatory Commission by filing a notice of appeal with the Commission in accordance with Section 380.07, Florida Statutes. A copy of each development order issued in the Green Swamp Area of Critical State Concern shall be transmitted to the Bureau of Land and Water Management, Department of Community Affairs and to the developer or owner of the property affected by such decision.

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.11, Formerly 27F-6.11, Transferred from 27F-6.011.

28-27.012 Variances. Variance procedures provided in local ordinances shall apply to the Green Swamp Area of Critical State Concern. However, in addition to the standards provided in such ordinances, no variance shall be granted for any development within the critical area unless such development is designed consistent with critical area regulations to have minimum adverse impact on the area's water storage capacity, surface water flow and wetlands. The applicant shall have the affirmative burden of establishing that the development will have a minimum adverse impact on such resources.

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.12, Formerly 27F-6.12, Transferred from 27F-6.012.

28-27.013 Amendments. Upon adoption by the County Commission of any land development regulations which would apply solely to the Green Swamp Area of Critical State Concern, such regulations shall be transmitted to the Bureau of Land and Water Management, Department of Community Affairs. If the Bureau finds that such regulations comply with the principles for guiding development specified in Chapter 28-26, Florida Administrative Code, adopted by the Administration Commission pursuant to Chapter 380, Florida Statutes, the Bureau shall by rule, approve the submitted regulations. Approved regulations shall supersede any regulations previously adopted for the Green Swamp Area of Critical State Concern.

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.13, Formerly 27F-6.13, Transferred from 27F-6.013.

28-27.014 Enforcement. Pursuant to Section 380.05(8), Florida Statutes, this Code shall be administered by the local government as if the regulations constitute or are a part of the local land development regulations.

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.14, Formerly 27F-6.14, Transferred from 27F-6.014.

28-27.015 Severability. If any one or more of the provisions of these regulations or the application of such provisions to any situation, circumstance or person shall for any reason be held invalid, such invalidity shall not affect any other provision of these regulations or the application of such regulations to any other situation, circumstance or person.

Specific Authority 380.05 FS, Chapter 28-26, FAC. Law Implemented 380.05(8) FS. History—New 7-20-75, Formerly 22F-6.15, Formerly 27F-6.15, Transferred from 27F-6.015.

APPENDIX H

SECTION V

RECOMMENDED PRINCIPLES FOR GUIDING DEVELOPMENT

Pursuant to Section 380.05, Florida Statutes, the principles, outlined in Table IV below, for guiding development within the proposed area of critical state concern are recommended for adoption by the Administration Commission by rule pursuant to Chapter 120, Florida Statutes. These principles, when adopted, become the basis for the county jurisdictions of Lake and Polk to prepare land development regulations for the designated area of critical state concern. The recommended principles, identified in Table IV, specify:

I) a variety of objectives to be achieved through the adoption and enforcement of critical area development regulations, and;

II) a listing of elements requiring regulation and regulatory guidelines related to land-development activities which must be considered when preparing regulations;

III) a general section stating that these guidelines should be supplemental to existing regulations; and requesting the Southwest Florida Water Management District to provide assistance to Lake and Polk Counties.

When the principles are properly implemented by the adoption and enforcement of regulations, then the advantages of coordinating development in the area of critical state concern, as identified in Section III of this report, should be achieved.

To the extent possible, the Division of State Planning will provide technical assistance to local governments in the preparation of land-development regulations for areas of critical state concern.

TABLE IV

RECOMMENDED PRINCIPLES FOR GUIDING DEVELOPMENT

I.	Objectives To Be Achieved
1.	Minimize the adverse impacts of development on resources of the Floridan Aquifer, wetlands, and flood-detention areas.
2.	Protect the normal quantity, quality and flow of ground water and surface water which are necessary for the protection of resources of state and regional concern.
3.	Protect the water available for aquifer recharge.

TABLE IV (Continued)

RECOMMENDED PRINCIPLES FOR GUIDING DEVELOPMENT

I.	Objectives To Be Achieved

4. Protect the functions of the Green Swamp Potentiometric High of the Floridan Aquifer.

5. Protect the normal supply of ground and surface water.

6. Prevent further salt-water intrusion into the Floridan Aquifer.

7. Protect or improve existing ground and surface-water quality.

8. Protect the water-retention capabilities of wetlands.

9. Protect the biological-filtering capabilities of wetlands.

10. Protect the natural flow regime of drainage basins.

11. Protect the design capacity of flood-detention areas and the water-management objectives of these areas through the maintenance of hydrologic characteristics of drainage basins.

II. Elements Requiring Regulation	Regulatory Guidelines
- Site Platting -	- The platting of land should be permitted only when such platting commits development to a pattern which will not result in the alteration of the natural surface water flow regime and which will not reduce the natural recharge rate of the platted site.
- Site Alteration -	- Site alteration should be permitted only when such alteration will not adversely affect the natural surface-water flow regime or natural recharge capabilities of the site.
	- Site alteration should be permitted only when such alteration will not cause siltation of wetlands or reduce the natural retention and filtering capabilities of wetlands.

TABLE IV (Continued)

RECOMMENDED PRINCIPLES FOR GUIDING DEVELOPMENT

II. Elements Requiring Regulation	Regulatory Guidelines
- Site Alteration -	- All site alteration activities should provide for water retention and settling facilities; should maintain an overall site runoff equivalent to the natural flow regime prior to alteration and should maintain a runoff rate which does not cause erosion.
- Soils -	- All soil exposed as a result of site alteration or development activities should be located and stabilized in a manner to prevent the alteration of the natural flow regime. - All soil exposed as a result of site alteration or development activities should be restored with suitable vegetation.
- Ground Water -	- Ground water withdrawal should not exceed the safe yield per acre as determined by the Southwest Florida Water Management District.
- Storm Water Runoff -	- Storm-water runoff should be released into the wetlands in a manner approximating the natural flow regime.
- Solid Waste -	- Solid waste disposal facilities should be located in areas and operated in a manner that will not adversely affect the ground-water system.
- Structures -	- Structures should be placed in a manner which will not adversely affect the natural flow regime and which will not reduce the recharge capabilities. - Placement of structures should be consistent with sound flood plain management practices such as compliance with the Flood Disaster Protection Act of 1973.

TABLE IV (Continued)

RECOMMENDED PRINCIPLES FOR GUIDING DEVELOPMENT

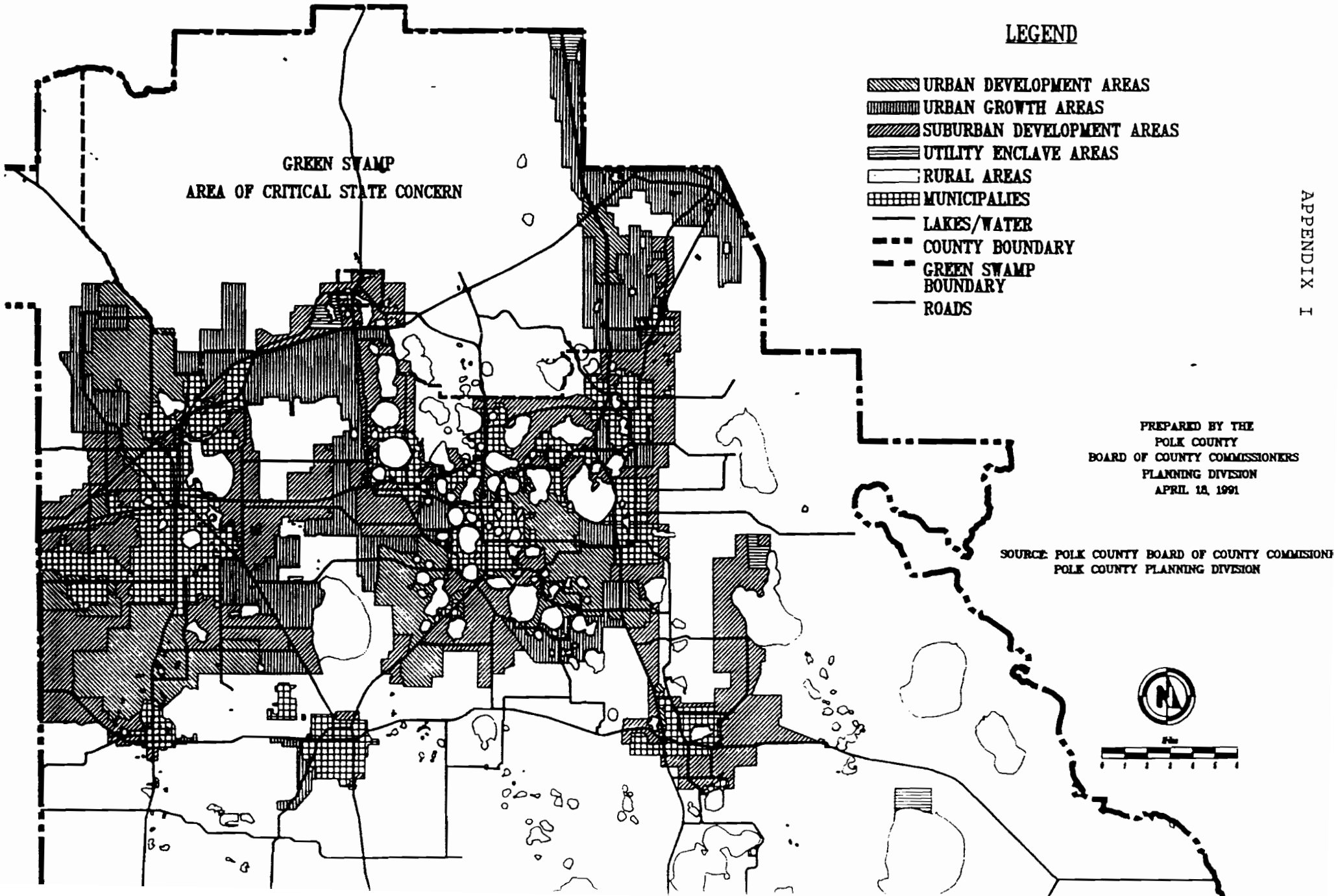
II. Elements Requiring Regulation	Regulatory Guidelines
- Administration and Planning -	- To the extent possible, regulations should be performance oriented, and should differentiate between the natural development suitability of the wetlands, flatwoods and uplands. - All land-development regulations adopted pursuant to these guidelines should be administered by the local government.

II.	General

1. The above guidelines are oriented towards protection of natural resources and public investments of regional and state importance. The regulations developed from these guidelines should be supplemental to existing county land-use regulations.

2. In developing appropriate regulations for the Green Swamp Critical Area, the Southwest Florida Water Management District is hereby requested to assist the counties of Lake and Polk.

3. Commencing 15 days after adoption by the Administration Commission, the principles for guiding development contained herein shall apply to all development undertaken in the critical area.


GREEN SWAMP
AREA OF CRITICAL STATE CONCERN
LEGEND
URBAN DEVELOPMENT AREAS
URBAN GROWTH AREAS
SUBURBAN DEVELOPMENT AREAS
UTILITY ENCLAVE AREAS
RURAL AREAS
MUNICIPALIES
LAKES/WATER
COUNTY BOUNDARY
GREEN SWAMP BOUNDARY
ROADS
PREPARED BY THE
POLK COUNTY
BOARD OF COUNTY COMMISSIONERS
PLANNING DIVISION
APRIL 18, 1991
SOURCE: POLK COUNTY BOARD OF COUNTY COMMISIONS
POLK COUNTY PLANNING DIVISION

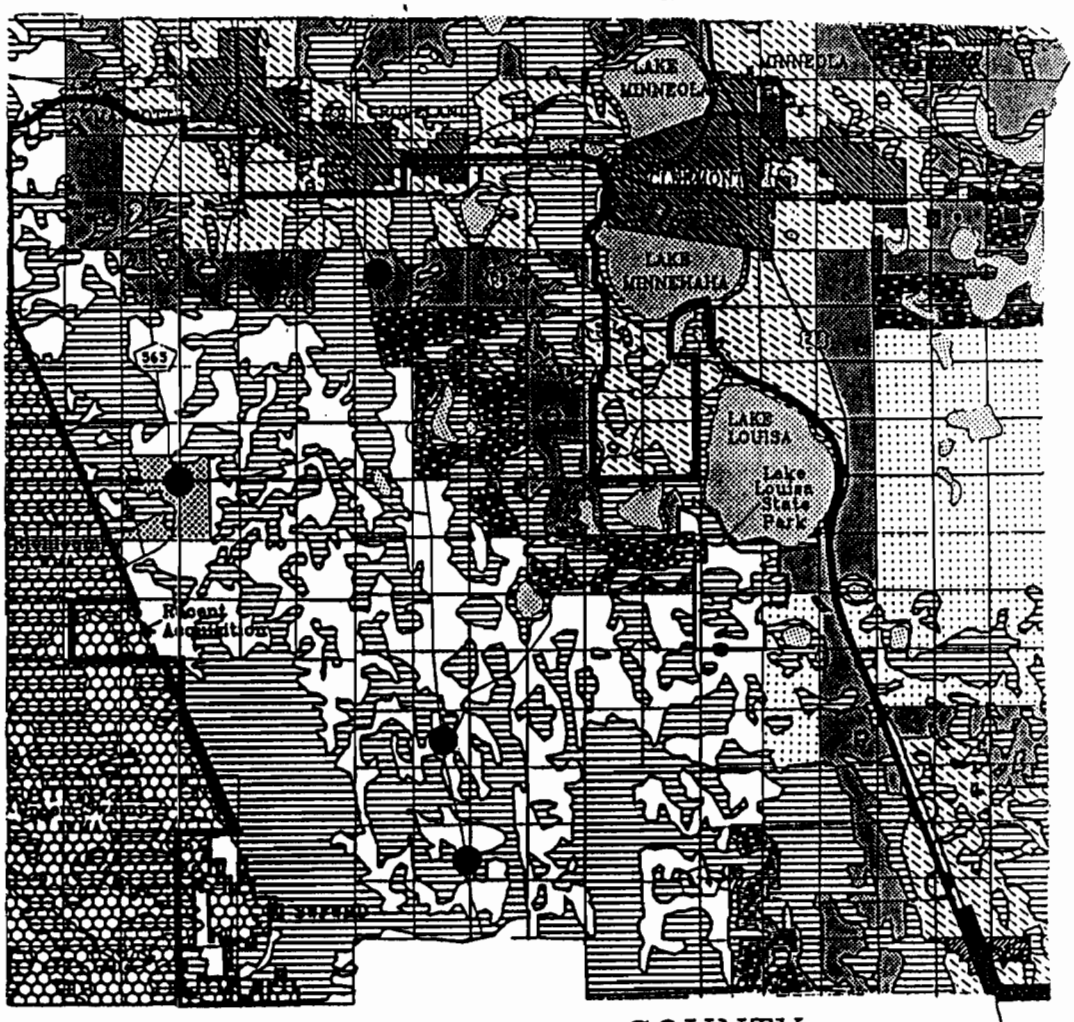
APPENDIX I

FUTURE LAND USE PLAN MAP
LAKE COUNTY – 2005
(WITH ADOPTED 2005 TRAFFIC CIRCULATION NETWORK)

LEGEND

- Neighborhood Commercial
- Community Commercial
- Regional Comercial
- Commercial Corridor
- Employment Center (Depicts industrial Zoning as of 7/9/91. Small parcels mey not be shown but are entitled to the use if zoned prior to 7/9/91).
- Future Employment Center
- Urban up to 22 DU/net ac
- Urban up to 10 DU/ac
- Urban Expansion up to 6 DU/ac
- Suburban up to 3 DU/ac
- Semi-Rural Future Urban 1 DU/2ac
- Rural Village up to 3 DU/ac
- Rural 1 Du/5ac
- Institutional
- Municipalities
- Wetlands 1 DU/5 ac Transferable Source: FGFWFC, 1986/87 Note: This map represents a general location of wetlands. An exact wetlands boundary shall be determined in the field by the agency with jurisdiction.
- Rural 1:40 SENDING AREA 1 DU/40ac
- RURAL 1:20 SENDING AREA 1 DU/20ac
- RURAL 1:20 RECEIVING AREA 1 DU/20ac
- Conservation/Public Resource Lands
- General Aviation Facilities
- Wekiva River Protection Area Boundary
- Mt. Plymouth-Sorrento Urban Compact Node (up to 5.5/ac)
- Green Swamp Area of Critical State Concern Boundary
- Water Management District Lands
- Ocala National Forest

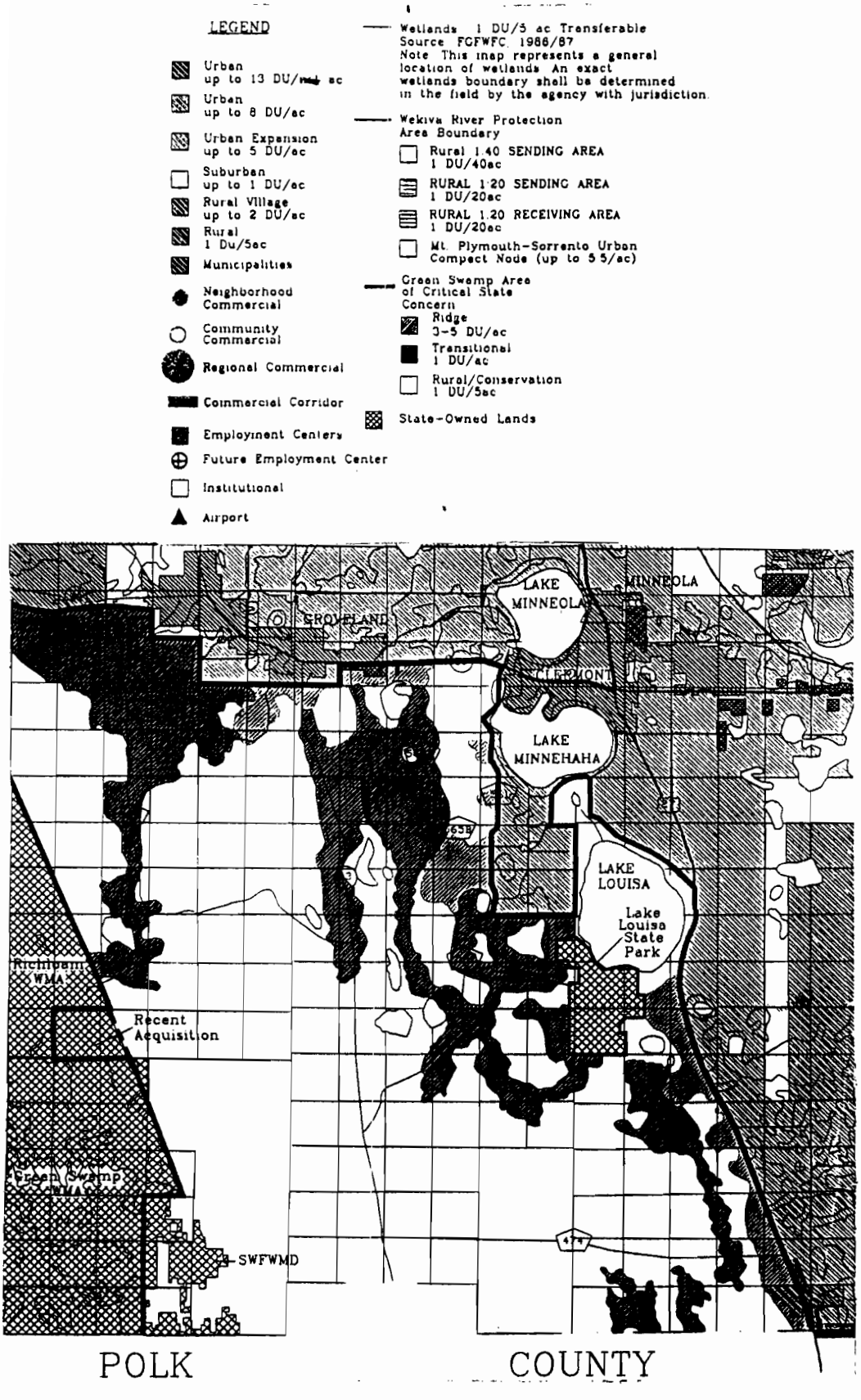
NUMBER OF LANES 2005
6 LANES
4 LANES
3 LANES
2 LANES
LIMITED ACCESS FACILITY INTERCHANGE



Feb.1992

DRAFT ONLY!

FUTURE LAND USE PLAN MAP
LAKE COUNTY - 2005
(WITH ADOPTED 2005
TRAFFIC CIRCULATION NETWORK)



May 1992

APPEDIX J

Regulations and Enforcement of "Taking" of Gopher Tortoise by Development Activities Under Existing Rules of The Florida Game and Fresh Water Fish Commission

Chapter 39-27.002(4) FAC provides for the protection of species of special concern:

> (4) Species of special concern - No person shall take, possess, transport, or sell any species of special concern or parts thereof or their nests or eggs except as authorized by Commission regulations or by permit from the Executive Director or by statute or regulation of any other state agency, permits being issued upon reasonable conclusion that the permitted activity will not be detrimental to the survival potential of the species.

As conflicts occurred between development and tortoises, there have been numerous questions from both staff and from the development and environmental communities as to how this rule applied to a development activity, such as paving, that resulted in the death of individual tortoises.

Commission staff proposed a rule that would have established a permitting program with thresholds, exemptions, grandfathering provisions, and permitting requirements. At its January meeting, the Commission decided to not pursue this specific rule but to instead rely on existing rules. This put Commission staff back in the position of interpreting the existing rule which clearly prohibits the taking of these animals without a permit. Staff is interpreting the rule as follows:

1. For purposes of law enforcement and permitting, "taking" includes the entombment or killing of gopher tortoises as a result of bulldozing, grading, paving, or building construction. Where such "taking" occurs, a permit will be required from the Executive Director or his designee.

2. Five options are available to an individual who wishes to conduct activities that will take tortoises:

   A. Avoid developing in an area occupied by tortoises.

   B. Avoid individual burrows by a sufficient distance to assure that the entire burrow is protected.

   C. Proceed with activities that will probably entomb or kill tortoises and mitigate for the taking by providing a degree of habitat protection similar to that provided by DRI developers, as outlined in the Commission's Gopher Tortoise Habitat Protection Guidelines (Nongame Tech. Bull. #4). These permits will be processed by

the Office of Environmental Services.

D. Relocate those tortoises that would otherwise be "taken." This option is generally a less valid conservation approach, but would at least remove the individual tortoise from the path of land clearing. Relocation will be performed as covered in current relocation guidelines. A conservation easement or other binding assurance should be obtained on private lands to insure long-term protection of those individuals moved. Public lands should not be used except where Division of Wildlife personnel conclude that stocking is important to tortoise management on that parcel. Relocation permits are processed by the Endangered Species Coordinator in Tallahassee.

E. In cases where five or fewer tortoises are affected and adequate habitat will exist on the site following construction, tortoises may be captured by the landowner or his agents and released back onto the site in an area where they can move freely. If inadequate or no tortoise habitat will exist on the site following construction, the landowner or his agents may only pursue options 1-4 above. Permits to capture and release tortoises on site will be issued by regional Division of Wildlife personnel based on telephone conversations (field verifications may be conducted by GFC personnel if deemed necessary.)

Many people are already familiar with the relocation option. Three changes will be seen, however.

1. There will be increased emphasis on assuring that recipient sites are protected into the future.

2. Public lands will generally not be allowed as recipient sites.

3. A 21-day delay for appeal of the permit will be included in most relocation permits.

The habitat protection option is patterned after existing Tortoise Habitat Protection guidelines except that the guidelines were written for evaluating "regionally significant" resources for DRIs. Therefore, the minimum density and acreage thresholds do not apply to "taking" permits. The following steps summarize the process if the habitat protection option is chosen.

1. The applicant shall provide the following information:

   A. Name of owner or developer.

   B. Location of site to quarter, quarter section.

C. Map, preferably on a topographic 1:24,000 quadrangle or larger scale map, showing areas where taking will occur and landmarks or roads to allow site inspection.

D. Map showing areas occupied by tortoises with densities up to 0.8/acre and areas occupied at densities greater than 0.8/acre.

E. Acres in each category.

F. How applicant proposes to protect the required amount of habitat.

2. The Commission will issue a letter permit to the applicant. The permit will have the following conditions:

A. There will be a 21-day appeal period before any taking can occur.

B. For off-site mitigation, the applicant must have a second letter from the Commission in his possession confirming that habitat protection options have been completed.

Using the habitat protection option, the applicant may mitigate for the "taking" of individuals by providing a prescribed degree of habitat protection. Under this option the applicant will preserve an area of tortoise habitat equal to 15% of the occupied gopher tortoise habitat being affected that has a density of up to 0.8 tortoises/acre plus 25% of the occupied gopher tortoise habitat being affected that has a density of 0.8 tortoises/acre or greater. Commission staff presumes that this level of protection allows a degree of taking that will not adversely affect the survival potential of the species and therefore meet the requirements of Ch. 39. Commission staff does not require or recommend that a person choosing this option relocate tortoises. Habitat may be preserved in one of three ways at the discretion of applicant:

1. Protect an occupied area of the proper size on site in perpetuity in relatively large contiguous blocks.

2. Purchase a parcel of tortoise habitat of the proper size adjacent to public lands that are managed in a manner compatible with tortoise protection and donate the parcel to the public landowner.

3. Purchase the appropriate number of acres in an existing or proposed mitigation park within the Regional Planning Council boundaries. This option may not be available in regions where mitigation facilities are not proposed or

anticipated.

Attached are GFC contact points for either the habitat protection option or the relocation option.

OES Offices

620 South Meridian Street
Tallahassee, FL 32399-1600
904-488-666
SC 278-6661

29200 Tuckers Grade
Punta Gorda, FL 33955
813-639-3515
SC 721-7570

Post Office Box 3407
Marathon Shores, FL 33052
305-743-9312
SC 451-5002

110 43rd Avenue Southwest
Vero Beach, FL 32968
407-778-5094
SC 778-5094

3900 Drane Field Road
Lakeland, FL 33803
813-648-3206
SC 595-3210

APPENDIX K

GLOSSARY

ACRONYMS

ACSC	Area of Critical State Concern
ADA	Application for Development Approval
BMP	Best Management Practices
BOD	Biochemical Oxygen Demand
CARL	Conservation and Recreational Land Program
CFRPC	Central Florida Regional Planning Council
COE	U.S. Army Corps of Engineers
DCA	Department of Community Affairs
DER	Florida Department of Environmental Regulation
DHR	Division of Historical Resources
DNR	Florida Department of Natural Resources
DRI	Development of Regional Impact
EA/EIS	Environmental Assessment/Environmental Impact Statement
ECFRPC	East Central Florida Regional Planning Council
EEL	Environmentally Endangered Land Program
EPA	U.S. Environmental Protection Agency
FGFWFC	Florida Game and Fresh Water Fish Commission
FRSC	Florida Rivers Study Committee
LAFT	Land Acquisition Trust Fund
MOA	Memorandum of Understanding
MSSW	Management and Storage of Surface Water
OFW	Outstanding Florida Water
OST	On-site Tank
P2000	Preservation 2000
PUD	Planned Unit Development
SCS	Soil Conservation Service
SJRWMD	St. Johns River Water Management District
SOR	Save Our Rivers
SWFWMD	Southwest Florida Water Management District
TBRPC	Tampa Bay Regional Planning Council
TDR	Transfer Development Rights
USGS	U.S. Geological Survey
WMD	Water Management District
WRPC	Withlacoochee Regional Planning Council

TERMS

Absorption field A drainfield to treat wastewater or dispose of effluent.

Absorption Adhesion of gas molecules, liquid, or dissolved solids to a surface; also an advanced method of wastewater treatment in which activated carbon removes organic matter from wastewater.

Aerobic Life or processes that occur only in the presence of oxygen (see also **Anaerobic**).

Agriculture Methods of production and management of livestock, crops, vegetation, and soil.

Agricultural easement A non-possessory interest in land which restricts the conversion of the use of the land, preventing non-agricultural uses.

Agricultural pollution The liquid and solid wastes from farming, including runoff and leaching of pesticides and fertilizers; erosion and dust from plowing; animal manure and carcasses; crop residues; and debris.

Ambient Background data on a subject usually prior to alteration.

Anaerobic Life or processes that occur in, or are not destroyed by, the absence of oxygen.

Anthropocentrism/anthropogenic Viewing nature, the Earth, and the rest of the universe in terms of human values, with their resources to be exploited for human benefit; in this view, other forms of life are seen as less important (see also **Biocentrism**).

Anticline An upfold or arch of layered rock in which the layers bend downward in opposite directions from the top of the fold.

Aquaclude A layer impervious to the flow of water, for example, the thick confining beds between the surficial and Floridan aquifers.

Aquifer A geologic formation or group of formations that contains sufficient saturated, permeable material to be able to yield significant quantities of water to wells and springs.

Aquatic Preserve An exceptional area of submerged lands and its associated waters set aside to be maintained essentially in its natural or existing condition. Most aquatic preserves are also Outstanding Florida Waters; any sale, lease, transfer, or use must be found to be in the public interest (see also **Outstanding Florida Water**).

Area of Critical State Concern (ACSC) A Florida environmental protection designation for areas that contain especially valuable species or habitats.

Archaeology The scientific discipline responsible for studying the social and cultural past through material remains, with the goal of ordering and describing the events of the past and explaining the meaning of these events.

Archaeological assessment An evaluation of the archaeological resources present in an area, their scientific significance, and the cost of protecting or properly investigating them.

Artesian water Water under hydrostatic pressure confined in an aquifer by relatively impervious materials, which rises in a well above the top of the aquifer.

Artifact A material object made or modified in whole or in part by man.

Base flow A stream's sustained low flow; or the groundwater flow to a stream channel.

Best Management Practices (BMP's) Conservation practices or systems of practices and management measures that control soil loss and reduce water quality degradation caused by nutrients, animal waste, toxins, and sediment.

Biocentrism A view in which nature, the Earth, and the universe in terms of the value of all biological communities, not just those that are human (see also **Anthropocentrism**).

Biochemical oxygen demand (BOD) The amount of dissolved oxygen, expressed in milligrams per liter, required by an environment for biological respiration and chemical reactions. It is a measure of the amount of organic material in water.

Biological diversity The number of different species living in a particular habitat or area; it may be an indicator of a particular ecosystem's state of health.

Biological integrity The health of a particular ecosystem, characterized by the number and variety of species present as well as the system's stability and capacity to sustain itself over a long period.

Biome Geographically distinct parts of the biosphere, each one of which has its own specialized group of ecosystems.

Bioremediation The restoration of all or some of an ecosystem or area's biological functions. Not enough is known about many systems, however, and others are so complex that restoration is difficult or impossible (see also **Mitigation**).

Biota The animal and plant life of a particular region considered as a total ecological entity.

Biotic or biological diversity The assemblage of biotic (living) components of a landscape expressed as a measure of contrast. That is, the number of different organisms.

Black water (1) Surface water that is dark in color because it contains high levels of colored organic acids, e.g. tannic acid, or (2) domestic wastewater that contains animal, human, or food wastes (see also **Tannic acid**).

Buffer The space next to a sensitive area required to protect it from human activities so that its biological function and stability as an ecosystem are preserved; some restrictions on the type of future development are usually imposed.

Carrying capacity The size of a population that an environment or habitat can support indefinitely.

Chemical oxygen demand (COD) A measure of the oxygen required to oxidize all organic and inorganic compounds in water.

Classes of Waters of the State:

Class I-A Surface waters that are used as a potable source for public water supplies or withdrawn for treatment as such.
Class I-B Groundwaters that are used as potable and agricultural water supplies and storage.
Class II Coastal waters which have the capability to support shellfish harvesting.
Class III All other coastal and inland waters not otherwise specifically classified by the DER. The primary requirement for these waters is that they be maintained as a quality sufficient to allow body contact water sports and propagation of fish and wildlife.
Class IV Agricultural and industrial water supplies.
Class V Navigation, utility and industrial use.

Clearcutting The timber-harvesting practice of removing all the trees in a particular area at one time.

Climax ecosystem An ecosystem's stable, self sustaining stage of development, often only reached after a very long period (such as centuries) without a natural disaster or human disturbance.

Commensalism A relationship between organisms where one benefits, while the other neither benefits nor is harmed.

Community, ecological A natural assemblage of plants and animals that live in the same environment, are mutually sustaining and interdependent, and are constantly fixing, utilizing, and dissipating energy.

Community, wildlife All the populations of different species of animals that live in the same environment.

Cone of influence Area surrounding one or more major waterwell(s) the boundary of which is determined by an environmental government agency based on groundwater travel or drawdown depth. The cone shape comes from lowering of the potentiometric surface to the point of well pumping with the narrow point being at the end of the well shaft, and the widest section spreading upward toward the potentiometric surface.

Concurrency As mandated by Florida's 1985 Growth Management Act, concurrency ensures that public facilities and services are concurrent with the impact of new development.

Confined aquifer An aquifer that is overlain by a confining bed which has a significantly lower hydraulic conductivity than the aquifer.

Confining bed A body of relatively impervious material next to an aquifer. In nature, however, its "hydraulic conductivity" may range from nearly zero to some value distinctly lower than that of the aquifer.

Connate water Water entrapped in sediment at the time of their deposition.

Conservation areas Areas of land ownership that have legal restrictions relating to how the use of the land can effect its environment.

Consistency The requirement of Florida's 1975 Local Government Comprehensive Planning Act that local governments make land-use decisions that are consistent with their comprehensive plans and with state plans.

Consumptive use The portion of water withdrawn from the immediate water environment by such means as evaporation, transpiration, and consumption by humans and animals. It is sometimes called water consumed or water depletion.

Controlled or prescribed burning Controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions which allow the fire to be confined to a predetermined area and at the same time produce the intensity of heat and rate of spread required to attain planned resource management objectives.

Coppice Sprouting of a plant or tree from its stump.

Critical habitat A specific area essential to conserving a protected species that may require special management protection.

Cumulative impact The total effect of a number of human activities on the environment; while each one alone may not have a noticeable effect, in combination with others the effect can be significant.

Cursorial Adapted to or specialized for running as opposed to flying, crawling, etc.

Cypress dome Poorly drained to permanently wet depressions dominated by pond cypress. They are called "domes" because of their appearance when viewed from the side.

Density Number per unit area.

Desalination (or desalinization) Removing salt from ocean or brackish water by evaporation or reverse osmosis.

Developments of Regional Impact (DRI) Any development which, because of its character, magnitude, or location, would have a substantial impact upon the health, safety, or welfare of citizens of more than one county, as defined in Chapter 380.06, Florida Statutes.

Discharge The volume of water that passes a given point within a given period of time.

Dissolved oxygen (DO) The oxygen freely available in water that is vital to the existence of fish and other aquatic life. Secondary and advanced wastetreatment systems are usually designed to protect DO in waste-receiving waters.

Drainage basin The land area drained by a river; a subdivision of a watershed.

Drainage detention structure A structure which collects and temporarily stores stormwater for the purpose of treatment through physical, chemical, or biological processes with subsequent gradual release of the stormwater.

Drainage divide The boundary of a drainage basin, or a ridge that divides one drainage basin from another.

Drainage facilities A system of man-made structures designed to collect, convey, hold, divert, or discharge stormwater; and includes stormwater sewers, canals, detention structures, and retention structures.

Drainage retention structure A structure designed to collect and prevent the release of a given volume of stormwater by complete on-site storage.

Drawdown The lowering of the upper surface of a water table.

Easement A right or privilege that a person may have in another's land, as the right-of-way.

Ecological indicator A species or community (or their response) that is a measure of environmental conditions.

Ecological niche The role of a species in an ecosystem

Ecosystem The interaction of a biological community and its environment, considered collectively. Each ecosystem is made of biotic and abiotic (living and nonliving) components.

Ecotone Transition zone between adjacent ecosystems

Effluent Treated or untreated wastewater flowing out of a treatment plant, sewer, or industrial outfall into a water body.

Eminent domain The authority of the government to take or forcibly acquire private land for public use, with compensation paid to the landowner.

Endangered species Animals, plants, or other living organisms in immediate danger of extinction because of human-induced or natural changes in their environments.

Environmentally sensitive area Any location containing endangered or protected plants, animals or historic properties.

Equilibrium number The number of species supportable in a given area over the long term.

Eutrophic The aging process by which a water body evolves into a bog or marsh and eventually fills in and disappears. In later stages, the water body is choked by plant life as the levels of nutrients such as nitrogen and phosphorus released by the decaying organic matter increase, and the amount of dissolved oxygen in the water decreases; this further favors the development of plant over animal life.

Eutrophication The processes that result in a higher concentration of dissolved nutrients in a water body.

Evapotranspiration The process by which water is removed from the soil by evaporation and by transpiration from plants.

Exotic species A plant or animal species not native to a geographic area or ecosystem. Because they have no natural pests once they are placed in a new location, many exotic species reproduce prolifically and replace native species or the habitats that support

those species. Those of concern in Florida include such plants as the melaleuca tree, Brazilian pepper, and water hyacinths and such animals the tilapia fish, walking catfish and wild hogs.

Extirpation Extinction of a species from particular area (not its entire range) where it formerly occurred.

Facultative Used to describe a species that tolerates moderate amounts of pollution or low dissolved oxygen.

Fault A fracture in the Earth's crust where one side of the fracture is displaced from the other.

Fauna The animals of an area.

Fecal coliform Bacteria that are present in the intestines or feces of warm-blooded animals and that are often used as indicators of the sanitary quality of water.

Fire ecology The study of natural communities such as pine flatwoods and scrub that have adapted to naturally occurring fires every 3 to 5 years. Fire-adapted species that would become extinct without fires to maintain their habitat include redcockaded woodpeckers, bluebird, fox squirrels, gopher tortoises, and many trees, shrubs, and wildflowers.

Fire management All activities required to provide protection of burnable forest values from fire and the use of fire to meet land management goals and objectives.

Flatwoods The most common plant community in Florida, flatwoods are dominated by longleaf pine, slash pine, and saw palmettos. They are often temporarily flooded in the summer, and in the dry season burn naturally from lightning strikes. Flatwoods contain many fire-dependent species.

Floodplain Relatively level valley floor built of material transported by a stream and deposited beyond the stream channel during floods. Pertaining to the area of lands adjacent to a water course that are periodically inundated during flood events.

Floodway Area of stream or river that has considerable velocity.

Flora The species of plants in an area.

Floridan aquifer The confined, artesian aquifer underlying most of Florida which serves as a principal supply of water.

Forb A broad-leaved, flowering plant other than a grass, often part of the succession toward a climax ecosystem.

Gauging station An installation for measuring the discharge of a stream.

Genetic viability The chance of survival from egg to adult.

Gray water Domestic wastewater that does not contain human wastes; it comprises water from kitchen and bathroom sinks as well as bathtubs and laundry tubs.

Greenbelt law Preferential property tax treatment for lands which are used primarily for bona fide agricultural purposes wherein, "bona fide agricultural purposes" means good faith commercial agricultural use of the land.

Groundwater Water beneath the land surface in zones of saturation.

Habitat, wildlife The area or type of environment in which an organism or biological population normally lives or occurs.

Hammock In Florida, it is an area higher than its surroundings characterized by hardwood forests of broad-leafed evergreens such as oaks, sweetgums, hickories, palms, and hollies.

Headwaters The area of a watershed or river basin that is farthest from the mouth of the stream or river and that does not have a defined river or stream channel, but is dominated by isolated wetlands and overland flow.

Herpetology The study of reptiles.

Historic site A location where a significant event took place or where a significant cultural resource is now or used to be situated.

Home range The area routinely traversed by an animal.

Hydraulic conductivity (K) The coefficient which quantifies the resistance of a porous medium (e.g. saturated soil) to fluid flow. This coefficient depends on properties of the fluid and the medium and has units of length per time. In the U.S. K is often expressed as the flow in gallons per day through an area of one square foot under a gradient of one foot per foot at 60 degrees F.

Hydric - Of or pertaining to wet conditions: often used to describe forested wetland ecosystems. (See Hammock).

Hydric soil A soil that in its undrained condition is saturated, flooded, or pooled long enough during the growing season to develop anaerobic conditions that favor the growth and regeneration of hydrophytic vegetation (plants that are adapted to wet areas).

Hydrogeology The geology of groundwater that emphasizes its occurrence, movement, replacement, and depletion, as well as the properties of rocks that control groundwater movement and storage.

Hydrological cycle The global cycle of water movement from the atmosphere to Earth and back, incorporating the oceans, atmosphere, and land.

Hydrology The science of the occurrence, properties, distribution, and circulation of the earth's waters and their relationship with the environment.

Hydroperiod The cyclical frequency of water in a particular area. Certain plants such as cypress, for example, need seasonal flooding to reproduce.

Hydrophytic vegetation Plant life growing in water or in a place that is at least periodically deficient in oxygen because of high water levels.

Hydrostatic force The pressure exerted or transmitted by water at any given point in a body of water at rest.

Impervious A hard surface that allows little or no passage of water or sediments.

Infrastructure The public structures and services needed by a community, including roads, schools, fire protection, and transportation systems.

Insularity Of or relating to the extent that a specific habitat area is surrounded by dissimilar land uses that in an ecological sense isolates it from natural animal and plant dispersion mechanisms.

Integrity, biological All of the plants and animals that are characteristic of an area and all of the processes that result from interactions between these species and their environments.

Isolated wetlands Wetlands that do not share a common connection, hydrologic or vegetative, with adjacent wet systems or waters of the state.

Karst An area of irregular topography formed on limestone, dolomite, and gypsum beds, and other rocks in which dissolution has produced geologic features such as fissures, sinkholes, underground streams, and caverns.

Landscape A heterogeneous land area composed of a cluster of interacting ecological systems that are repeated in similar form throughout. Landscapes very in size, down to a few kilometers in diameter.

Landscape association An assemblage of ecological communities with similar topography and geology which are connected.

Landscape dynamics The areal and functional relationships between different parts of the landscape, e.g. the distribution, sizes, and topographic and hydrologic connections among ecosystems in a landscape association.

Leaching The removal of soluble materials from soil (including mining and dredge spoil) by water that passes through.

Life requisites Those components of a habitat that an organism needs to survive.

Littoral zone The interface between the open water area of a lake or pond and the surrounding uplands which will support the growth of submerged, emergent or floating-leaf aquatic plants.

Macroinvertebrate A bottom-dwelling aquatic invertebrate. The analysis of the quantity and type of macroinvertebrate species is used as an indicator of water quality. Polluted areas tend to have large numbers of only a few macroinvertebrate species that can tolerate decreased oxygen levels, while nonpolluted areas tend to have smaller numbers of many different macroinvertebrates.

Mast The nuts of forest trees, such as pine nuts, acorns, and grass seeds, that accumulate on the ground and provide food for wild animals.

Mesic Related to conditions of moderate moisture or water supply, used to describe organisms occupying moist habitats.

Mitigation Measures taken to reduce adverse impacts on the environment by replacing, enhancing, or providing substitute sensitive areas for those that will be destroyed. Most mitigation that involves creating a particular ecosystem, however, is not successful because of a lack of maintenance and follow up. Further, some particularly complex ecosystems, such as bayheads, have never been successfully created or duplicated by humans.

Mitigation ratio The ratio of the area that will be created and the area scheduled to be destroyed, which is usually negotiated between the developer and government agencies.

Mitigation, type-for-type or in-kind Replacement of the altered system with one as close as possible to the original, utilizing the same or similar species of plants.

Model A representation of any kind of system (such as an ecosystem, a set of wildlife populations, or a landscape association) written in a computer language that shows changes over time and responds to different sets of conditions.

Native species Species that are native to a particular geographic area. Because they are part of an ecosystem where everything is interdependent, these species are adapted to local foods, soil and weather conditions, and pests and diseases. Native plants, for example, need less water, fertilizer, and pesticides than species not adapted to a particular location.

Nonpoint source pollution Pollution sources that are diffuse and do not come from a single point. The pollutants are usually carried off the land by stormwater runoff. The most common nonpoint sources are agriculture, forestry, urban areas, mining, construction, dams and channels, land disposal, and salt water intrusion.

Oligotrophic Refers to deep, clear lakes with low nutrient supplies, that contain little organic matter and that have a high dissolved-oxygen (DO) level.

Overstory The layer of foliage (leaves and branches) formed by the largest trees in a forested area.

Permitting Authorization to engage in or conduct any construction, operation, modification, or expansion of any installation, structure, equipment, facility, or appurtenances thereto, operation or activity which will reasonably be expected to be a source of pollution or a hinderance, or affect the health and welfare of the population or environment.

Platting The legal process of registering subdivision.

Point source pollution A specific, identifiable point of origin at which any pollutant that harms plant, animal, or human life physically discharges into the environment.

Population, minimum viable The smallest number of individuals that will give 99% probability of the species surviving in a particular area for at least 1,000 years.

Potable water Water that is fit for human consumption.

Potentiometric level The level to which water will rise in tightly cased wells that penetrate aquifers.

Potentiometric surface An imaginary surface representing the static head of groundwater in an aquifer, defined by the levels to which water will rise in a well. Particular potentiometric surfaces include the water table and the artesian pressure surface.

Prescribed burn (also called controlled burn) A management plan where burning is carried out under close supervision, in areas where periodic fires are a part of the ecosystem and crucial to the survival of numerous fire-adapted species of animals and plants.

Preservation area Areas protected from any further development except in extreme cases of overriding public interest. The preservation concept includes consideration of ecologically sensitive plants, animals, fragile topographic features, environmentally unique areas as well as important historic and archeological areas.

Preservation 2000 A 1990 Florida bill that created a $3 billion, 10-year land acquisition program; as much as $300 million will be appropriated annually, secured by $30 million annual increments over the life of the program.

Rails-to-trails A program that converts abandoned rail lines for public use, usually as trails or bicycle paths.

Rangeland Land on which the natural vegetation is predominantly native grasses, grasslike plants, forbs, or shrubs valuable for forage that do not qualify as timberland and are not developed for another use. it includes natural grassland and savannah.

Rare or endangered ecosystem A natural, native ecological community type which due to its limited distribution, small areal extent or rate of disappearance/modifications is it danger of being lost as a viable component of the natural landscape.

Reasonable use A rule that restricts a landowner to a reasonable use of his own rights and property, qualified by the similar rights of others, and the condition that such use not injure others in the enjoyment of their rights.

Receiving waters A water body into which wastewater or treated effluent is discharged.

Recharge The process by which water is added to an underground zone of saturation, usually by percolation from the soil surface, such as the recharge of an aquifer.

Recharge area (also called high-water-recharge area of high recharge area) A land area in which water reaches to the zone of saturation from surface infiltration, such as an area where rainwater soaks through the earth to reach an aquifer.

Reclamation The 'reasonable' restoration of productivity to lands made barren through processes such as erosion, mining, or land clearing. Some lands, however, such as those that have been strip mined, regain some productivity but are permanently altered from their original states because of changes to the soil's underlying hydrological structure.

Reverse osmosis A water treatment process used to process drinking water or wastewater that adds pressure so that water is forced through a semipermeable membrane. It removes most drinking water contaminants.

Reuse of water The practice of using water which is no longer fit for a particular use for a different application which can tolerate water of a lesser quality.

Riparian Related to the banks of a stream, lake, river, or tidewater.

Rookery A colony, or the nesting or breeding grounds of gregarious birds or mammals.

Runoff Rainwater or irrigation water that runs over the land and then into streams, rivers, lakes, or other surface waters. it can carry numerous suspended or dissolved pollutants from the air and land into the water. It is usually expressed in inches of water uniformly distributed over the area that contributes the water.

Salt-water intrusion The invasion of fresh surface or ground water by salt water, often caused by removing large amounts of fresh water from the aquifer, so that salt water alongside or underneath the fresh water flows in to take its place.

Seepage,groundwater Slow, vertical or horizontal movement of groundwater in the soil.

Septage Material within and/or discharged from a septic system.

Septic tank An underground storage tank for wastes from homes not on a public sewer system. Waste flows to a tank, where bacteria break down the organic material, and the resulting sludge settles. The effluent then flows out of the tank into a drainfield, and the sludge is periodically pumped out. Septic systems can cause pollution, however, if they are not large enough, or if they are used in low-lying areas or areas with a high water table.

Semi-aquatic Adapted for living near water and needing water to survive but not living in water all the time such as fish.

Silviculture Activities of man involing regeneration, tending andharvesting a forest.

Sinkhole A form of subsidence that results from the collapse of the ground surface into a subterranean cavity that has formed in a bed of limestone. Sinkholes are common in Florida because of the porous limestone that underlies much of the state. Although sinkhole development is a natural process, it can be accelerated by large-scale withdrawals of groundwater from the aquifer.

Slough A linear wetland drainage feature usually dominated by cypress lacking a perceptual water flow and open channelway.

Species of special concern A Florida designation for species that are not in immediate danger of extinction but whose numbers are diminishing.

Species richness The number of species in an ecosystem.

Strand A linear wetland drainage feature usually dominated by cypress having water flow, but not an open channelway.

Succession, vegetational The process of change in the types of plants occupying an area as plants mature, are replaced, and otherwise respond to the environment.

Surface-water discharge The rate of flow of streams, expressed in cubic feet per second (cfs).

Surficial aquifer The surface of an unconfined aquifer, defined by the level at which water stands in wells that penetrate the water body far enough to hold standing water.

Tannic acid A substance that leaches from leaves and other organic material and gives water a tea or coffee color. The water is not polluted but in its natural condition; it has a low pH.

Territory, breeding An area usually including the nesting or denning site and possibly a variable foraging range that is preempted by an individual male animal and defended against the intrusion of rival individuals.

Threatened species a species under special regulatory protection because its numbers are diminishing.

Total coliform A particular group of bacteria that are used as indicators of possible sewage pollution.

Transfer of development rights (TDR) A process by which development rights are severed from parcels of land and transferred to other parcels. Sending areas are designated where such rights can be bought, as well as receiving areas where they can be used.

Transfer of Mitigation Requirements (TNR) A practice that allows the off-site transfer of requirements for mitigation for destruction of some vegetative community. The mitigation most often required is creation of an equal or greater area of like kind community but can include fee simple purchase.

Transmissivity The rate at which water moves through an aquifer.

Turbidity The concentration in water of suspended solids (such as silts, clays, and small particles of organic matter).

Understory The foliage lying beneath the tallest trees consisting mainly of seedling trees, small tress, shrubs, and herbaceous plants.

Upland The high areas of a region or tract of land.

Vegetation areas, transitional Areas that contain plants that are characteristic of identifiable adjacent plant communities.

Vertebrate An animal with a backbone; the category includes mammals, birds, reptiles, fish, and amphibians.

Water budget An accounting of the flow to, flow from, and storage changes of water in a hydrologic unit.

Water-dependent Of or relating to the need for water as a necessary component for survival.

Water table The level in the soil below which the ground is saturated with water. It is defined by the level at which water in an unconfined aquifer stands in a well that goes far enough into the aquifer to hold standing water.

Wetland An area that is always or regularly saturated with water and characterized by hydric soi,s and vegetation adapted to life in wet conditions.

Wetlands, ephemeral Lands that fluctuate between wet and dry stages to the extent that the needs of organisms depending on wet environments are only occasionally and temporarily satisfied.

Wetlands, jurisdictional Wetlands that can be legally regulated by government.

Wildlife corridors or linkages A relatively natural connection for the primary purpose of allowing the movement and providing life requisites of wildlife in their search for food or mates. Such connections are not necessarily "roadways for animals," but may instead serve to allow long-term cross breeding between scattered populations or allow the colonization of habitat which is unutilized by a particular species. In the case of large animals with large home-range requirements, the corridors may provide connections between areas that would in themselves be too small to provide suitable habitat, but together satisfy the species requirements

Wildlands Management Areas (or Wildlands District) An area of the landscape that is designated as a wildlands. It is a management area where special attention is given to ensuring that human uses and development actions do not detract from its wild

and scenic character, thus human uses are minimized and controlled. Districts that are designated as Wildlands Management Areas do not preclude human uses for development or recreation, only that human uses is a minor portion of the whole district. Wildlands areas are managed through development controls, regulatory actions, and in some cases through resource management to remain wild and scenic in character.

Xeric Of or relating to an extremely low amount of moisture available for the support of plant life. Often used as a description of a forested upland ecosystem (See Hammock).

Zoning The regulation of land use, population density, and building size by district.

(Definitions principally from the Guide to Florida Environmental Issues and Information Resources, by the Environmental Information Center of the Florida Conservation Foundation, Inc., 1991. Other sources include: Snell and Anderson 1970, Fernald and Patton 1984, Forman and Goodron 1986, CFRPC Regional Policy Plan 1987, ECFRPC Regional Policy Plan, ECFRPC Buffer Report 1990, Brewer 1979, Chandler and Cheney 1983, Allee 1949)