North Fork St. Lucie River Aquatic Preserve

Management Plan • August 2009 - July 2019

Florida Department of Environmental Protection
Coastal and Aquatic Managed Areas

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North Fork St. Lucie River Aquatic Preserve
3300 Lewis Street • Fort Pierce, FL 34981 • 772.429.2995

Florida Department of Environmental Protection
Coastal and Aquatic Managed Areas
3900 Commonwealth Blvd., MS #235
Tallahassee, FL 32399 • aquaticpreserves.org

Great egrets with breeding plumage on the North Fork bird rookery.

Mission Statement

The mission of the Office of Coastal and Aquatic Managed Areas (CAMA) in relation to Florida's 41 Aquatic Preserves (APs), three National Estuarine Research Reserves (NERRs), National Marine Sanctuary, and Coral Reef Conservation Program is to protect Florida's coastal and aquatic resources.

Long-term goals of the Aquatic Preserve Program

- Protect and enhance the ecological integrity of the Aquatic Preserves;
- Restore areas to their natural condition;
- Encourage sustainable use and foster active stewardship by engaging local communities in the protection of aquatic preserves; and
- Improve management effectiveness through a process based on sound science, consistent evaluation, and continual reassessment.

Executive Summary

North Fork St. Lucie River Aquatic Preserve Management Plan	
Lead Agency	Florida Department of Environmental Protection (DEP) Office of Coastal and Aquatic Managed Areas (CAMA)
Common Name of Property	North Fork St. Lucie River Aquatic Preserve
Location	St. Lucie and Martin counties, Florida
Acreage Total	2,972 acres surface water
Acreage Breakdown According to Florida Natural Areas Inventory Natural Community Types	
FNAI Natural Communities	*Acreage according to GIS*
Natural Communities	2,972 acres
Seagrass Bed	Ephemeral (short-lived) patches
Mollusk (Oyster) Reef	31 acres
Estuarine Tidal Swamp	535 acres
Freshwater Tidal Swamp	119 acres
Slough	40 acres
Unconsolidated Substrate	2,247 acres
Total Acreage	2,972 acres
Management Agency	Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas
Designation	Aquatic Preserve
Archeological/Historical	The Division of Historical Resources Master Site File, Florida Department of State, indicates that there are six historical sites located within or adjacent to the preserve; three shell middens, one historic road scar, one shack, and one bridge.
Management Needs	
Ecosystem Science	Natural resource protection within the preserve requires a general understanding of the resource location and extent as well as unique species-specific interactions associated with each resource. An increase in monitoring, especially of rare and protected species, will also increase the ability to protect important resources threatened by construction activities and poor water quality. Monitoring the preserve's transition zone (area where water changes from fresh to estuarine) is needed to document water quality changes associated with large-scale watershed restoration projects.
Resource Management	The preserve and its watershed have been dramatically altered by large-scale dredging practices and an interconnected network of canals that ultimately discharge into the St. Lucie River. The need to restore the St. Lucie River has been acknowledged by local, state and federal governments, and is directly addressed in several existing projects. The North Fork St. Lucie River has been verified as impaired water through the joint U.S. Environmental Protection Agency and DEP Total Maximum Daily Load program. A Basin Management Action Plan is being developed to unite St. Lucie County, Martin County, Stuart, and Port St. Lucie to produce a plan that addresses specific actions necessary to reduce the amount of nutrients entering the North Fork. This effort will help to meld the goals of all regional plans, including those outlined within for the preserve; especially those that pertain to hydrologic restoration, shoreline stabilization, and the creation of oyster reef habitat.

Education & Outreach	Most education and outreach activities for the preserve are classified as community outreach. Materials are needed to facilitate understanding of the connection between watershed activities, climate change, and the health of the preserve. A brochure specific to the preserve and a species poster are needed to provide graphical display of resources in need of protection. Increased community involvement is also needed and is expected to be obtained through future reactivation of the Stewards for the Southeast Florida Aquatic Preserves, Inc. Citizen Support Organization.
Public Use	Although a variety of user groups are regularly observed within the preserve, little is known about the type and intensity of use throughout the year. Boating activities in the narrow and winding upper reaches of the preserve need to be evaluated to better understand potential impacts to natural resources, water quality, and public safety. Removal of derelict vessels and other submerged debris are necessary to increase boater safety and reduce impact to natural resources.
Public Involvement	Public support of government conservation programs is vital to the success of those programs. The goal of the public process is to foster understanding of the problems facing these fragile ecosystems and the steps necessary to manage the resources within the preserve. The North Fork St. Lucie River Aquatic Preserve advisory committee was formed in June 2007 to provide guidance during the planning process. Three advisory committee meetings (June, August, and November 2007) and two public meetings (July 2007 and March 2008) were held to help revise the plan. The plan was presented to the Acquisition and Restoration Council and the Governor and Cabinet at public hearings for approval.

Site Summary

Coastal Zone Management Issues - The State of Florida has over 17 million residents and over 76 million visitors annually. Florida has the second longest state coastline, and nowhere else in the country are so many people so close to such an extensive and economically valuable coastline. Within these coastal communities, recreational activities such as boating and fishing shape community culture and provide positive economic growth. However, rapid coastal development, increasing public access, and changing land use patterns are complicating regulation and management efforts within valuable aquatic systems. To protect and enhance the unique coastal resources throughout Florida, a variety of issues that affect water quality, quantity, and growth management must be addressed (Florida Department of Environmental Protection [DEP], 2005). Challenges facing the North Fork St. Lucie River include low water quality that is further degraded by unnatural water management practices, the need for hands-on resource management, rapid conversion of agricultural lands to urban developments deemed to have significant regional impact, reduced local awareness, little understanding of public use trends, and the impacts of public use on the protected resources.

Goals - The management goals and associated strategies outlined in this document provide an action plan that will be used to address these challenges over the next decade. Because of limited resources and the overlap of jurisdictional boundaries, success will depend on partnerships formed with private, local, regional, state, and federal organizations and agencies. Partnerships will be formed to promote the maintenance or improvement of the quality of water reaching the preserve to meet the needs of the natural resources. Routine assessment of water quality status is required to document change over time. Resource management goals that will improve water quality include hydrologic restoration, muck removal, and creation of oyster reef habitat. Documentation of natural resource location and extent will allow mangers to evaluate the success of large-scale watershed restoration projects. Maintenance of a safe environment for fish, wildlife, and user groups, and the promotion of low-impact recreational opportunities are also important goals that will be addressed by preserve staff.

CAMA / BTIITF Approval

CAMA approval date: March 13, 2009 **BTIITF approval date:** August 11, 2009

Comments:

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Anhingas use the North Fork St. Lucie River for foraging and breeding.

Part One

Basis for Management

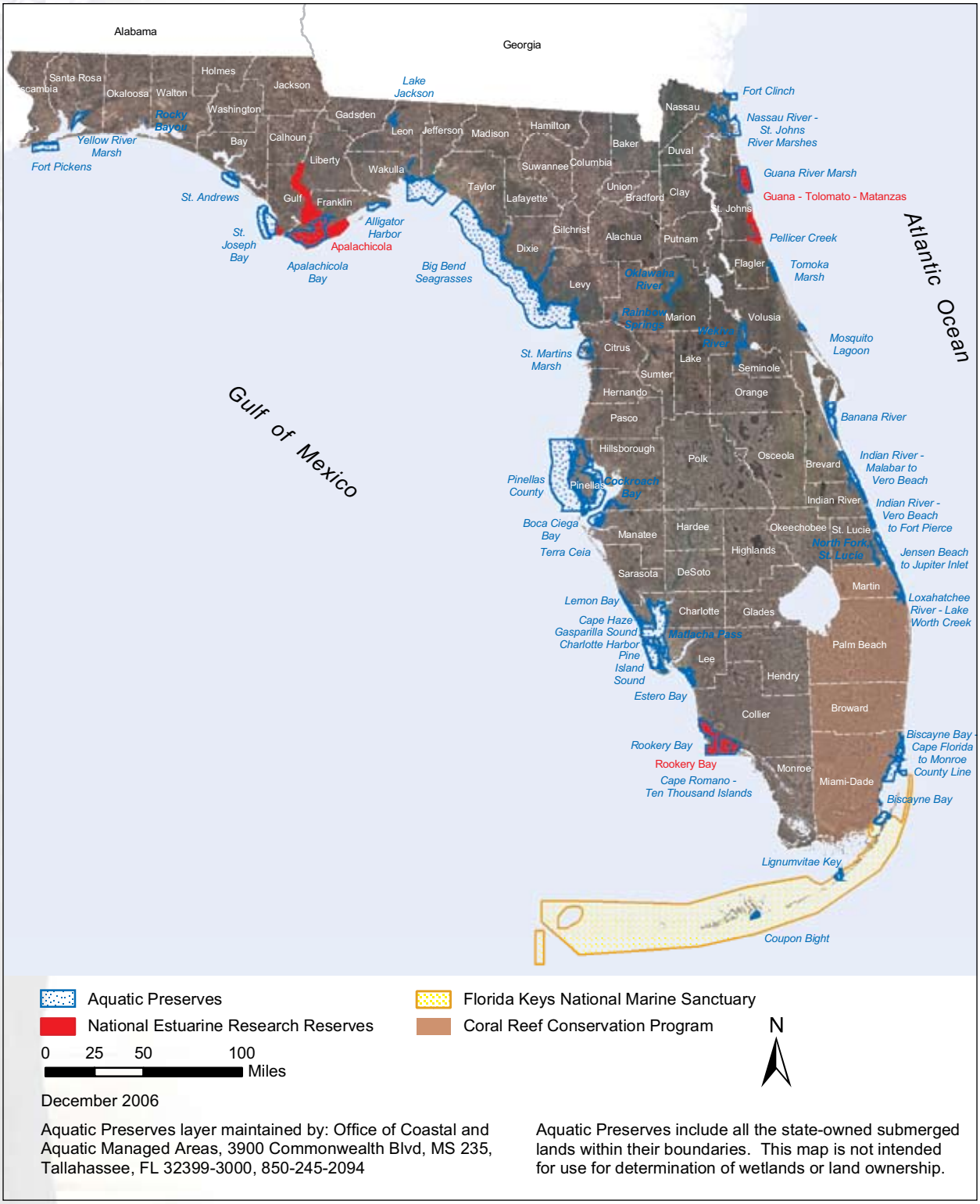
Chapter One

Introduction

The Florida aquatic preserves are administered on behalf of the state by the Florida Department of Environmental Protection's (DEP) Office of Coastal and Aquatic Managed Areas (CAMA) as part of a network that includes 41 aquatic preserves, 3 National Estuarine Research Reserves (NERRs), a National Marine Sanctuary, the Coral Reef Conservation Program and the Florida Oceans and Coastal Council. This provides for a system of significant protections to ensure that our most popular and ecologically important underwater ecosystems are cared for in perpetuity. Each of these special places is managed with strategies based on local resources, issues and conditions.

Our expansive coastline and wealth of aquatic resources have defined Florida as a subtropical oasis, attracting millions of residents and visitors, and the businesses that serve them. Florida's submerged lands play important roles in maintaining good water quality, hosting a diversity of wildlife and habitats (including economically and ecologically valuable nursery areas), and supporting a treasured quality of life for all. In the 1960s, it became apparent that the ecosystems that had attracted so many people to Florida could not support rapid growth without science-based resource protection and management. To this end, state legislators provided extra protection for certain exceptional aquatic areas by designating them as aquatic preserves.

Title to submerged lands not conveyed to private landowners is held by the Board of Trustees of the Internal Improvement Trust Fund (the Trustees). The Governor and Cabinet, sitting as the Trustees, act as guardians for the people of the State of Florida (§253.03, Florida Statutes [F.S.]) and regulate the use of these public lands. Through statute, the Trustees have the authority to adopt rules related to the management of sovereignty submerged lands (Florida Aquatic Preserve Act of 1975, §258.36, F.S.). A higher layer of protection is afforded to aquatic preserves including areas of sovereignty lands that have been "set aside forever as aquatic preserves or sanctuaries for the benefit of future generations" due to "exceptional biological, aesthetic, and scientific value" (Florida Aquatic Preserve Act of 1975, §258.36, F.S.).



Map 1 / Aquatic preserve and CAMA system map.

This tradition of concern and protection of these exceptional areas continues, and now includes: the Rookery Bay NERR in Southwest Florida, designated in 1978; the Apalachicola NERR in Northwest Florida, designated in 1979; and the Guana Tolomato Matanzas NERR in Northeast Florida, designated in 1999. In addition, the Florida Oceans and Coastal Council was created in 2005 to develop Florida's ocean and coastal research priorities, and establish a statewide ocean research plan. The group also coordinates public and private ocean research for more effective coastal management. This dedication to the conservation of coastal and ocean resources is an investment in Florida's future (See Map 1).

1.1 / Management Plan Purpose and Scope

With increasing development, recreation and economic pressures, our aquatic resources have the potential to be significantly impacted, either directly or indirectly. These potential impacts to resources can reduce the health and viability of the ecosystems that contain them, requiring active management to ensure the long-term health of the entire network. Effective management plans for the aquatic preserves are essential to address this goal and each site's own set of unique challenges. The purpose of these plans is to incorporate, evaluate and prioritize all relevant information about the site into a cohesive management strategy, allowing for appropriate access to the managed areas while protecting the long-term health of the ecosystems and their resources.

The mandate for developing aquatic preserve management plans is outlined in Section 18-20.013 and Subsection 18-18.013(2) of the Florida Administrative Code (F.A.C.). Management plan development and review begins with the collection of resource information from historical data, research and monitoring, and includes input from individual CAMA managers and staff, area stakeholders, and members of the general public. The statistical data, public comment, and cooperating agency information is then used to identify management issues and threats affecting the present and future integrity of the site, its boundaries, and adjacent areas. This information is used in the development and review of the management plan, which is examined for consistency with the statutory authority and intent of the Aquatic Preserve Program. Each management plan is evaluated periodically and revised as necessary to allow for strategic improvements. Intended to be used by site managers and other agencies or private groups involved with maintaining the natural integrity of these resources, the plan includes scientific information about the existing conditions of the site and the management strategies developed to respond to those conditions.

To aid in the analysis and development of the management strategies for the site plans, four comprehensive management programs are identified. In each of these management programs, relevant information about the specific sites is described in an effort to create a comprehensive management plan. It is expected that the specific needs or issues are unique and vary at each location, but the four management programs will remain constant. These management programs are:

- Ecosystem Science
- Resource Management
- Education and Outreach
- Public Use

In addition, unique local and regional issues are identified, and goals, objectives and strategies are established to address these issues. Finally, the program and facility needs required to meet these goals as identified. These components are all key elements in an effective coastal management program and for achieving the mission of the sites. This document serves as an update to the original North Fork St. Lucie River Aquatic Preserve Management Plan adopted on May 22, 1984 (Florida Department of Natural Resources [DNR], 1984).

1.2 / Public Involvement

CAMA recognizes the importance of stakeholder participation and encourages their involvement in the management plan development process. CAMA is also committed to meeting the requirements of the Sunshine Law (§286.011, F.S.):

- Meetings of public boards or commissions must be open to the public;
- Reasonable notice of such meetings must be given; and
- Minutes of the meetings must be recorded.

Several key steps are to be taken during management plan development. First, staff organizes an advisory committee comprised of key stakeholders. Next, staff advertises and conducts one or more public meetings to receive input from stakeholders on the concerns and perceived issues affecting each of the sites. This input is used in the development of a draft management plan that is reviewed by CAMA staff and the advisory committee. After the initial reviews, the staff advertises and conducts, in conjunction with the advisory committee, additional public meetings to engage the stakeholders for feedback on the draft plan and the development of the final draft of the management plan. For additional information about the advisory committee and the public meetings refer to Appendix C - Public Involvement.

Mature oaks provide shade for fishermen at White City Park.

Chapter Two

The Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas

2.1 / Introduction

The Florida Department of Environmental Protection (DEP) protects, conserves and manages Florida's natural resources and enforces the state's environmental laws. The DEP is the lead agency in state government for environmental management and stewardship and commands one of the broadest charges of all the state agencies, protecting Florida's air, water and land. The DEP is divided into three primary areas: Regulatory Programs, Land and Recreation, and Planning and Management (See Figure 1). Florida's environmental priorities include restoring America's Everglades; improving air quality; restoring and protecting the water quality in our springs, lakes, rivers and coastal waters; conserving environmentally-sensitive lands; and providing citizens and visitors with recreational opportunities, now and in the future.

The Office of Coastal and Aquatic Managed Areas (CAMA) is the unit within the DEP that manages more than four million acres of submerged lands and select coastal uplands. This includes 41 aquatic preserves, 3 National Estuarine Research Reserves (NERRs), the Florida Keys National Marine Sanctuary and the Coral Reef Conservation Program. The three NERRs, the Florida Keys National Marine Sanctuary and the Coral Reef Conservation Program are managed in cooperation with the National Oceanic and Atmospheric Administration (NOAA).

CAMA manages sites in Florida for the conservation and protection of natural and historical resources and resource-based public use that is compatible with the conservation and protection of these lands. CAMA is a strong supporter of the NERR system and its approach to coastal ecosystem management. The State of Florida has three designated NERR sites, each encompassing at least one aquatic preserve within its boundaries. Rookery Bay NERR includes Rookery Bay Aquatic Preserve and Cape Romano - Ten Thousand Islands Aquatic Preserve; Apalachicola NERR includes Apalachicola Bay Aquatic Preserve; and Guana Tolomato Matanzas NERR includes Guana River Marsh Aquatic Preserve and Pellicer Creek Aquatic Preserve. These aquatic preserves provide discrete areas designated for additional protection beyond that of the surrounding NERR and may afford a foundation for additional protective zoning in the future.

Each of the Florida NERR managers serves as a regional manager overseeing multiple other aquatic preserves in their region. This management structure advances CAMA's ability to manage its sites as part of the larger statewide system.

2.2 / Management Authority

Established by law, aquatic preserves are submerged lands of exceptional beauty that are to be maintained in their natural or existing conditions. The intent was to forever set aside submerged lands with exceptional biological, aesthetic, and scientific values as sanctuaries, called aquatic preserves, for the benefit of future generations.

The laws supporting aquatic preserve management are the direct result of the public's awareness of and interest in protecting Florida's aquatic environment. The extensive dredge and fill activities that occurred in the late 1960s spawned this widespread public concern. In 1966, the Board of Trustees of the Internal Improvement Trust Fund (the Trustees) created the first aquatic preserve, Estero Bay, in Lee County.

In 1967, the Florida Legislature passed the Randall Act (Chapter 67-393, Laws of Florida), which established procedures regulating previously unrestricted dredge and fill activities on state-owned submerged lands. That same year, the Legislature provided the statutory authority (§253.03, Florida Statutes [F.S.]) for the Trustees to exercise proprietary control over state-owned lands. Also in 1967, government focus on protecting Florida's productive water bodies from degradation due to development led the Trustees to establish a moratorium on the sale of submerged lands to private interests. An Interagency Advisory Committee was created to develop strategies for the protection and management of state-owned submerged lands.

In 1968, the Florida Constitution was revised to declare in Article II, Section 7, the state's policy of conserving and protecting natural resources and areas of scenic beauty. That constitutional provision also established the authority for the Legislature to enact measures for the abatement of air and water pollution. Later that same year, the Interagency Advisory Committee issued a report recommending the establishment of 26 aquatic preserves.

The Trustees acted on this recommendation in 1969 by establishing 16 aquatic preserves and adopting a resolution for a statewide system of such preserves. In 1975 the state Legislature passed the Florida Aquatic Preserve Act of 1975 (Act) that was enacted as Chapter 75-172, Laws of Florida, and later became Chapter 258, Part II, F.S. This Act codified the already existing aquatic preserves and established standards and criteria for activities within those preserves. Additional aquatic preserves were individually adopted at subsequent times up through 1989.

In 1980, the Trustees adopted the first aquatic preserve rule, Chapter 18-18, Florida Administrative Code (F.A.C.), for the administration of the Biscayne Bay Aquatic Preserve. All other aquatic preserves are administered under Chapter 18-20, F.A.C., which was originally adopted in 1981. These rules apply standards and criteria for activities in the aquatic preserves, such as dredging, filling, and building docks and other structures that are stricter than those of Chapter 18-21, F.A.C., which apply to all sovereignty lands in the state.

This plan is in compliance with the Conceptual State Lands Management Plan, adopted March 17, 1981 by the Board of Trustees of the Internal Improvement Trust Fund and represents balanced public utilization, specific agency statutory authority, and other legislative or executive constraints. The Conceptual State Lands Management Plan also provides essential guidance concerning the management of sovereignty lands and aquatic preserves and their important resources, including unique natural features, seagrasses, endangered species, and archaeological and historical resources.

Through delegation of authority from the Trustees, the DEP and CAMA have proprietary authority to manage the sovereignty lands, the water column, spoil islands (which are merely deposits of sovereignty lands), and some of the natural islands and select coastal uplands to which the Trustees hold title.

Enforcement of state statutes and rules relating to criminal violations and non-criminal infractions rests with the Florida Fish and Wildlife Conservation Commission Marine Patrol, DEP law enforcement, and local law enforcement agencies. Enforcement of administrative remedies rests with CAMA, the DEP Districts, and Water Management Districts.

2.3 / Statutory Authority

The fundamental laws providing management authority for the aquatic preserves are contained in Chapters 258 and 253, F.S. These statutes establish the proprietary role of the Governor and Cabinet, sitting as the Board of Trustees of the Internal Improvement Trust Fund, as Trustees over all sovereignty lands. In addition, these statutes empower the Trustees to adopt and enforce rules and regulations for managing all sovereignty lands, including aquatic preserves. The Florida Aquatic Preserve Act was enacted by the Florida Legislature in 1975 and is codified in Chapter 258, F.S.

The legislative intent for establishing aquatic preserves is stated in Section 258.36, F.S.: "It is the intent of the Legislature that the state-owned submerged lands in areas which have exceptional biological,

aesthetic, and scientific value, as hereinafter described, be set aside forever as aquatic preserves or sanctuaries for the benefit of future generations." This statement, along with the other applicable laws, provides a foundation for the management of aquatic preserves. Management will emphasize the preservation of natural conditions and will include lands that are specifically authorized for inclusion as part of an aquatic preserve.

Management responsibilities for aquatic preserves may be fulfilled directly by the Trustees or by staff of the DEP through delegation of authority. Other governmental bodies may also participate in the management of aquatic preserves under appropriate instruments of authority issued by the Trustees. CAMA staff serves as the primary managers who implement provisions of the management plans and rules applicable to the aquatic preserves. CAMA does not "regulate" the lands per se; rather, that is done primarily by the DEP Districts (in addition to the Water Management Districts) which grant regulatory permits. The Florida Department of Agriculture and Consumer Services through delegated authority from the Trustees, may issue proprietary authorizations for marine aquaculture within the aquatic preserves and regulates all aquacultural activities as authorized by Chapter 597, Florida Aquaculture Policy Act, F.S. Staff evaluates proposed uses or activities in the aquatic preserve and assesses the possible impacts on the natural resources. Project reviews are primarily evaluated in accordance with the criteria in the Act, Chapter 18-20, F.A.C., and this management plan.

CAMA staff comments, along with comments of other agencies and the public are submitted to the appropriate permitting staff for consideration in their issuance of any delegated authorizations in aquatic preserves or in developing recommendations to be presented to the Trustees. This mechanism provides a basis for the Trustees to evaluate public interest and the merits of any project while also considering potential environmental impacts to the aquatic preserves. Any activity located on sovereignty lands requires a letter of consent, a lease, an easement, or other approval from the Trustees.

Many provisions of the Florida Statutes that empower non-CAMA programs within DEP or other agencies may be important to the management of CAMA sites. For example, Chapter 403, F.S., authorizes rules concerning the designation of "Outstanding Florida Waters" (OFW), a program that provides aquatic preserves with additional regulatory protection. Chapter 379, F.S., regulates saltwater fisheries, and provides enforcement authority and powers for law enforcement officers. Additionally, it provides similar powers relating to wildlife conservation and management. The sheer number of statutes that affect aquatic preserve management prevents an exhaustive list of all such laws from being provided here.

2.4 / Administrative Rules

Chapters 18-18, 18-20 and 18-21, F.A.C., are the three administrative rules directly applicable to the uses allowed in aquatic preserves specifically and sovereignty lands generally. These rules are intended to be cumulative, meaning that Chapter 18-21, F.A.C., should be read together with Chapter 18-18, F.A.C., or Chapter 18-20, F.A.C., to determine what activities are permissible within an aquatic preserve. If Chapter 18-18, F.A.C., or Chapter 18-20, F.A.C., are silent on an issue, Chapter 18-21, F.A.C., will control; if a conflict is perceived between the rules, the stricter standards of Chapter 18-18, F.A.C., or Chapter 18-20, F.A.C., supersede those of Chapter 18-21, F.A.C. Because Chapter 18-21, F.A.C. concerns all sovereignty lands, it is logical to discuss its provisions first.

Originally codified in 1982, Chapter 18-21, F.A.C., is meant "to aid in fulfilling the trust and fiduciary responsibilities of the Board of Trustees of the Internal Improvement Trust Fund for the administration, management and disposition of sovereignty lands; to insure maximum benefit and use of sovereignty lands for all the citizens of Florida; to manage, protect and enhance sovereignty lands so that the public may continue to enjoy traditional uses including, but not limited to, navigation, fishing and swimming; to manage and provide maximum protection for all sovereignty lands, especially those important to public drinking water supply, shellfish harvesting, public recreation, and fish and wildlife propagation and management; to insure that all public and private activities on sovereignty lands which generate revenues or exclude traditional public uses provide just compensation for such privileges; and to aid in the implementation of the State Lands Management Plan."

To that end, Chapter 18-21, F.A.C., contains provisions on general management policies, forms of authorization for activities on sovereignty lands, and fees applicable for those activities. "Activity," in the context of the rule, includes "construction of docks, piers, boat ramps, boardwalks, mooring pilings, dredging of channels, filling, removal of logs, sand, silt, clay, gravel or shell, and the removal or planting of vegetation" (Rule 18-21.003, F.A.C.). To be authorized on sovereignty lands, activities must be not contrary to the public interest (Rule 18-21.004, F.A.C.).

Chapter 18-21, F.A.C., also sets policies on aquaculture, geophysical testing (using gravity, shock wave and other geological techniques to obtain data on oil, gas or other mineral resources), and special events related to boat shows and boat displays. Of particular importance to CAMA site management, it additionally addresses spoil islands, preventing their development in most cases.

Chapters 18-18 and 18-20, F.A.C., apply standards and criteria for activities in the aquatic preserves that are stricter than those of Chapter 18-21, F.A.C. Chapter 18-18, F.A.C., is specific to the Biscayne Bay Aquatic Preserve and is more extensively described in that site's management plan. Chapter 18-20, F.A.C., is applicable to all other aquatic preserves. It further restricts the type of activities for which authorizations may be granted for use of sovereignty lands and requires that structures that are authorized be limited to those necessary to conduct water dependent activities. Moreover, for certain activities to be authorized, "it must be demonstrated that no other reasonable alternative exists which would allow the proposed activity to be constructed or undertaken outside the preserve" (Paragraph 18-20.004(1) (g), F.A.C.).

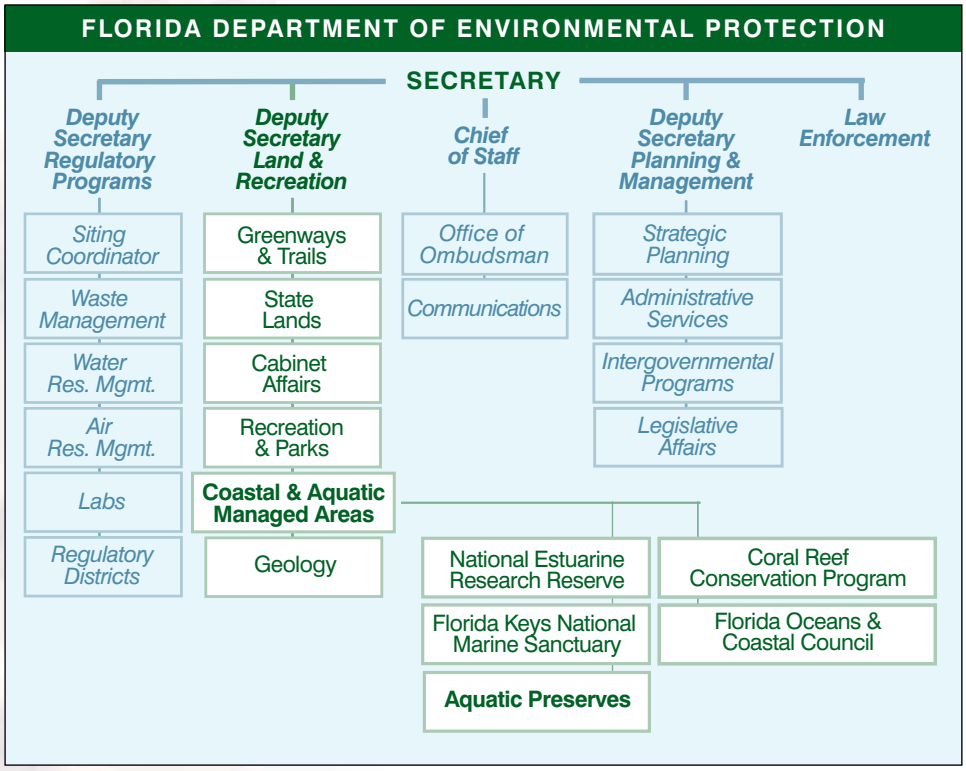


Figure 1 / State structure for managing aquatic preserves.

Chapter 18-20, F.A.C., expands on the definition of "public interest" by outlining a balancing test that is to be used to determine whether benefits exceed costs in the evaluation of requests for sale, lease, or transfer of interest of sovereignty lands within an aquatic preserve. The rule also provides for the analysis of the cumulative impacts of a request in the context of prior, existing, and pending uses within the aquatic preserve, including both direct and indirect effects.

Chapter 18-20, F.A.C., directs management plans and resource inventories to be developed for every aquatic preserve. Further, the rule provides provisions specific to certain aquatic preserves and indicates the means by which the Trustees can establish new or expand existing aquatic preserves.

As with statutes, aquatic preserve management relies on the application of many other DEP and outside agency rules. Perhaps most notably, Chapter 62-302, F.A.C., concerns the classification of surface waters, including criteria for OFW, a designation that provides for the state's highest level of protection for water quality. All aquatic preserves contain OFW designations. No activity may be permitted within an OFW that degrades ambient water quality unless the activity is determined to be in the public interest. Once again, the list of other administrative rules that do not directly address CAMA's responsibilities but do affect CAMA sites is so long as to be impractical to create within the context of this management plan.

Ebbing tides at St. Lucie Inlet show the connectivity of Lake Okeechobee, the St. Lucie River and its watershed, the Indian River Lagoon, and the nearshore reefs. (Photo taken by Chris Perry.)

Chapter Three

The North Fork St. Lucie River Aquatic Preserve

3.1 / Description of Representative Ecosystem Region

3.1.1 / Historical Background

The earliest known settlers in the St. Lucie watershed were the Ais and Seminole Indians. The Ais were first documented in 1568 occupying lands adjacent to the St. Lucie River (SLR) but were decimated by 1763 when the British took possession of Florida. After their disappearance, the Seminoles (a mix of Micossukee, Creek, and Choctaw) occupied Florida. The North Fork was used by the Seminole Indians as a transportation route linking the SLR area with the lower St. Johns River marshes to the northwest. The Seminoles were believed to use these routes in seasonal hunting excursions from the St. Johns marshes to Hutchinson Island where they would hunt bear (*Ursus americanus*) and West Indian manatee (*Trichechus manatus*). The North Fork was also used in the Seminole Wars of the 1800s. Large military forces are believed to have traveled through this area during the 1838 winter campaign of General Jessup during the Second Seminole War.

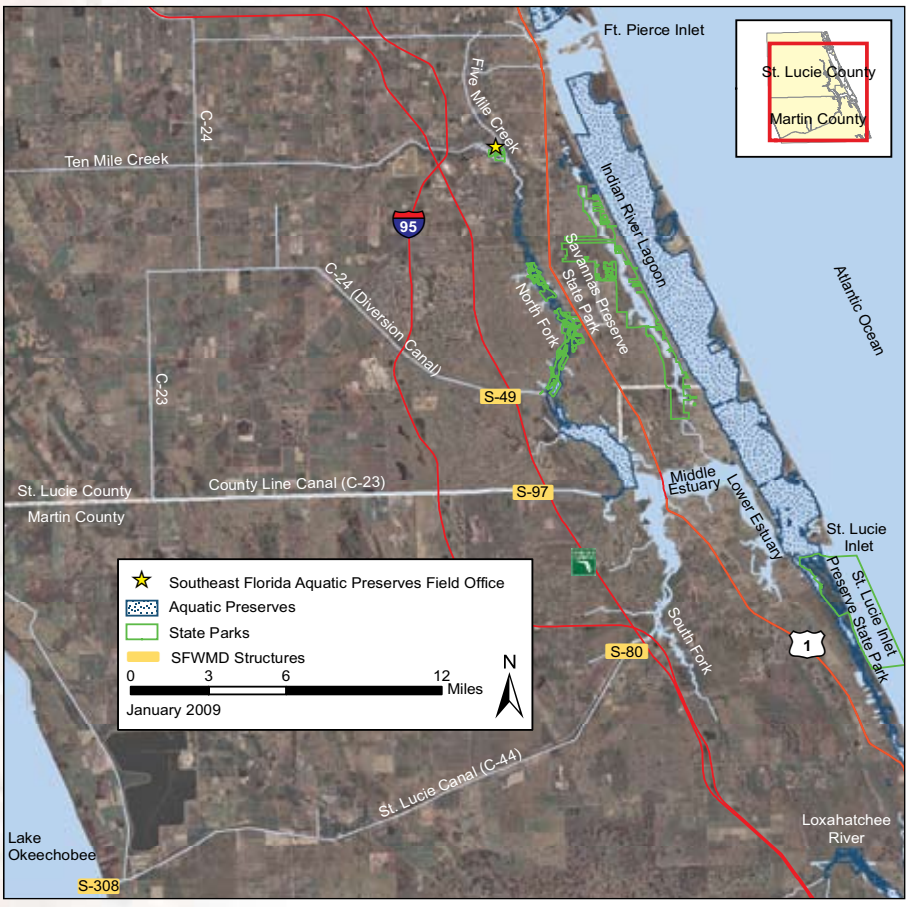
The earliest European settlements along the SLR date back to the 1890s at Spruce Bluff and White City. Spruce Bluff was the first organized non-Indian settlement. The small Scandinavian community, located near present day Norseman's Harbor in Port St. Lucie, included a small school house, sawmill, post office, and a small (seven-person) cemetery. Spruce Bluff is now designated as a 97-acre public recreation area owned and managed by St. Lucie County. White City was colonized by a small, mid-western Danish group. The name "White City" was inspired by the large white buildings observed by the Danish settlers at the 1896 Chicago World Fair. Midway Road, White City's main thoroughfare and the preserve's northern boundary, was named after Midway Plaisance, the fair's main entertainment attraction that featured the original Ferris Wheel and Buffalo Bill's Wild West Show (Burgess, 2007).

Prior to European settlement, the SLR was a freshwater system that drained into the Indian River Lagoon (IRL). The creation of St. Lucie Inlet in 1892 connected the Indian River Lagoon to the Atlantic Ocean at the mouth of the SLR. This project ultimately converted the freshwater tributary to a riverine estuary (freshwater in the upper reaches and saltwater in the middle and lower sections). This unique salinity gradient changed the natural resources found in the SLR. The river now serves as an important brooding and nursery ground for migratory fish, such as snook (*Centropomus* spp.), snapper (*Lutjanus* spp.), and opossum pipefish (*Microphis brachyurus lineatus*) that require estuarine and freshwater to complete their lifecycle.

Construction of the Central and Southern Florida (C&SF) Flood Control Project during the early and mid-1900s further changed the dynamics and diversity within the SLR by altering the distribution, timing, and flow of water reaching the river. The C&SF Project, authorized by several federal flood control acts, was primarily designed to address flood control and drainage for land reclamation in central and southern Florida. The C&SF canals in Martin and St. Lucie counties (C-44, C-23, and C-24) form a direct connection between the South Fork and Lake Okeechobee, and have expanded the North Fork SLR watershed (See Map 2). Drainage of the watershed allows for conversion of natural land to agricultural and urban developments. An unprecedented population increase adjacent to the North Fork began in 1958. As of 2006, the City of Port St. Lucie had approximately 144,159 residents living within a 112 square-mile area – a higher population than West Palm Beach (97,500 in 2005) (University of Florida [UF], 2007). Impacts from the construction of drainage canals and agricultural and urban development practices extend into the IRL where water either flows north to Ft. Pierce Inlet, south into Peck's Lake or out St. Lucie Inlet to nearshore reefs within St. Lucie Inlet Preserve State Park (Byrne & Patino, 2004; Smith, unpublished data).

A flood control project directly impacting the rate at which water flowed through the North Fork to the Middle Estuary was simultaneously being conducted by the North St. Lucie Water Control District (NSLWCD) and U.S. Army Corps of Engineers (USACE) from the 1920s to the 1940s. The project focused on straightening portions of the North Fork to promote rapid drainage of water to the Middle and Lower estuaries and eventually the Atlantic Ocean. In the process of straightening the river, the dredged spoil was piled into berms (mounds) along the banks of the new channel. These spoil piles, which can measure up to 50 feet wide and 25 feet tall, block former riverbends and oxbows as well as isolate a large portion of the North Fork floodplain (PBS&J, 2003). Historically, the slow and meandering path of the North Fork allowed suspended solids to settle out of the water column and nutrients to be filtered by floodplain and shoreline vegetation. The direct rivercourse does not allow the North Fork to function as it once did, which affects the water quality and sediment loads reaching the estuary.

The SLR is divided into four sections: North Fork, South Fork, Middle Estuary, and Lower Estuary. A 16-mile portion of the North Fork was designated as an aquatic preserve (AP or preserve) in 1972 to protect the aesthetic, biological, and scientific value for future generations (See Map 3). Because of its geographic location and tidal connection through St. Lucie Inlet, the aquatic preserve supports high species diversity and serves as an important nursery ground for a variety of fish and wildlife (See Map 2). Diverse habitats, which currently range from freshwater tidal swamps to estuarine mangrove forests and oyster reefs, are key to the wide range of diversity in the preserve.



Map 2 / Connectivity of the St. Lucie River to Lake Okeechobee and the nearshore reefs within St. Lucie Inlet Preserve State Park.

Today, large-scale restoration projects have been identified that will allow water management practices to improve the salinity regime and water quality in the SLR. These projects call for state and federal funding to improve the environmental quality and management of the Northern Everglades (SLR and IRL in Martin and St. Lucie counties).

International/National/State/Regional Significance

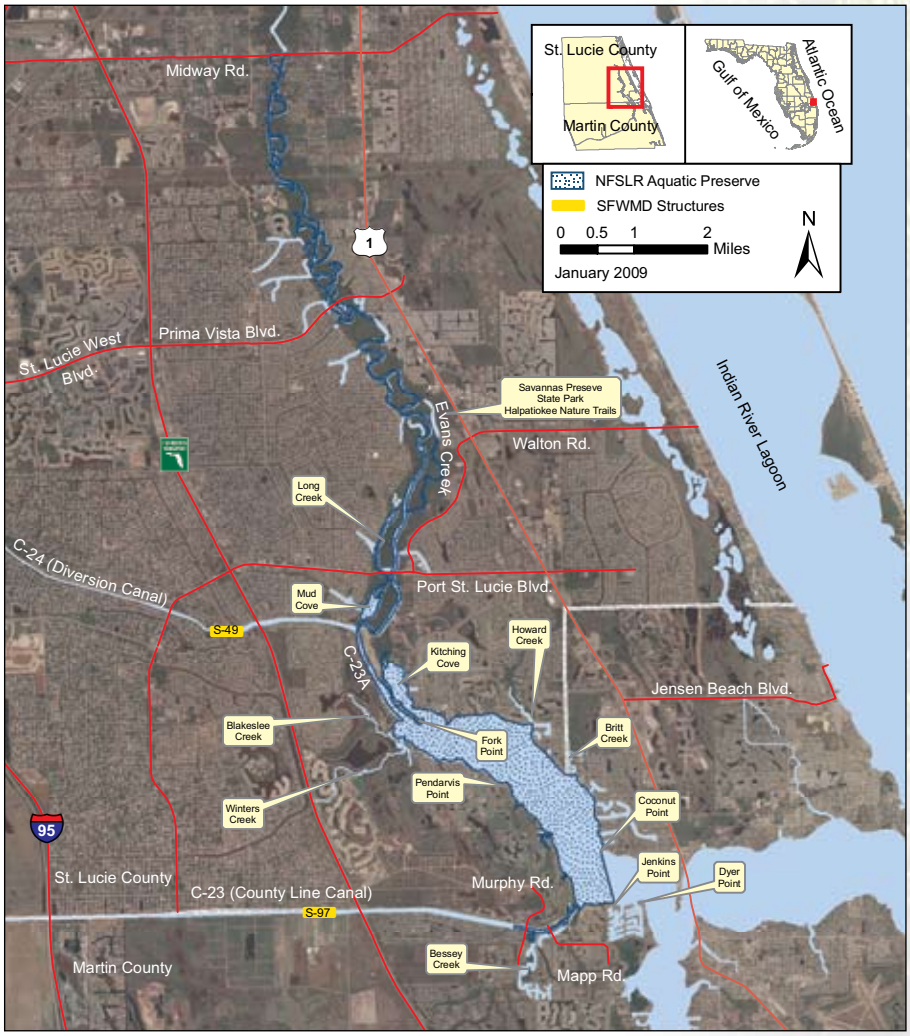
The SLR receives federal and state attention through its connection to the Indian River Lagoon (IRL), Lake Okeechobee, and nearshore coral reefs and its designation as an Aquatic Preserve (See Map 3). The IRL is one of the most biodiverse estuaries in North America (Swain et al., 1995). As the largest tributary of the IRL, the SLR has been integrated into the IRL National Estuary Program (NEP), a partnership between water management districts and the U.S. Environmental Protection Agency. The St. Lucie connection to Lake Okeechobee (via the C-44 canal) makes the restoration projects in the preserve and its watershed the northernmost component of the Comprehensive Everglades Restoration Plan (CERP). The mouth of the SLR is adjacent to St. Lucie Inlet, the northernmost extent of tropical coral reefs on Florida's east coast. The reefs immediately south of St. Lucie Inlet (in St. Lucie Inlet Preserve State Park) are exposed to riverine waters from the SLR and IRL during outgoing tides. These Martin County reefs have been incorporated into Florida's Coral Reef Conservation Program, a partnership between the National Oceanic and Atmospheric Administration (NOAA) and Florida Department of Environmental Protection (DEP). As a state aquatic preserve, the North Fork SLR is designated as an Outstanding Florida Waters (pursuant to Chapter 62-302 F.A.C.).

The SLR provides relatively contiguous habitat for fish and wildlife. The wide salinity range (fresh upper reaches and saline lower reaches) and associated habitats in the North Fork are unique to the region and serve as a productive nursery and spawning ground for recreationally and commercially important species of fish and wildlife. Several rare fish species that rely on a tidal system with wide salinity ranges for one or more phases of their lifecycle are limited to the tributaries of the IRL, such as the SLR. Adjacent state and county-owned public lands with natural shorelines provide a wildlife corridor which connects a variety of natural communities and facilitates a wilderness experience that is easily accessible to the residents of White City, Port St. Lucie, and Stuart.

Location/Boundaries

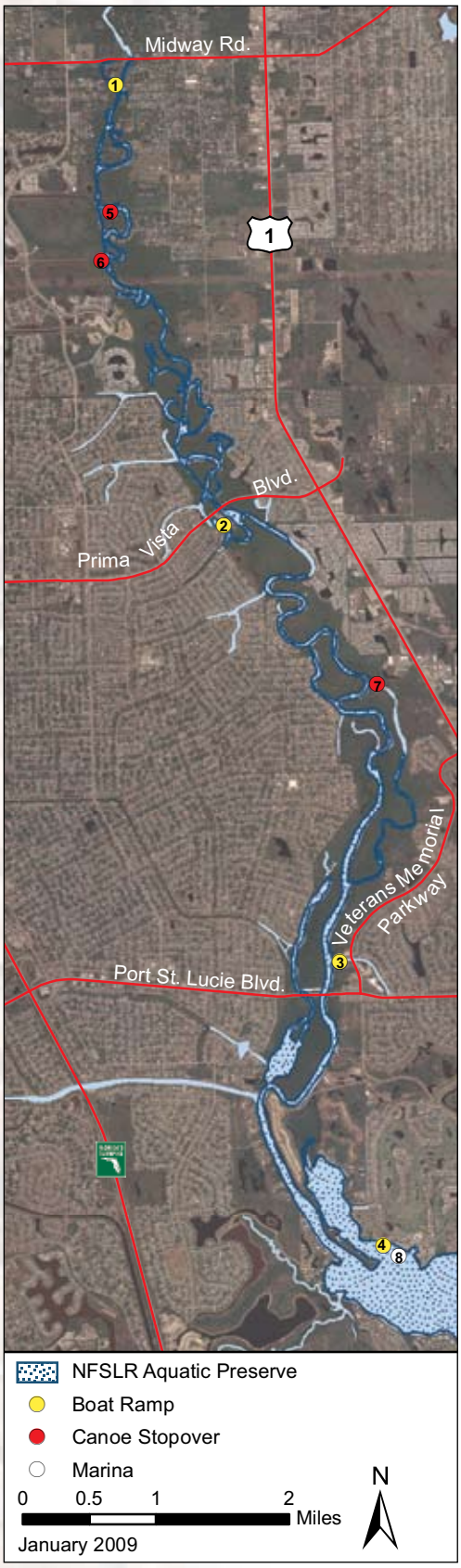
The North Fork St. Lucie River Aquatic Preserve (NFSLRAP) is located in southeast Florida, approximately 40 miles northwest of West Palm Beach. Most of the preserve is within St. Lucie County, and continues south into Martin County. Much of the preserve lies within the city of Port St. Lucie, an established but unincorporated community within St. Lucie County, located approximately two miles south of Ft. Pierce. A portion of the preserve lies within the city of Stuart and two established but unincorporated communities within Martin County: Jensen Beach and Palm City.

The preserve is bounded on the north by Midway Road in White City. The southern preserve boundary extends from Coconut Point in Stuart (north shore) to Jenkins Point in Palm City (south



Map 3 / North Fork St. Lucie River Aquatic Preserve site map.

shore) just west of the Roosevelt Bridge (U.S. Highway 1) in Martin County (See Map 3). The eastern and western boundaries encompass the state-owned sovereign submerged lands occurring below the mean high water (MHW) line to which the state holds title. The preserve is approximately 16 miles long through the natural riverbends (See Appendix B.5.1). It is 0.01 miles (53 feet) wide at the northern boundary, and 0.7 miles (3,696 feet) wide at the southern boundary.



Map 4 / North Fork St. Lucie River Aquatic Preserve public amenities.

The preserve runs roughly parallel to several main highways; it is approximately three miles east of the Florida Turnpike, five miles east of Interstate 95, and 0.5 mile west of U.S. Highway 1. Five bridges currently cross the aquatic preserve: 1) Midway Road at the northern boundary, 2) Prima Vista Boulevard, approximately four miles south of the northern boundary, 3) Port St. Lucie Boulevard, approximately 10 miles south of the northern boundary, 4) Mapp Road, and 5) Murphy Road, both over the C-23 Canal at the southwest boundary.

The preserve currently contains four public boat ramps, three public canoe stopovers, and one public marina (See Map 4). The four public boat ramps include: 1) White City Park, 2) River Park Marina, 3) Veteran's Memorial Park at Rivergate, and 4) Club Med - Sandpiper. The three canoe stopovers are located at St. Lucie County's Oxbow Eco-Center, Idabelle Island, and Savannas Preserve State Park - Halpatiokee Canoe and Nature Trail. With the exception of Club Med - Sandpiper, public access points to the preserve are associated with adjacent public lands and are managed by local and state agencies. As of June 2007, 379 private single-family docks, 12 private multi-slip docks, and eight private boat ramps provide additional access to the preserve (Southeast Florida Aquatic Preserves, unpublished data). These private facilities reduce congestion at public access points.

The headquarters for the NFSLRAP is the Southeast Florida Aquatic Preserves (SEFLAP) Field Office, located at 3300 Lewis Street in Ft. Pierce, Florida 34981. The office is situated on public land managed by the Savannas Preserve State Park located at the confluence of Five Mile and Ten Mile creeks. The headquarters is approximately two miles north of the aquatic preserve boundary at Midway Road.

Public Amenities
Aquatic Preserve Access Points
1. White City Park
2. River Park Marina
3. Veteran's Memorial Park at Rivergate
4. Club Med - Sandpiper
Canoe Stopovers within the Preserve
5. Idabelle Island
6. Ocbow Eco - Center
7. Savannas Preserve State Park
Marina with Public Restaurant
8. Club Med - Sandpiper

The Southeast Florida Aquatic Preserves Field Office.

3.1.3 | Resource Description

The information in this section describes the resources found throughout the aquatic preserve.

Surrounding Population Data and Future Projected Changes

Between 2000 and 2007 Florida's population more than doubled (17%) that of the country (7%) (U.S. Census Bureau, n.d.). During the same time period Martin County's population increased 13% and St. Lucie County's population increased 41%, more than five times the rate of the country (Schenker, n.d.). While the number of unincorporated residents of Martin and St. Lucie counties and the City of Stuart increased a similar 14%, 13%, and 13%, respectively, the population of the City of Port St. Lucie experienced a dramatic increase of 75% (Schenker, n.d.). The exponential growth of Port St. Lucie is supported by the conversion of natural and agricultural lands located west of Interstate 95 to large-scale developments of regional impact.

The estimated populations of Martin and St. Lucie counties have more than doubled since adoption of the original NFSLRAP Management Plan in 1984 (Schenker, n.d.). By 2019, when the next management plan revision is scheduled, the populations of Martin and St. Lucie counties are projected to increase by an additional 28%. The increasing local population affects the preserve in complex ways, and long-term population projections must be taken into consideration for the protection of local natural resources. Projections for 2030 indicate that the populations of Martin and St. Lucie counties will increase by an additional 56% from the 2008 statistics (UF, 2007). At that time, both the cities of Stuart and Port St. Lucie will have reached complete build-out in which all lots have either been built upon or are being used for another specific purpose (Castellano, 2004; Martin County Growth Management Department, 2005). Studies have shown that between 1990 and 2003 the population increase of Martin and St. Lucie counties was primarily from new people moving into the area (UF, 2007).

Topography and Geomorphology (surface features and formation)

The North Fork SLR watershed is defined by four physiogeographic regions (regions with differing land characteristics). The North Fork SLR itself is located in the Eastern Valley region within St. Lucie County, which is bordered to the southwest by the Osceola Plain and to the east by the Atlantic Coastal Ridge (See Map 5). This valley is composed of long, low, narrow ridges ranging from 15 to 30 feet in elevation. The Green Ridge extends from western Port St. Lucie along Interstate 95 to the C-44 Canal. The headwaters of the North Fork drain the Eastern Valley between the Osceola Plain and the Atlantic Coastal Ridge. Natural topography (surface features) in the North Fork SLR watershed is generally flat with few natural rises. Adjacent upland elevations increase 10 feet and consists of scrub, scrubby flatwoods,

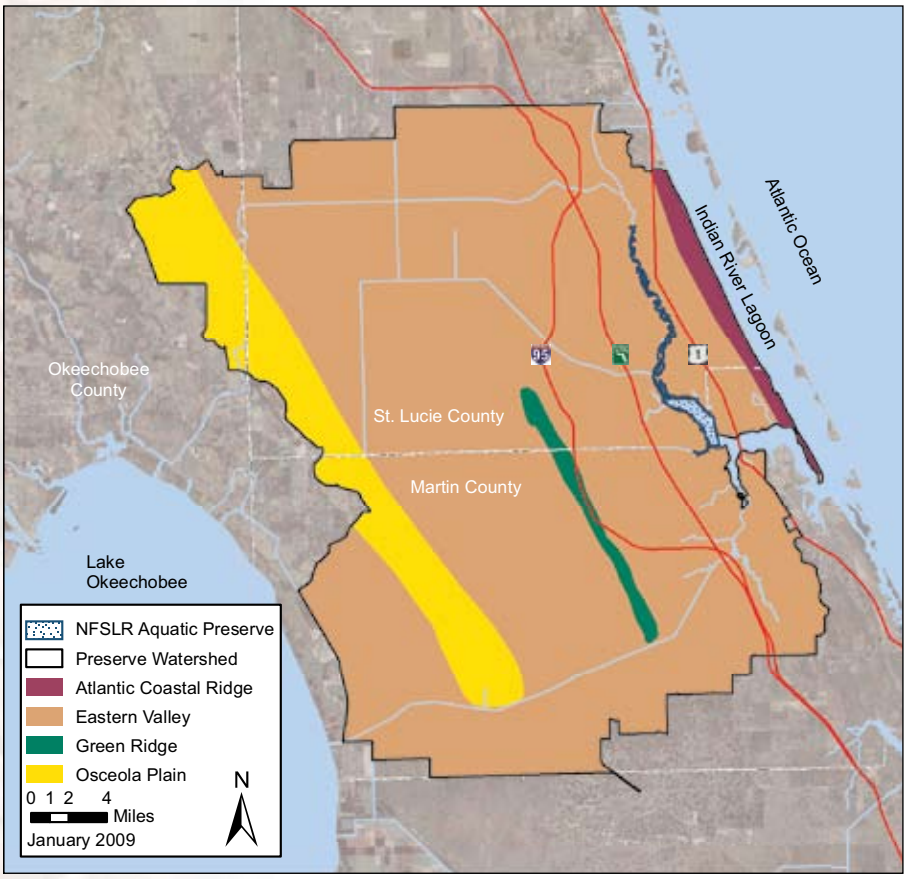
and pine flatwoods habitats. Most of the preserve is between one and five feet elevation and consists of wetland communities including tidal and floodplain swamp and forest. Taller features in the watershed all are manmade and include bridges, roads, high rise buildings, communication towers, spoil piles, and water control structures such as pump stations, canals, and levees.

Sections of the North Fork SLR were straightened between the 1920s and 1940s by NSLWCD and USACE for navigation and flood control purposes. The associated spoil was piled as much as 25 feet high and 50 feet wide along the newly-created channel. The existing spoil deposits have formed a non-contiguous berm that has isolated historic floodplains and cut off old river bends (See Map 6) (PBS&J, 2003).

In addition to increasing bank elevations along the North Fork, the C&SF Flood Control Project expanded the North Fork watershed and altered associated topography and drainage patterns. Project canals and associated control structures within the North Fork watershed include the C-44, C-23, and C-24 canals and the S-80, S-97, and S-49 structures. Prior to drainage, wet season rains pooled broadly across the SLR watershed. When sheet flow (water flow across a flat surface) occurred it moved toward the naturally lower elevations surrounding the North Fork SLR, from the northwest to the southeast. The construction of a drainage canal system has resulted in controlled discharges of water from west to east through the primary canal system which is fed by numerous feeder canals and ditches that crisscross the watershed. Historical flows from the North and South Forks of the SLR have decreased, and large volumes of water now enter the Middle Estuary. Stormwater runoff to the North Fork historically accounted for 60% of all surface water flows to the St. Lucie Estuary (SLE). Approximately 25% of the surface water runoff currently flows to the estuary through that historic route. Freshwater runoff into the Middle Estuary has increased substantially (from 3% to 25% through Bessey Creek) as a result of the canals. Historically, most rainwater was absorbed by the region's wetland system, which reduced the amount of nutrients and sediment reaching the river during the wet season and increased the amount of groundwater reaching the preserve during the dry season.

Geology (rock structure)

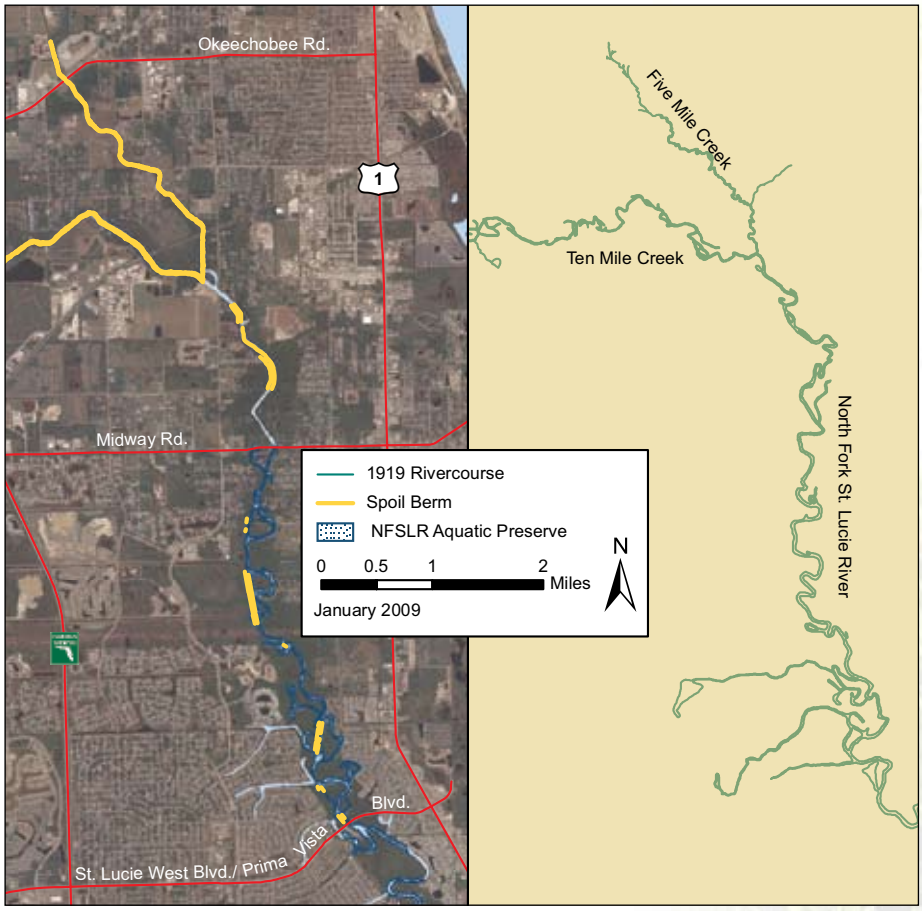
The SLR and its watershed are comprised of coastal lowlands which formed during the advance and retreat of glaciers during the most recent ice age (Pleistocene Epoch). The region contains four surface geologic formations: Holocene, Holocene/ Pleistocene, Pleistocene, and Pliocene. The most recent formed over 10,000 years ago during the Holocene and consists primarily of sand, clay, and organics. It occurs near the coastline at elevations lower than five feet. The Holocene/Pleistocene formation is associated with the Atlantic Coastal Ridge, and is composed primarily of sand located along the beach ridge and dunes. The Anastasia formation, which formed during the Pleistocene over 1.8 million years ago, is composed of limestone, coquina, and sand. This formation lies under the Atlantic Coastal Ridge from St. John's County south to Palm Beach County. It can be exposed along the coast, and extends up to 20 miles inland. The



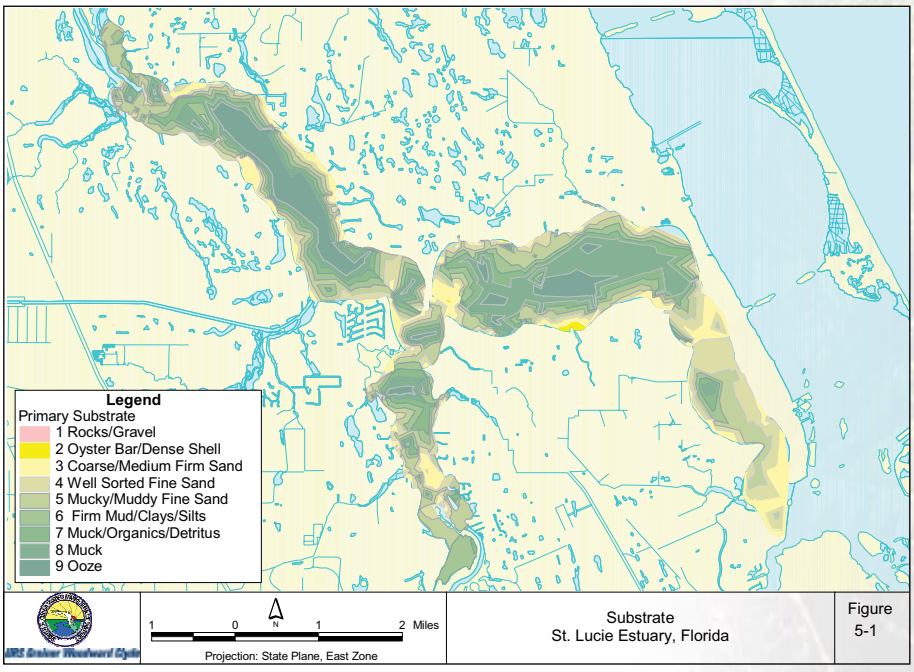
Map 5 | Physiographic regions within the North Fork St. Lucie River Aquatic Preserve watershed.

Anastasia formation is part of the surficial aquifer system. The Pliocene formation dates back to over 5.3 million years and contains some of the most abundant and diverse fossils in the world. These complex sediments, composed of shells, sand, and clay, confound the origin of this formation. Once categorized as the Caloosahatchee formation, it is now known as the Tertiary-Quaternary shell unit. These four surface geologic formations overlie basement rocks of the Florida Platform, including Precambrian-Cambrian igneous rocks, Ordovician-Devonian sedimentary rocks, and Triassic-Jurassic volcanic rocks (Scott, 2001).

Sediment analyses of the SLR have documented the transition from coarse, well-sorted sands along the shallow margins of the river to fine silt and clay particles (muck) in the deepest areas of the North Fork (See Map 7) (Haunert, 1988; Shropp, McFetridge, & Taylor, 1994). In comparison to other sites in the SLR, the North Fork showed the least amount of sand and the most mud, silt/clay, and ooze (soft decaying organic matter). While mapping seagrass in the SLR, Ibis Environmental, Inc. (2007) documented one to three feet of silt substrate in the North Fork (Kitching Cove to Bessey Creek) compared with 2-18 inches in the South Fork and infrequent occurrences in the Middle and Lower Estuary. The high concentrations of fine grain sediments in the North Fork negatively impact the health and abundance of the seagrass and oyster reefs within the preserve (Chamberlain & Hayward, 1996).



Map 6 / The pre-altered 1919 rivercourse and berm locations associated with the straightening process along Ten Mile Creek, Five Mile Creek, and the North Fork St. Lucie River upstream of Prima Vista Boulevard.



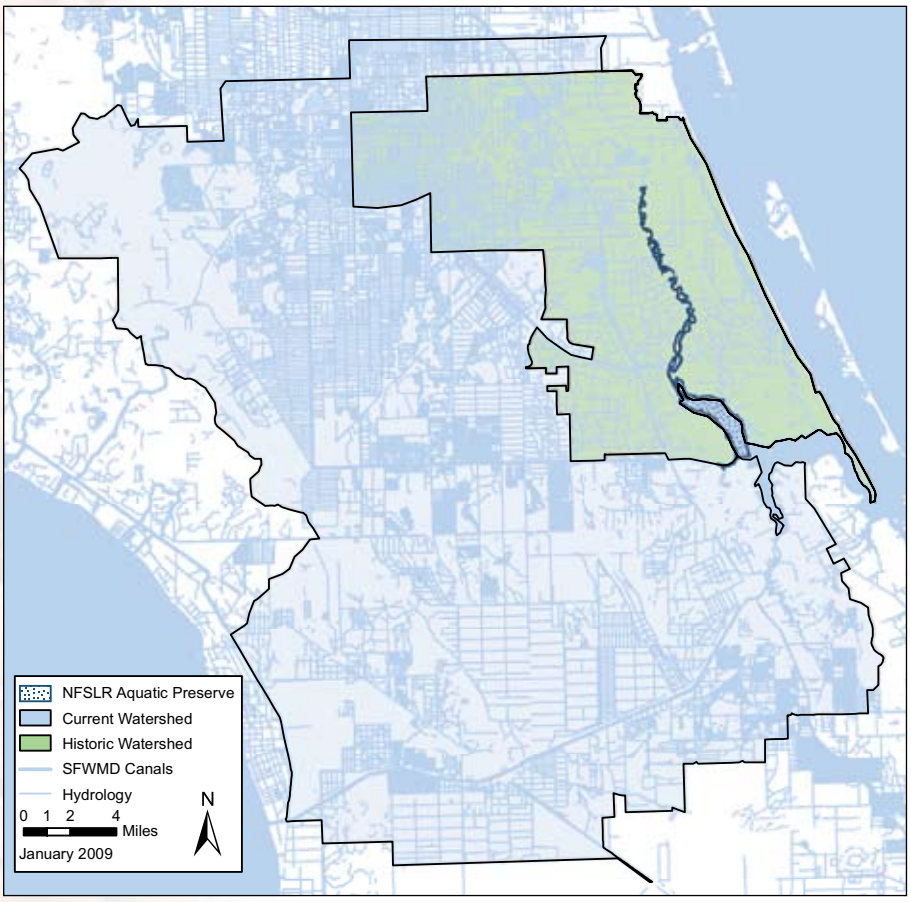
Map 7 / Sediment type and location in the St. Lucie River (URS Greiner Woodward Clyde, 1999).

Hydrology and Watershed

The hydrology of the North Fork and its headwaters was altered in the early to mid 1900s to support the growing demands of development (agricultural and urban) and navigation. This began with a network of agricultural and residential canals and drainages managed by the NSLWCD, South Florida Water Management District (SFWMD), the City of Port St. Lucie, the City of Ft. Pierce, and St. Lucie County. Prior to these drainage efforts the North Fork SLR watershed encompassed 187 square miles (119,732 acres) (See Map 8). The primary canal system, developed as part of the C&SF Flood Control Project, includes the C-44 (St. Lucie Canal), C-23 (County Line Canal), and C-24 (Diversion Canal). Although the C-23 and C-24 are the only primary canals that drain directly in the preserve, water from the C-44 (consisting of watershed runoff and water released from Lake Okeechobee) enters the southern section of the North Fork during flooding tides (Murdock, 1954a). The portion of the preserve most influenced by discharge from the C-44 is also the most suitable area for oysters and seagrass which can be negatively affected by prolonged exposure to excessive amounts of freshwater. Construction of these canals has expanded the watershed to 821 square miles (525,440 acres) in St. Lucie and Martin counties by diverting flows from the areas that were historically in the St. Johns River or Lake Okeechobee basins to the North Fork (See Map 8).

Alteration and expansion of the historic watershed coupled with ecologically-degrading land use practices have set the stage for the current impaired condition of the North Fork and most other SLR watershed basins (See Map 9). Historic wetland ecosystems, mostly pine flatwoods and dry prairies with depressional wetlands, facilitated dynamic watershed storage and sheet flow. Reduced movement through natural features kept wetlands flooded and provided for movement of groundwater to the river during the dry season. This made historic wetlands and estuaries less vulnerable to Florida's variable rainfall.

The rate at which water moved through both the SLR and its watershed was further increased in 1922 when the USACE and NSLWCD began dredging the headwaters, Ten Mile Creek, and the upper reaches of the North Fork for flood control and navigation. Spoil deposited along the newly-created channel isolated both floodplain habitat (primarily tidal swamp and hydric hammock) and oxbows (blackwater river) from the original rivercourse (See Map 6) (PBS&J, 2003). Five Mile Creek was also straightened for flood control. Today, Five and Ten Mile creeks are canals with steep banks and narrow remains of floodplain habitats degraded by dense stands of non-native vegetation (mostly Brazilian pepper (*Schinus terebinthifolius*)). With the exception of two hydrologic restoration sites, (one oxbow and one floodplain reconnection site) completed in 2002-2003, these areas remain isolated from the existing main river channel. Thus, a significant portion of the river's potential natural filtration of nutrients and sediments is not utilized to its full capacity.



Map 8 / Hydrologic alterations within historic and current watersheds of the North Fork St. Lucie River Aquatic Preserve.

Bathymetric data for the SLR has been collected between 1872 and 2007

(Woodward-Clyde International-Americas, 1998; South Florida Water Management District, unpublished data). The most recent map, produced by SFWMD in 1998, indicates little change has occurred near the shorelines since 1944 (Woodward-Clyde International-Americas, 1998). The most substantial bathymetric changes have occurred in the deeper, more central, zones of the North Fork characterized by high amounts of fine sediment. Data shows an accumulation of sediment from 0.5 to 4 feet in some areas since 1963 (See Map 10) (Woodward-Clyde International-Americas, 1998; URS Greiner Woodward Clyde, 1999).

Accumulation of muck in the SLR began 4,000 years ago when the SLR was deeper and mainly fresh water (See Figure 2) (He, Stoffella, Calvert, Zhang & Yang, 2003). Recent construction and operation of major canals, urban development, agricultural practices, and straightening of the North Fork SLR are believed to have accelerated the natural process of muck formation that currently plagues this system (Schrader, 1984; Woodward-Clyde International-Americas, 1998; PBS&J, 2003; St. Lucie River Initiative, Inc., 2004).

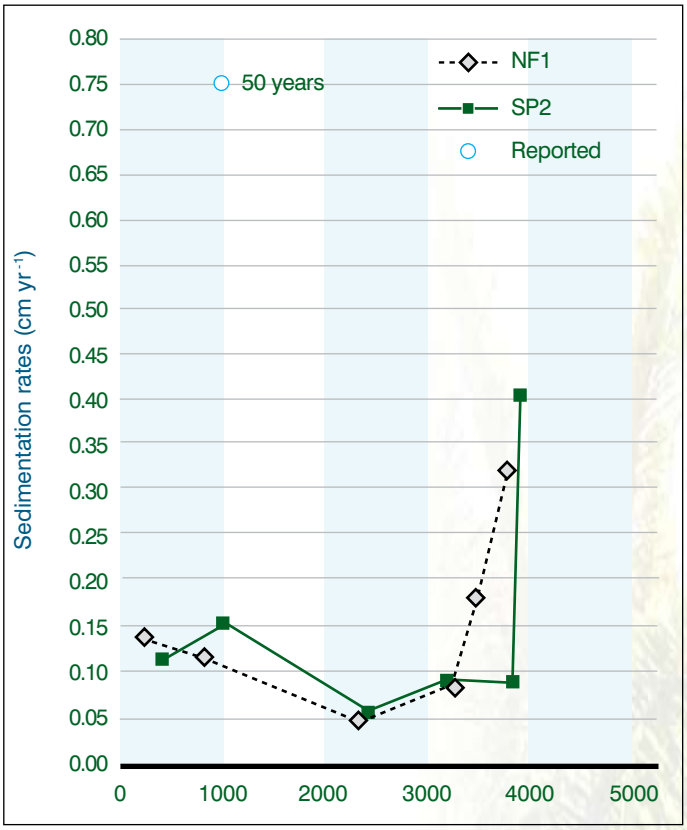
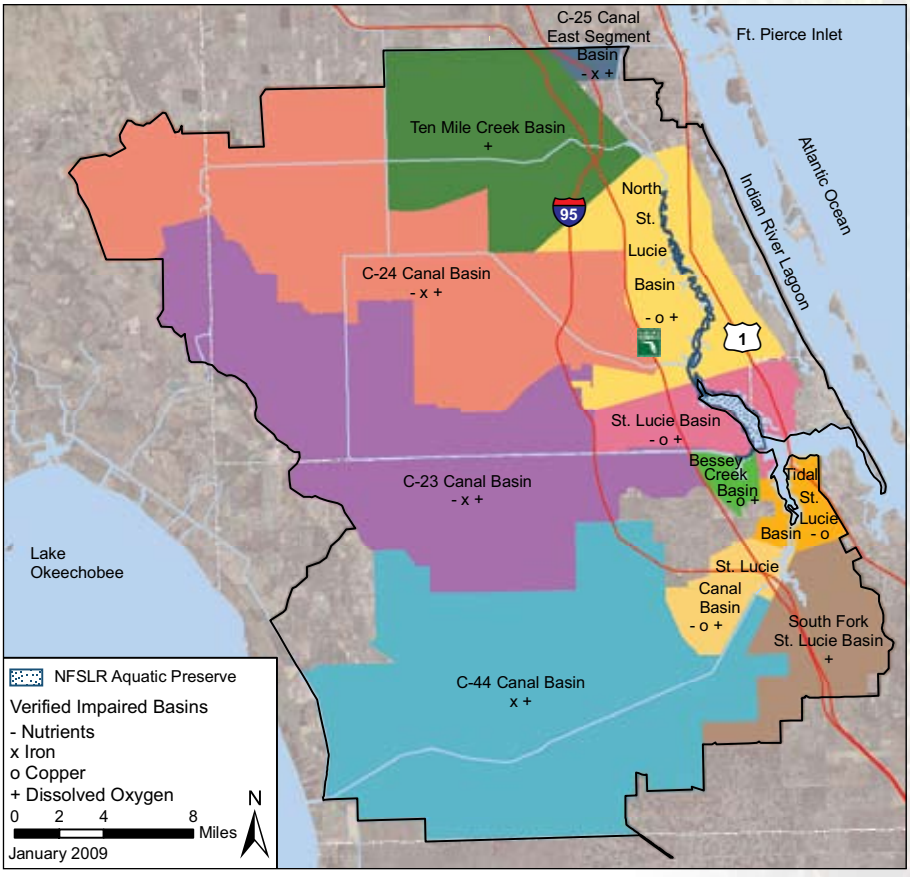


Figure 2 / Sedimentation trends in the St. Lucie River (He et al., 2003).

A comprehensive study of muck in the SLR was completed by St. Lucie River Initiative, Inc. (2004) in response to regulatory and public policy issues concerning muck and its removal. Conclusions from the report indicate that:

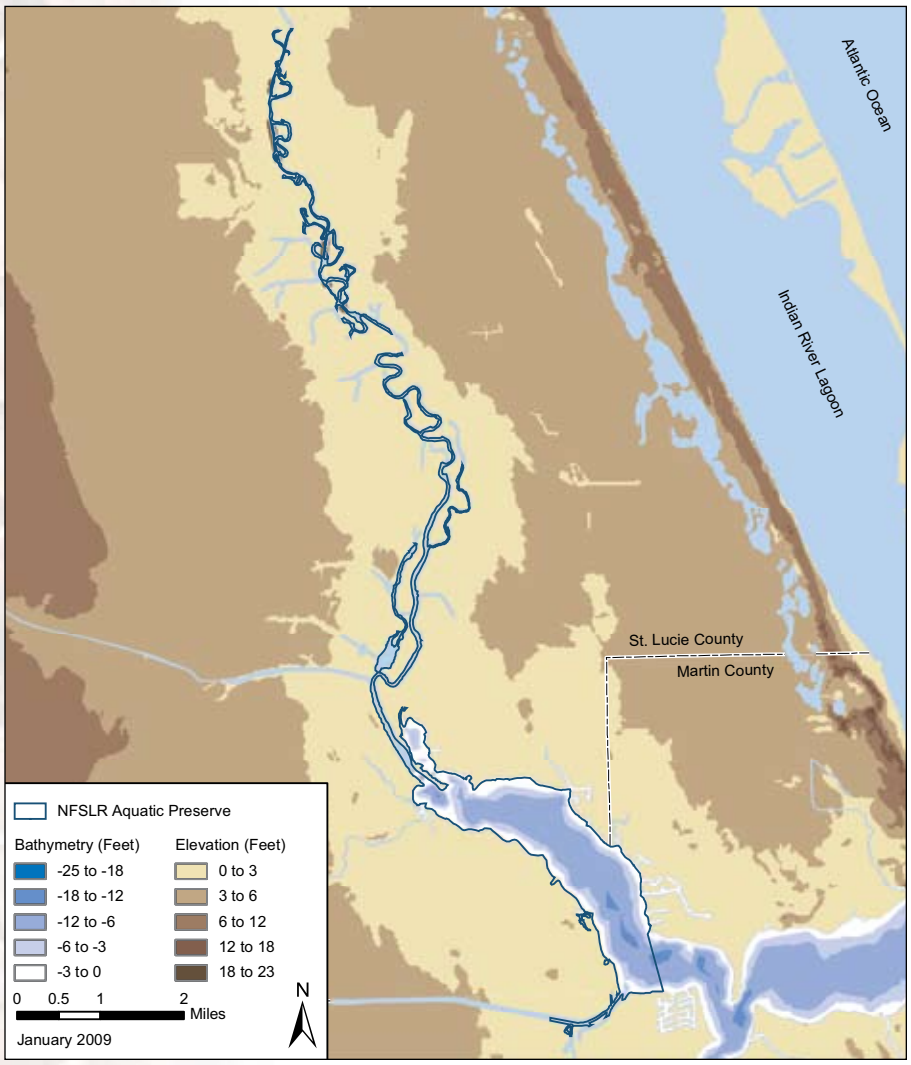
1. Muck sediments in the SLE originate from uplands within the watershed (Schrader, 1984; He et al., 2003);
2. Although muck accumulated within the system prior to anthropogenic changes to the watershed, accumulation rates have dramatically increased within the past 200 years (Schrader, 1984; He et al., 2003);
3. Several muck deposits within the SLR are greater than 15 feet deep (St. Lucie River Initiative, Inc., 2004);



Map 9 / Impaired waters within the North Fork St. Lucie River Aquatic Preserve watershed.

4. Toxic and/or hazardous characteristics of St. Lucie muck sediments are below state and federal standards for toxic and/or hazardous classification (He, Zhang, Stoffella, Calvert, & Wilson, 2001);
5. Muck removed during pilot projects has high salt content that complicates application on agricultural lands (He et al., 2001; He et al., 2003);
6. Cost-effective beneficial uses of SLR muck sediments remain to be identified (He, Stoffella, Zhang, Calvert, Banks, Yang & Yu, 2004);
7. Sediment traps should be excavated in the deepest muck deposits to best control turbidity as it is expected that loose surface layers from shallow areas will gradually migrate to the deeper traps (St. Lucie River Initiative, Inc., 2004); and
8. Final muck disposal should focus on simple upland containment knowing that potential beneficial uses are affected by the upland disposal site design (St. Lucie River Initiative, Inc., 2004).

Today, much of the watershed runoff from the North Fork drainage basins flows quickly from smaller, residential canals into large canals that cross the coastal ridge (C-23 and C-24) instead of being detained, evaporated, cleansed, and held by natural systems. This drainage system has become an important source of irrigation water and freeze protection for agricultural lands. Rainfall, groundwater, and inflow from the Floridan Aquifer replenish surface water stored in the canals. Prior to large-scale citrus expansion in the 1960s, canal storage in St. Lucie County was adequate to meet irrigation demands. However, drainage and subsequent development of the large wetland areas in western St. Lucie County have depleted much of the historic surface water storage sites. Rapid movement of excess stormwater produced during the wet season to the North Fork coupled with increased demand for water for agriculture and urban uses result in an unnaturally high volume of water reaching the North Fork in the wet season and a low volume of water during the dry season (USACE & South Florida Water Management District [SFWMD], 2004).



Map 10 / Bathymetry of the North Fork St. Lucie River Aquatic Preserve and surrounding watershed elevations

Ongoing Restoration Projects in the North Fork St. Lucie River Aquatic Preserve

CERP

The CERP is a component of the C&SF Restudy Report of 1999 that was formulated to achieve ecological restoration of the Greater Everglades Ecosystem (Everglades, the Florida Keys, and the contiguous nearshore coastal waters of South Florida) while providing for other water resource needs of the region. The Indian River Lagoon - South (IRL-S) Project, a regional component of CERP, includes $1.2 billion in projects to be cost-shared between SFWMD and USACE (See Map 11). Its purpose is to make the structural and

operational changes necessary in Martin and St. Lucie counties to improve the quality of the environment, the protection of the aquifer, and the integrity, capability, and conservation of urban and agricultural water supplies. Specific components proposed in the IRL-S Project that will directly impact the quality of the preserve include reservoirs, stormwater treatment areas (STAs), natural storage and treatment areas, North Fork floodplain restoration, diversion of flow, muck removal, and creation of artificial habitat.

Ten Mile Creek Water Preserve Area

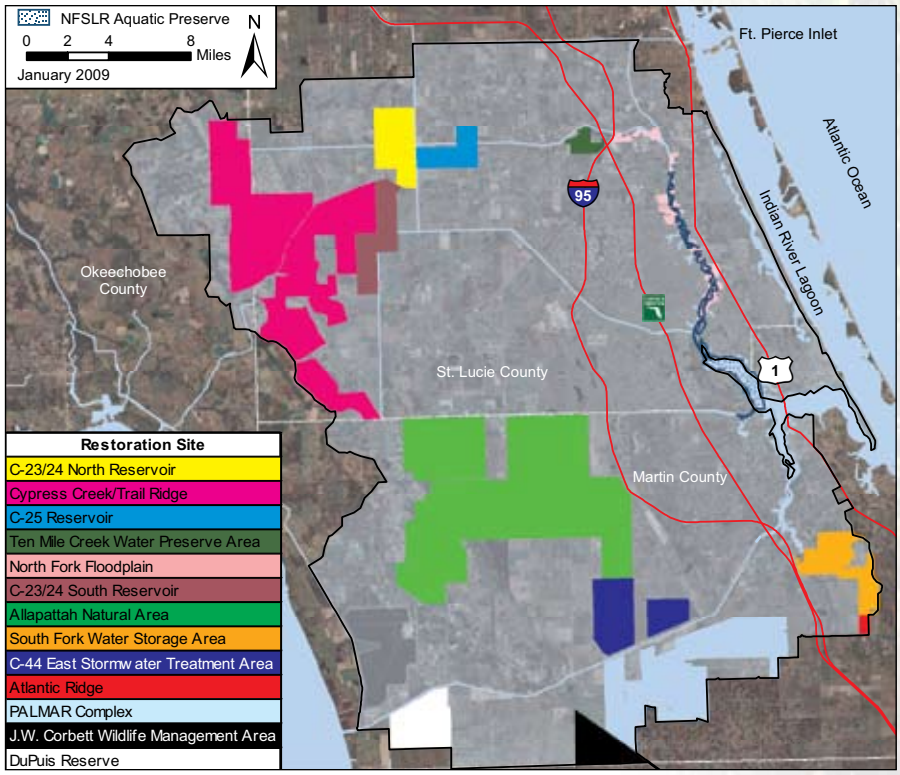
Another project deemed critical to the restoration of the South Florida ecosystem is the Ten Mile Creek Water Preserve Area (WPA). This project lies within the Ten Mile Creek basin, which contributes a large volume of stormwater to the headwaters of the North Fork SLR (See Map 11). The 550-acre reservoir and 110-acre STA facility are intended to cleanse stormwater runoff entering Ten Mile Creek and create a more natural salinity range in the SLR. This critical restoration project will greatly enhance the ability to maintain appropriate salinities in the preserve and help offset the damaging effects of releases through C&SF canals until components of the IRL-S can be implemented. Construction of the Ten Mile Creek WPA began in August 2003 and was completed in December 2005. It is currently in the Interim Operational Phase, consisting of careful observations and assessment of site conditions. Continued evaluation of site conditions and operational factors will be on-going until the facility becomes fully operational.

Hydrologic Restoration

A needs assessment for hydrologic restoration of the North Fork and its headwaters was drafted by PBS&J in June 2003. The study highlights suitable floodplain and oxbow reconnection sites to help offset hydrologic impacts to the SLR (See Appendix B.5.2). These restoration projects align with the goals outlined in the 1993 IRL Surface Water Improvement Management (SWIM) Plan and the 2004 IRL-S Project Implementation Report (PIR) North Fork Floodplain Restoration component. Approximately 324 acres of floodplain wetlands along the North Fork can be hydrologically reconnected to the river (PBS&J, 2003). It is expected that funds directed at floodplain and oxbow reconnections will promote a shift from habitat homogeneity (channels) to habitat heterogeneity (oxbows, meanders, streams, braids, and sheet flow across wetlands), decrease sedimentation, and improve water quality conditions. Thus, hydrologic restoration activities in the upper reaches of the North Fork are expected to improve downstream conditions and will help support recruitment and long-term establishment of oysters and seagrass in the southern portion of the preserve.

Climate

The North Fork SLR is located in a subtropical climate. The average annual rainfall in the watershed is approximately 55 inches, with the majority occurring from May to October (wet season) as a result of thunderstorm events. Air temperatures range from the 90s in the summer to the 40s in the winter with an average monthly temperature in the low 70s. Water temperatures range from the high 80s in the summer to the high 50s in the winter (Gunter & Hall, 1963; Chamberlain & Hayward, 1996). Heavy rain events and unpredictable tropical storms and hurricanes result in increased freshwater inputs between June and November.



Map 11 / Large-scale restoration efforts within the North Fork St. Lucie River Aquatic Preserve watershed.

The Ten Mile Creek Water Preserve Area is anticipated to reduce the nutrient, sediment, and pollutant loads of the water flowing into Ten Mile Creek and, consequently, the preserve.

Three hurricanes impacted the region in 2004-2005 and negatively affected the resources in the SLE (Switzer, Winner, Dunham, Whittington & Thomas, 2006; L. Burgess, personal communication, September 6, 2007). Hurricanes Frances and Jeanne (Categories 2 and 3, respectively) made unprecedented landfalls only 20 days apart in the same location over the IRL and SLR near St. Lucie Inlet in September 2004. Hurricane Wilma arrived from the southwest and struck the area as a Category 1 hurricane in October 2005. The effects of the hurricanes can still be seen in the number of felled trees, debris, derelict vessels, and damaged docks.

Hurricanes can cause an increase in the amount of freshwater released through the C-23, C-24, and C-44 canals which can alter the species makeup within the preserve (Switzer et al., 2006). These changes are temporary but noticeable. After hurricanes Frances and Jeanne, numbers of saltwater species such as striped mullet (*Mugil cephalus*) and white mullet (*Mugil curema*) declined in the North Fork while freshwater and oligohaline (near freshwater conditions) species such as blue crab (*Callinectes sapidus*), gizzard shad (*Dorosoma cepedianum)*, and ladyfish (*Elops saurus*) increased (Switzer et al., 2006).

Natural Communities

The natural community classification system utilized in this plan was developed by the Florida Natural Areas Inventory (FNAI) and the Florida Department of Natural Resources (DNR). The community types are defined by vegetation structure and composition, hydrology, fire regime, topography, and soil type. The community types are named for the most characteristic biological or physical feature (Florida Natural Areas Inventory [FNAI] & Florida Department of Natural Resources [DNR], 1990). FNAI also assigns global (G) and state (S) ranks to each natural community and species that FNAI tracks. These ranks reflect the status of the natural community or species worldwide (G) and in Florida (S). Lower numbers reflect a higher degree of imperilment (e.g. G1 represents the most imperiled natural communities worldwide, S1 represents the most imperiled natural communities in Florida). Appendix B.6 provides a full explanation of the FNAI community types and the ranking system.

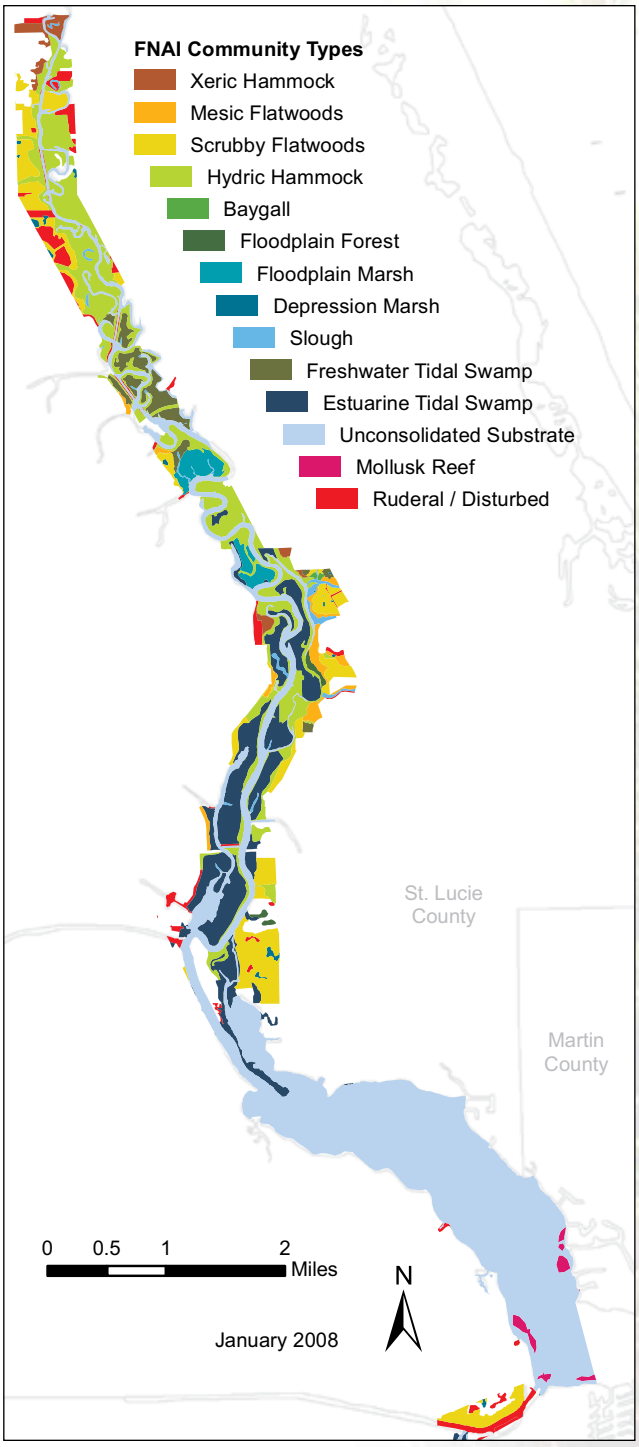
The IRL and SLR straddle the temperate and subtropical biogeographic zones. Species diversity in the system is among the highest in North America as it supports representative species from each zone as well as endemic species that are specific to this region (Swain et al., 1995). The preserve is comprised of oligohaline and estuarine habitat types and is surrounded by a variety of upland communities that

buffer the preserve from outside influences (See Map 12) (Teas, 1971). Descriptions and current status of preserve lands and buffering natural lands using FNAI codes are provided in detail below and in abbreviated form in Appendix B.6. The provided FNAI map was created using 2003 FNAI data for the North Fork St. Lucie River Buffer Preserve (now managed by Savannas Preserve State Park) and a 1999 SFWMD natural lands geographic information system (GIS) shapefile that were crosswalked to FNAI classifications. The 2003 FNAI data served as the primary layer and the SFWMD mapping efforts, once crosswalked to FNAI, were used to fill gaps. Future ground-truthing is necessary to depict the actual coverage of each habitat type. SFWMD provided both the oyster and seagrass GIS data used in this plan. Mollusk (oyster) reef data were collected in 2003 and although historically present, no seagrasses were located within the preserve during the SJRWMD's 2007 seagrass mapping effort. Five FNAI communities are currently located within the preserve and an additional seven communities are located adjacent to the preserve (Table 1). A portion of the floodplain consists of dredged spoil deposits and is classified as ruderal/disturbed. The global and state ranks for the communities within the preserve are all G3 and S3, respectively, with the exception of unconsolidated substrate which is considered G5 and S5, respectively. The global and state ranking systems are described in Appendix B.6.

Natural Communities within the Preserve

Mollusk Reef - In Florida, the most developed mollusk reefs are generally restricted to estuarine areas and are dominated by the Eastern oyster (*Crassostrea virginica*). Relatively large oyster beds in the Middle Estuary, small beds in the South Fork, and scattered beds in the North Fork were first documented in the early 1940s (Steward, Brockmeyer, Gostel, Sime & VanArman, 2003; Woodward-Clyde International-Americas, 1998). Like seagrasses, the oyster population in the preserve has been negatively affected by the quality, quantity, timing, and distribution of freshwater entering the system through water control structures. In addition to higher salinity levels, oysters require a hard (consolidated) substrate on which the spat (mollusk juveniles) settle and complete development. Spat die if they settle on soft (unconsolidated) substrates such as soft mud or shifting sand. Hard substrates, and therefore oyster reefs, are limited in the preserve due to high amounts of fine organic (mucky) sediments (St. Lucie River Initiative, Inc., 2004). The latest oyster reef mapping effort (2003) showed 31 acres of mollusk (live and dead oyster) reef were documented in the southern, more saline, portions of the preserve. Predators include man, blue crab, sheepshead (*Archosargus probatocephalus*), and black drum (*Pogonias cromis*).

Unconsolidated Substrates - Most submerged lands within the preserve are classified as unconsolidated substrate (2,247 acres). This includes one beach in Kitching Cove, areas with sand and shell bottom, tidal mud flats, and soft bottom. Estuarine unconsolidated substrates are mineral-based natural communities generally



Map 12 / Natural lands within and adjacent to the North Fork St. Lucie River Aquatic Preserve.

Oyster reefs in the preserve are susceptible to prolonged exposure to freshwater released from canals draining the watershed and Lake Okeechobee. (Photo taken by Heather Hitt at Florida Oceanographic Society.)

characterized as expansive, relatively open areas that lack dense populations of attached plant and animal species. While these areas may appear relatively barren, within the North Fork they support populations of insects, tube worms, mollusks, isopods, amphipods, burrowing shrimp, crabs, and bottom-dwelling fishes such as blennies, gobies, sleepers, and mangrove rivulus (*Rivulus marmoratus*). Densities of these organisms below the mean low water line can reach the tens of thousands per square meter, making these areas important feeding grounds for bottom-feeding fish such as redfish (*Sciaenops ocellatus*), flounder, spot (*Leiostomus xanthurus*), and sheepshead. The areas above the mean low water line are extremely important feeding grounds for birds and invertebrates. Unconsolidated substrate communities are important in that they will form the foundation for the development of other estuarine natural communities when conditions become appropriate. Unconsolidated substrate communities currently grade into tidal swamps, mollusk reefs, and small patches of short-lived seagrass. Gradation of unconsolidated substrate into seagrass beds and oyster reefs is one of the primary biological goals of federal, state, and locally-funded SLR restoration projects (Steward et al., 2003; USACE & SFWMD, 2004).

Estuarine Tidal Swamp - Approximately 535 acres of tidal swamp or mangrove forests are located in the southern, more saline portion of the preserve. This community is primarily comprised of red mangrove (*Rhizophora mangle*) with occasional giant leather fern (*Acrostichum danaeifolium*) and coastal plain willow (*Salix caroliniana*). These habitats play a critical role in the ecology of the river and the estuary. They protect the shoreline from erosion by reducing wave energy, contribute heavily to the input of organic material to the estuarine food web, and provide habitat for numerous estuarine fishes, crabs, and shrimps. Mangroves also play a role as the primary roosting and nesting site for wading birds and pelicans. One wading bird rookery, made of two adjacent mangrove islands, is located within the preserve. As of 2008, the upstream extent of mangroves is roughly one mile north of Prima Vista Boulevard. Future hydrologic changes within the watershed can be monitored by assessing mangrove survival and recruitment along the North Fork. In many areas Brazilian pepper, an invasive non-native, has replaced the mangroves. This is partially the result of artificially straightening the North Fork and its headwaters and the opportunistic character of Brazilian pepper. Non-native removal efforts have historically concentrated on removing pepper trees from the tidal swamps. Mangroves have naturally recruited into areas where pepper trees were treated with herbicide and one artificial canal has been planted with red mangroves as a mitigation project.

Freshwater Tidal Swamp - A large portion of the preserve, 119 acres, is classified as freshwater tidal swamp. This habitat type occurs along floodplains just inland (upstream) from the mangrove tidal swamps found in the preserve. These areas contain numerous species including an overstory of pop ash (*Fraxinus*

Giant leather fern along the upper reaches of the North Fork St. Lucie River Aquatic Preserve.

caroliniana), laurel oak (*Quercus laurifolia*), red maple (*Acer rubrum*), pond apple (*Annona glabra*), dahoon holly (*Ilex cassine*), and cabbage palm (*Sabal palmetto*) with a ground cover of saltbush (*Baccharis* spp.), wild coffee (*Psychotria* spp.), giant leather fern, pimpernel (*Samolus* sp.), buttonbush (*Cephalanthus occidentalis*), ardisias (*Ardisia* spp.), swamp lily (*Crinum americanum),* arrowhead (*Sagittaria* sp.), and stoppers (*Eugenia spp.* and *Myrcianthes fragrans*). The taller trees and shrubs provide habitat for various vines and epiphytes (plants that grow on other plants) such as poison ivy (*Toxicodendron radicans*), bromeliads (air plants [Bromeliaceae]), and orchids (Orchidaceae). The swamps are flooded twice daily in response to tidal cycles and are often fed by oxbows and sloughs. They are extremely vulnerable to hydrologic modifications and have been impacted by past dredging operations along the North Fork.

Slough - A slough is a depression associated with swamps and marshlands containing areas of slightly deeper water and a slow current. Several sloughs, totaling 40 acres, feed into the North Fork St. Lucie River Aquatic Preserve. Most sloughs have been channelized to facilitate drainage of stormwater from urban areas. The quality of this water is unknown, but the North Fork receives considerable stormwater runoff and most of it appears to be untreated. Altered sloughs are susceptible to disturbance caused by regular maintenance of drainage easements (e.g. non-native invasions, erosion) and by increased water volume and flow from stormwater alterations and new development in the watershed. Within the preserve, the sloughs contain wetland species such as swamp lily, arrowhead, pickerel weed (*Pontedaria cordata*), and leather fern. Unaltered sloughs are dominated by native species. The slough banks contain a diverse array of species including swamp (*Persea palustris*) and red bay (*P. borbonia*), pop ash, laurel oak, pond apple, wax myrtle (*Myrica cerifera*), saltbush, primrose (*Ludwigia spp.*), stoppers, wild coffee, and various vines and epiphytes such as poison ivy, bromeliads, and muscadine grape (*Vitis rotundifolia*).

Natural Communities

FNAI Natural Community Type	# Acres	% of Area	Federal Rank	State Rank	Comments
Mollusk Reef	31	1	G3	S3	Live and dead oyster reef
Unconsolidated substrates	2,247	76	G5	S5	
Tidal Swamp	535	18	G3	S3	Estuarine species
Freshwater Tidal Swamp	119	4	G3	S3	Freshwater species
Slough	40	1	G3	S3	

Table 1 | Natural communities within the North Fork St. Lucie River Aquatic Preserve.

Natural Communities Adjacent to the Preserve

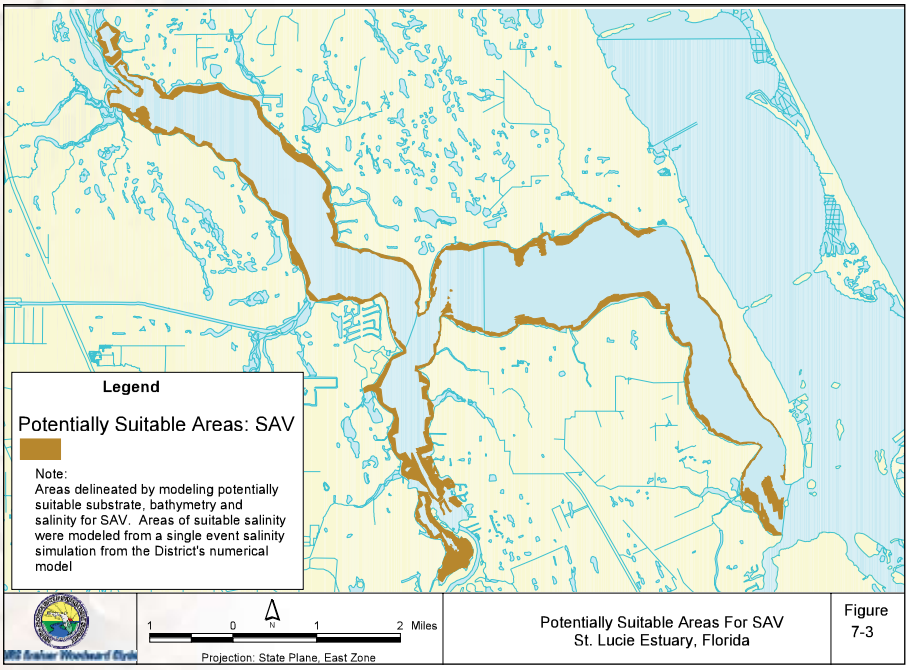
Seagrass Beds - Mapping efforts indicate that shoal grass (*Halodule wrightii*) and widgeon grass (*Ruppia maritima*) were historically present along the shorelines in the southern section of the preserve. The last evidence of seagrass seen in the North Fork SLR was an ephemeral patch of widgeon grass observed in 2002 (R. Robbins, personal communication, October 31, 2007). Altered salinity regimes (and a regular pattern of their occurrence), poor water quality, and limited amounts of suitable substrate have reduced the ability of the North Fork to support these valued ecosystem components (Woodward-Clyde International-Americas, 1998; USACE & SFWMD, 2004; Ibis Environmental, Inc., 2007). Muck deposits throughout a large portion of the southern section of the preserve have reduced the amount of potential submerged aquatic vegetation (SAV) habitat to the shallow edges lined with a higher concentration of coarse-grain sediments (See Map 13). Future CERP muck removal efforts and watershed restoration projects are expected to facilitate reestablishment of seagrass beds in the preserve.

Hydric Hammock - The hydric hammock found adjacent to the preserve is dominated by hardwoods, such as red maple, sweetgum (*Liquidambar styraciflua*), swamp and red bay, dahoon holly, laurel oak, gumbo limbo (*Bursera simaruba*), intermingled with cabbage palm, wax myrtle, and numerous epiphytes such as poison ivy, bromeliads, and orchids. Hydric hammocks have wet soils less than 60 days out of the year and support sparse ground cover such as royal (*Osmunda regalis*), bracken (*Pteridium aquilinum*), and cinnamon ferns (*O. cinnamomea*), wild coffee, and stoppers.

Floodplain Marsh – The adjacent floodplain marsh community is generally found in low spots and oxbows. A dense groundcover of sawgrass (*Cladium jamaicense*) and leather fern exists with a sparse overstory of trees and shrubs (such as coastal plain willow and wax myrtle) supported by saturated soils. The herbaceous plants are two to five feet tall. Floodplain marshes are extremely important as habitat for birds and juvenile estuarine and freshwater organisms such as fishes, crabs, and shrimps. Non-native species such as Brazilian pepper have heavily invaded the floodplain marsh primarily because of intense floodplain alteration associated with straightening the river in the early 1900s.

Floodplain Forest - Long-lived floodplain forests are located directly adjacent to the SLR as a transitional zone between the SLR and mesic and scrubby habitats. They support mixed wet and dry habitat associates such as red maple, coastal plain willow, wax myrtle, various ferns, and oaks. The plant species here are similar to those of hydric hammocks and are very susceptible to activities that negatively impact the hydrology of the site. The floodplain forests along the preserve also support saw palmetto (*Serenoa repens*), cabbage palm, wild coffee, and royal, bracken, leather and cinnamon ferns.

Depression Marsh - A few depression marshes are located adjacent to the preserve within flatwoods or scrubby habitats. Depressional marshes generally contain St. Johns wort (*Hypericum* spp.), yellow hatpin (*Syngonathus flavidulus*), cattail (*Typha latifolia*), jointed spikerush (*Eleocharis interstincta*), pickerel weed, arrowhead, yellow-eyed grass (*Xyris* sp.), redroot (*Lachnanthes caroliniana*), and chalky bluestem (*Andropogon virginicus*). Several of these marshes have been impacted by altered drainage and are in need of restoration.



Map 13 / Potential submerged aquatic vegetation habitat in the St. Lucie River (URS Greiner Woodward Clyde, 1999).

Scrubby Flatwoods – Scrubby flatwoods are well-drained and commonly found adjacent to xeric hammock

American alligators nest along the banks of the North Fork St. Lucie River Aquatic Preserve and its headwaters.

habitats along the North Fork. The oaks in this community are dense and average 15 feet tall. Fire is essential to maintain community balance and perpetuate fire-dependent species but has been absent from these habitats for decades. The overstory consists of scattered south Florida slash pine (*Pinus elliotti* var. *densa*) mixed with sand pine (*P. clausa*) and large scrub oaks (live [*Quercus virginiana*], sand live [*Q. geminata*], and myrtle [*Q. myrtifolia*]). The ground cover consists of saw palmetto with gallberry (*Ilex glabra*), lyonias (*Lyonia* spp.), tarflower (*Befaria racemosa*), blueberries (*Vaccinium* spp.), and occasional wiregrass (*Aristida beyrichiana*).

Xeric Hammock - Pockets of xeric hammock occur along the preserve in sandy areas adjacent to scrubby flatwood habitats. The community appears to be the result of decades of fire suppression and contains primarily scrub oaks, with saw palmetto, tarflower, lyonias, gallberry, blueberries, ground lichens, and occasionally sand pine. Populations of herbaceous ground cover are reduced. The xeric hammock has been used as an educational tool to teach the importance of fire to the ecology of the area.

Areas Adjacent to the Preserve

Ruderal/Disturbed - These areas represent 178 acres along the preserve and are characterized by historical ground disturbance (logging or clearing) and subsequent invasion by primarily non-native species such as Bahia grass (*Paspalum notatum*), Brazilian pepper, and Caesar weed (*Urena lobata*). Some native species remain, such as saw palmetto, wax myrtle, and muscadine grape. Approximately 25,200 linear feet of shoreline along the preserve from Fork Point to Midway Road is filled with sediment from development or dredge spoil (See Map 2) (USACE & SFWMD, 2004). This includes small areas near residences often associated with canals created for drainage and modified riverbanks that contain river bottom spoil from the 1920s dredging operation. These modified banks generally contain species associated with the floodplain forest and hydric hammock communities found adjacent to the preserve, including very large oaks. These spoil areas often prevent river water movement into the adjacent floodplain. Disturbed areas also include dirt roads and drainage areas (swales and banks) comprised of Bahia grass.

Native Species

Due to the geographic location, tidal connectivity through St. Lucie Inlet, and freshwater upper reaches, the preserve is teeming with a unique combination of temperate and tropical species that tolerate a wide salinity range (fresh to estuarine). To date, over 650 native species, including fish, amphibians,

reptiles, birds, mammals, invertebrates, plants, and phytoplankton, have been located and identified within the preserve and adjacent floodplain (See Appendix B.4.1 for complete listing). The only known rookery for the endangered (federal and state) wood stork (*Mycteria americana*) in St. Lucie County is in Mud Cove, within the preserve. It supports wood stork, great egret (*Ardea alba*), snowy egret (*Egretta thula*), tricolored heron (*E. tricolor*), and anhinga (*Anhinga anhinga*) populations. The rookery and the surrounding mangrove vegetation serve as important roosting habitat for brown pelican (*Pelecanus occidentalis*), little blue heron (*Egretta caerulea*), night heron (*Nycticorax* spp.), glossy ibis (*Plegadis falcinellus*) and white ibis (*Eudocimus albus*). Preserve species that have the potential to affect nesting success in these rookeries include the American alligator (*Alligator mississippiensis*), bobcat (*Lynx rufus*), and raccoon (*Procyon lotor*). The osprey (*Pandion haliaetus*) is commonly seen nesting in the floodplain and foraging within the preserve.

The West Indian manatee is often seen in the historic riverbends within the preserve where they occasionally feed on shoreline vegetation and reproduce (M. Meeker, personal communication, August 13, 2007; K. Cairnes, personal communication, August 8, 2007). At least three species of bats, the Mexican free-tailed (*Tadarida brasiliensis*), evening (*Nycticeius humeralis*), and Eastern yellow (*Lasiurus intermedius*), reside within the preserve and are usually seen feeding at dusk. The Mexican free-tailed bat is the most common species and can be found on the underside of bridges and inside buildings. The Eastern yellow bat is the least common species and is usually found in palm trees (K. Gioeli, personal communication, August 21, 2007). Bats feed on insects, including mosquitoes and agricultural pests, and therefore play a critical role in reducing the need for chemical pesticides near aquatic areas (U. S. Geological Survey [USGS], 2003).

The salinity range coupled with the emergent vegetation and red mangroves create productive nursery habitat for commercially important species including the blue crab, cinnamon river shrimp (*Machrobrachium acanthurus)*, penaeid shrimp (pink [*Farfantepenaeus duorarum*], brown [*F. aztecus*], and white [*Penaeus setiferus*]), and several species of fish including snapper, snook, tarpon (*Magalops atlanticus*), mullet (*Mugil* spp.), drum (Sciaenidae), sheepshead, and pompano (Carangidae). Freshwater species in the upper reaches of the preserve include crappie (*Pomoxis* spp.), bass (Serranidae), and sunfish (*Lepomis* spp.).

Listed Species

The preserve provides valuable habitat and protection for a variety of rare and protected species. Currently 33 listed species (11 plants, 2 fish, 5 reptiles, 13 birds, and 2 mammals) and three commercially exploited plant species have been documented in and adjacent to the preserve (See Appendix B.4.1.). An additional 20 rare species (including fish, reptiles, and birds) supported by the preserve have been identified by the Florida Committee on Rare and Endangered Plants and Animals (FCREPA) (Ashton, 1992; See Appendix B.4.1.). The rare plant list created by FCREPA is outdated (R. Ashton, personal communication, January 29, 2009). Rare plant species within and adjacent to the preserve will be included in the NFSLRAP species list once an updated document has been published by FCREPA.

The mangrove rivulus and opossum pipefish are the only two federally-listed fish species in the preserve. These species have a very limited distribution within the continental United States (U.S.) and have unique habitat requirements that should be protected to the greatest extent possible. The mangrove rivulus is a tropical killifish that is widely distributed from Florida to Brazil but locally rare as it reaches the northern extent of its range on both coasts in central Florida (Taylor, 1993; Taylor, Davis & Turner, 1995). This species was listed by NOAA National Marine Fisheries Service (NMFS) as a Species of Special Concern (SSC) in 1997.

The opossum pipefish is a circum-tropical (organisms which occur around the tropics of the world) species that was designated as an SSC through NOAA NMFS in 1991 and Threatened by FCREPA due to habitat destruction (associated with seawall, dock, and rip rap construction), isolation from habitat due to water control structures and degraded water quality. Predictable breeding adult populations in Florida are limited to the tributaries of the IRL (e.g. St. Lucie and Loxahatchee rivers) (Gilmore, 1992; 1999).

The American alligator and Florida brown snake (*Storeria dekayi victa*) are the only listed reptiles that inhabit the preserve. Alligators are a federally-listed threatened species and a state-listed SSC because of their similarity in appearance to the endangered American crocodile (*Crocodylus acutus*). Alligators are most common in the major river drainage basins, such as the tributaries to the IRL and large lakes in central and south Florida. They are tolerant of poor water quality and are commonly seen in local drainage canals, retention ponds, and ditches. Various sizes have been observed within the preserve and breeding is known to occur along the river banks (Teas, 1971; G. Evans, personal communication,

November 15, 2007; D. Wade, personal communication, November 15, 2007). The Florida brown snake is threatened at the state level and resides in the marshes and uplands adjacent to the preserve, but they feed on fish collected in the North Fork.

The West Indian manatee is the only listed mammal (endangered at both the federal and state level) found within the preserve. Spanning fresh to ocean water, they have been observed using historic riverbends, which are shallower and less traveled than the main channel, as breeding grounds. One of the largest potential threats to manatees in the preserve is boat strikes. The Sherman's fox squirrel (*Sciurus niger shermani*), listed through the state as an SSC, can be found adjacent to the preserve within Savannas Preserve State Park.

Several listed bird species utilize the preserve (See Appendix B.4.1). The wood stork, both federally and state-listed as endangered, and several SSC, including little blue heron, osprey, snowy egret, and tricolor heron, use the preserve as breeding grounds from February through July each year (Griffin, Morris, Rodgers & Snyder, accepted). Most of these species are regularly seen foraging within the preserve, even outside the breeding season. The brown pelican, an SSC, uses the mangroves for roosting but have not been observed to build nests along the North Fork. The loss or degradation of wetlands in central and south Florida is the primary threat to wood storks and other wading birds.

Mangrove rivulus are rare and hearty fish generally associated with great land crab (Cardisoma guanhumi) *burrows and areas of low oxygen. (Image provided by Dr. Scott Taylor.)*

Wood stork chicks at the Mud Cove Rookery.

Several species within the preserve have been designated by the FCREPA as rare due to limited availability of subtropical aquatic habitat and degradation of habitat quality in Florida. These include animals such as tropical peripheral fish (those that are on or near the edge of their geographical range) that are more commonly seen in the Caribbean. Four tropical fish are known to occur along the North Fork and are considered indicator species due to their specific habitat requirements (Beal, Hitt, Herren, Kaufmann & Hauck, 2006; USACE & SFWMD, 2004). These four fish, the bigmouth sleeper (*Gobiomorus dormitor*), river goby (*Awaous banana*), slashcheek goby (*Gobionellus psuedofasciatus*), and opossum pipefish, are listed as threatened by FCREPA (Ashton, 1992). An additional rare fish species, the mangrove rivulus, is listed by FCREPA as an SSC (Ashton, 1992). The largest U.S. populations of three rare snook species, the fat snook (*Centropomus parallelus*), the swordspine snook (*C. ensiferus*), and the tarpon snook (*C. pectinatus*), have also been documented in the North Fork SLR (Beal et al., 2006; G. Gilmore, personal communication, February 1, 2008; Dutka-Gianelli, unpublished data). Ichthyologists (scientists that study the biology and ecology of fish) believe that many of the above species warrant consideration for possible listing under the Endangered Species Act (ESA) of 1973 (G. Gilmore, personal communication, February 1, 2008).

Invasive Non-native Species

Like most waterbodies in Florida, the preserve is home to non-native species that compete with native residents for food and space. Several non-native species have been identified within and along the North Fork SLR (See Appendix B.4.2 for a complete listing).

Fish species include sailfish catfish (*Pterygoplichthys* spp.), blue (*Oreochromis aureus*) and spotted tilapia (*Tilapia mariae*), walking catfish (*Clarias batrachus*), South American brown hoplo (*Hoplosternum littorale*), grass carp (*Ctenopharyngodon idella*), and Mayan cichlid (*Cichlasoma urophthalmus*). The sailfin catfish is the most successful, abundant, and widespread of the armored catfish species and is found throughout central and south Florida. Frequent sightings indicate that a reproductive population exists in the North Fork SLR. Blue tilapia hybrids were positively identified in the North Fork SLR in 2006 (Gilmore, unpublished data). Native to North Africa and the Middle East, blue tilapia were imported in 1961 and have become established throughout central and south Florida. Tilapias compete with other native species that feed primarily on plankton and small organisms living in or on bottom detritus (Florida Fish and Wildlife Conservation Commission [FWC], 2007b). Walking catfish have been identified in the South Fork SLR and Five Mile Creek headwaters to the North Fork SLR and are presumed to reside in the upper reaches of the preserve as well. Native to Southeast Asia, walking catfish are an opportunistic species that consume a wide variety of food items including small fishes, aquatic insects, plant material, and detritus. Due to its ability to breath air, this species thrives in water with little to no oxygen and is well-adapted to short-lived water bodies with muddy bottoms. Habitat preferences tend to segregate individuals and reduce its overall effect on native species (Smithsonian Marine Station at Fort Pierce, 2007). The South American brown hoplo was first documented in the IRL system in 1995 and is now found throughout central and south Florida. Brown hoplo can be found in a variety of freshwater habitats including muddy bottom and slow moving rivers, streams, side channels, ponds, marshes, and manmade waterways such as ditches and borrow pits. The species feeds on benthic invertebrates and is capable of gulping air to survive in areas with low dissolved oxygen and high hydrogen sulfide levels. Electroshocking efforts in September 2005 revealed the presence of grass carp in the North Fork SLR (J. Beal, personal communication, August 9, 2007). To reduce maintenance costs, local municipalities stock retention and golf course ponds with triploid (sterile) grass carp. These ponds may be hydrologically connected to the preserve during heavy rain events. The fundamental threat that grass carp present to the natural resources within the preserve includes their ability to consume massive amounts of emergent (vegetation that grows in the water with the majority of the plant above the waters surface) and submerged vegetation. Aquatic vegetation is sparse within the preserve and serves as habitat and reproductive grounds for a variety of fish (e.g. opossum pipefish and gar [*Lepisosteus* spp.]). The Mayan cichlid is native to the Atlantic waters off Central and South America and was first recorded in Florida Bay in 1983. This species is now abundant through Lake Okeechobee and the St. Lucie Canal and tolerates a wide salinity range and habitats including canals and rivers. Mayan cichlid consume grass shrimp (*Palaeomononetes* spp.), small fish, snails, and insects. Specimens from the preserve have been caught on hook and line and photographed by recreational anglers.

The African cattle egret (*Bubulcus ibis*) naturally expanded its range to Florida in the early 1940s and has become ever-present. Cattle egret feed primarily in terrestrial pastures with cattle. Their unique foraging behavior, which is not tied to aquatic environments, has eliminated feeding competition with other native wading birds. The largest threat that the cattle egret presents to native species is the competition for nesting materials and rookery space. Cattle egret nest late in the year in Florida which reduces but does not eliminate the competition for space with native wood stork, egrets, and herons.

Brazilian pepper is regulated by Florida Fish and Wildlife Conservation Commission (FWC) as a Class I Prohibited Plant, which means that this plant is under the highest amount of regulation and “under no circumstances will this species be permitted for possession, collection, transportation, cultivation, and importation except as provided in Rule 62C-52.004, F.A.C.” This species has displaced native vegetation along the altered shorelines of the North Fork (such as mangroves and leather fern), Five Mile Creek, and Ten Mile Creek. Removal of this species along the river has been initiated by local state park staff. This is an intensive process that requires constant attention and funding.

Archaeological and Historical Resources

The Florida Department of State, Division of Historical Resources Master Site File indicates that there are six historical sites located within or adjacent to the preserve. They include three shell middens (one of which is scattered), one historic road scar, a shack, and a bridge. Spruce Bluff and White City are two of the earliest known European settlements (both Scandinavian) along the present day NFSLRAP (*circa*

1900). All that remains of the Spruce Bluff settlement is a small gravesite. White City was larger and several of the original homes of the founders still exist along with the Mercantile Building constructed between 1900 and 1905. These structures are included in the Master Site File.

3.1.4 / Values

The NFSLRAP was designated in 1972 because of its significant biological value. Due to its latitude and direct tidal connection to nearby seagrass beds, wormrock, and coral reef habitats, the preserve supports a unique combination of temperate and subtropical aquatic species. The North Fork serves as a valuable nursery ground for recreational and commercially important and rare species. The preserve also serves as foraging grounds and supports a rookery for the endangered wood stork.

Three public fishing piers are located within the preserve.

The preserve is economically important to local ecotourism and water sport companies, and commercial and recreational anglers who all rely on good water quality. The North Fork SLR provides opportunities for resource-based recreation in a highly developed area. The aesthetic value of the river and associated floodplain coupled with the abundance of fish and wildlife set the stage for such activities as bird-watching, photography, painting, and paddling. Boating and fishing are common activities, especially near public access points, and canoe and kayak stopovers provide access to public hiking trails along the river.

The River Lilly Cruise provides guided tours of the North Fork St. Lucie River.

The preserve is critical to avian and aquatic biology and ecology, geology, hydrology, and restoration science. Because of the highly altered state of the SLR, the system serves as a prime study site to analyze the effect of sedimentation, algal blooms, hypoxia, wide and rapid salinity fluctuations, heavy metals, pesticides, and non-native species on native SAV and fauna. As part of CERP, the SLR and its watershed will continue to provide critical information for the advancement of restoration science on a global level. Knowledge gained from pilot restoration projects within the preserve and North Fork watershed will lay the foundation for future similar projects.

3.1.5 / Citizen Support Organization

Currently inactive, Stewards for the Southeast Florida Aquatic Preserves Inc., a 501(c)(3) Citizen Support Organization (CSO), was formed on June 25, 1996 to support the NFSLRAP.

While the CSO is inactive, volunteer initiatives, citizen involvement, and community partnerships are still valuable enhancements to the preserve's efforts. Volunteers provide an invaluable resource to the aquatic preserve staff and to the public trust. They perform tasks and assist with ongoing and intermittent projects that would not be possible otherwise.

State Managed Lands and Waters

Since 1988, monies from the state's Conservation and Recreation Lands (CARL) Trust Fund (now known as Florida Forever) and Save Our Rivers program have been used to purchase the majority of the undeveloped public lands adjacent to the NFSLRAP and Ten Mile Creek (headwaters of the North Fork)(See Map 14). The state-managed lands adjacent to the preserve include:

DEP- Managed Lands

IRL - Jensen Beach to Jupiter Inlet Aquatic Preserve

The NFSLRAP staff also manage the IRL - Jensen Beach to Jupiter Inlet Aquatic Preserve. Although called a river, the IRL - Jensen Beach to Jupiter Inlet Aquatic Preserve is actually an estuary where freshwater from the SLR converges with saltwater from the Atlantic Ocean. The IRL - Jensen Beach to Jupiter Inlet Aquatic Preserve is 37 miles long and encompasses 22,000 acres. Despite its legal name, it stretches from Ft. Pierce to Jupiter Inlet. There are numerous boat ramps, canoe launches, public parks and marinas for public use, as well as education centers, museums, and spoil islands located within or adjacent to this aquatic preserve.

Savannas Preserve State Park - North Fork St. Lucie River Property

Savannas Preserve State Park's North Fork SLR property is managed under DEP's Division of Recreation and Parks (DRP). The mission of DRP is "to provide resource-based recreation while preserving, interpreting, and restoring natural and cultural resources." Providing recreational opportunities is a component of the park but the emphasis is placed on preservation and land management. The Savannas Preserve State Park consists of multiple discontinuous parcels totaling 8,147 acres. The North Fork SLR portion of the property contains several parcels along the NFSLRAP totaling 967 acres. The primary reason for acquiring the North Fork property was to maintain a viable buffer that was capable of filtering water prior to its entering the preserve.

There are currently two public access points along the North Fork property:

1. Miller-Wild at the northern portion of the park in Ft. Pierce which has a parking lot, trail system, and a canoe stopover; and,
2. Halpatiokee which has a parking lot, trail system, boardwalk, and a canoe stopover.

A third parcel, Rivergreen, has a proposed trail system and boardwalk.

SFWMD Managed Lands

The mission of the SFWMD is "to manage and protect water resources of the region by balancing and improving water quality, flood control, natural systems, and water supply."

Ten Mile Creek WPA

The 922-acre Ten Mile Creek WPA (See Figure 3) is composed of a reservoir and a stormwater treatment area (polishing cell), totaling approximately 5,000 acre-feet of storage capacity. An acre-foot is the volume of water necessary to cover one acre of surface area to a depth of one foot. The purpose of the Ten Mile Creek WPA is to temporarily store stormwater from the Ten Mile Creek Basin, the largest subbasin of the North Fork SLR. Storage of excess stormwater, as opposed to its flowing into Ten Mile Creek at the time of rainfall, will allow sediments to settle, nutrient uptake by vegetation, and the timed, measured release of the water. The reduced sediment and nutrient loads, and timely delivery are expected to improve the water quality and restore the habitat of the North Fork SLR.

Strazulla Tract

A pilot oxbow reconnection project was completed in 2003 on the Strazulla Tract, which lies just south of Platt's Creek approximately one mile north of Midway Road. A trail system, canoe dock, and camping area are proposed for this site.

County-Managed Public Lands

St. Lucie County public lands are managed under their Department of Parks and Recreation and their Environmental Resource Department. St. Lucie County's mission is "to provide service, infrastructure and leadership necessary to advance a safe community, maintain a high quality of life, and protect the natural environment for all our citizens."

Figure 3 | Layout of the Ten Mile Creek Water Preserve Area (Provided by SFWMD).

St. Lucie County-owned lands adjacent to the preserve and its headwaters include:

1. Ten Mile Creek Recreation Area: includes a lake, canoe launch, pavilion, interpretive trail, restrooms, picnic tables, and a parking lot;
2. Gordy Road Recreation Area: includes a lake, canoe launch, disc golf course, interpretive trail, pavilion, picnic tables, and restrooms;
3. George E. LeStrange Natural Area: includes a lake, canoe launch, and parking lot (a canoe slip is proposed for future construction);
4. Jones Hammock: a trail is proposed to connect Platt's Creek to Ten Mile Creek;
5. Sweetwater Hammock: includes a trail, canoe slip, and picnic tables;
6. Platt's Creek Restoration Area: location of the Environmental Resources Division offices, and includes a stormwater retention pond (a canoe launch and hiking trails are proposed);
7. White City Park: includes a boat ramp, fishing dock, picnic tables, public restrooms, and a canoe launch;
8. Lepore: includes a pond; a drainage project is proposed;
9. Captain Hammond's Hammock Natural Area: includes a canoe dock, trail, boardwalk, and a picnic table;
10. Oxbow Eco-Center: includes boardwalks, trail system, bridges, observation tower, canoe launch, and an education center;
11. Idabelle Island: a canoe stopover and picnic table; a primitive camping site is proposed;
12. Citrus Hammock Natural Area: includes a canoe dock and picnic table (a stormwater retention pond is proposed);
13. River Park Marina: includes a boat ramp, canoe launch, nature trail, playground, public restrooms, and fishing piers; and
14. Spruce Bluff: includes a parking lot, small cemetery, trails, boardwalks, and Indian mounds (a canoe dock and picnic tables are proposed)

Several other parcels exist that are not yet named, some of these have proposed infrastructure.

City of Port St. Lucie Managed Public Lands

Port St. Lucie's public lands are managed by the city's Department of Parks and Recreation. Their motto is "Port St. Lucie Parks and Recreation, creating a sense of community."

City of Port St. Lucie lands adjacent to the preserve include:

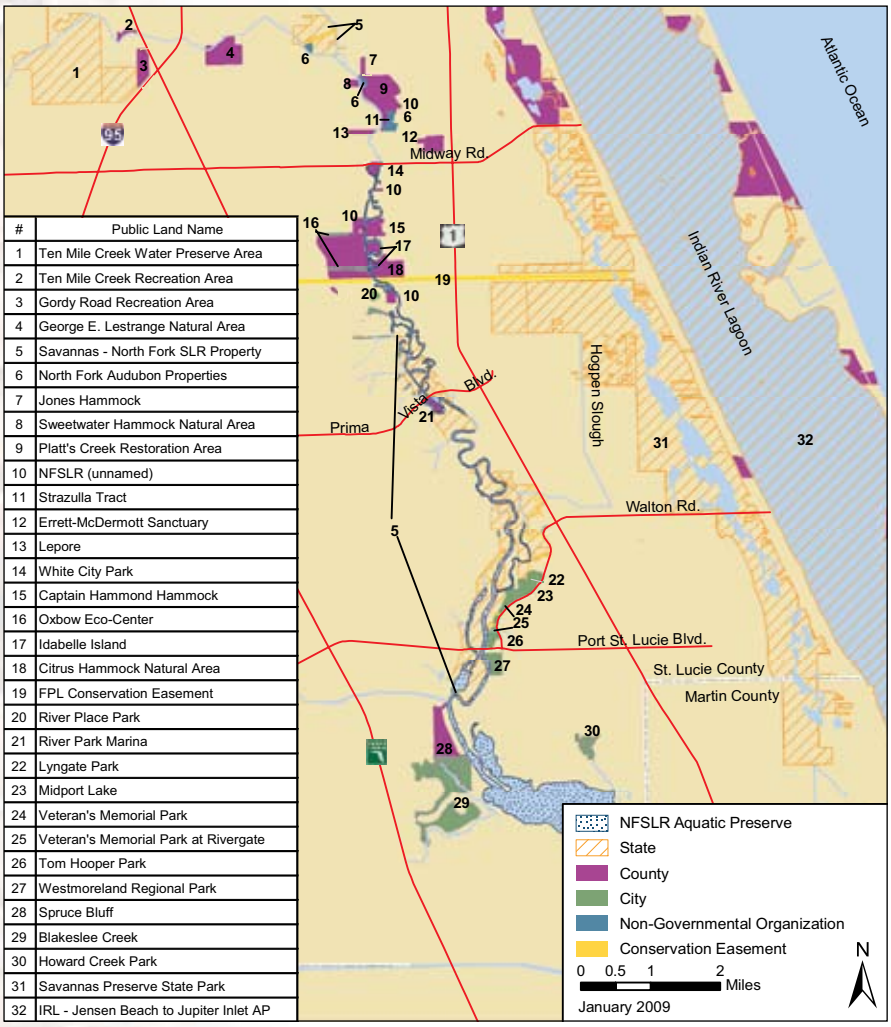
1. Lyngate Park: active use facilities with night use and lights;
2. Midport Lake: neighborhood open space with model boating and dogs permitted on leash;
3. Veteran's Memorial Park: community special facilities with ceremonial grounds and monuments;
4. Veteran's Memorial Park at Rivergate: community special facilities with covered pavilions and a boat ramp;
5. Tom Hooper Park: community special facilities with lighted boardwalk on the SLR;
6. River Place Park: neighborhood park with active and passive use facilities that close at dusk; and
7. Westmoreland Regional Park: site is currently undeveloped; gardens are proposed.

Non-Governmental Organization Managed Public Lands

Two non-governmental organizations own land adjacent to the NFSLRAP and its major tributary, Ten Mile Creek.

Audubon of Florida

Audubon of Florida is a private conservation organization whose mission is "to conserve and restore natural ecosystems, focusing on birds and other wildlife for the benefit of humanity and the earth's biological diversity." Audubon of Florida owns four parcels adjacent to the NFSLRAP: Audubon, Audubon Island, Hall/ Audubon, and Errett-McDermott Sanctuary.



#	Public Land Name
1	Ten Mile Creek Water Preserve Area
2	Ten Mile Creek Recreation Area
3	Gordy Road Recreation Area
4	George E. Lestrange Natural Area
5	Savannas - North Fork SLR Property
6	North Fork Audubon Properties
7	Jones Hammock
8	Sweetwater Hammock Natural Area
9	Platt's Creek Restoration Area
10	NFSLR (unnamed)
11	Strazulla Tract
12	Errett-McDermott Sanctuary
13	Lepore
14	White City Park
15	Captain Hammond Hammock
16	Oxbow Eco-Center
17	Idabelle Island
18	Citrus Hammock Natural Area
19	FPL Conservation Easement
20	River Place Park
21	River Park Marina
22	Lyngate Park
23	Midport Lake
24	Veteran's Memorial Park
25	Veteran's Memorial Park at Rivergate
26	Tom Hooper Park
27	Westmoreland Regional Park
28	Spruce Bluff
29	Blakeslee Creek
30	Howard Creek Park
31	Savannas Preserve State Park
32	IRL - Jensen Beach to Jupiter Inlet AP

Map 14 / Public lands within the North Fork St. Lucie River Aquatic Preserve watershed.

Florida Power and Light

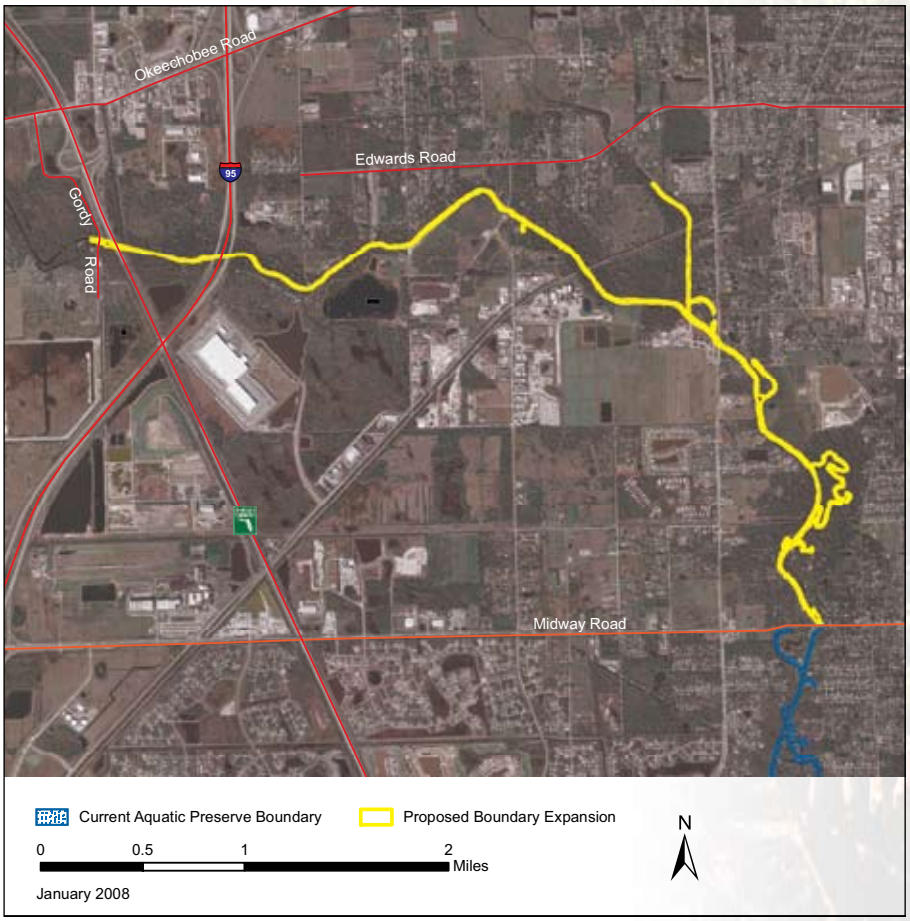
Florida Power and Light (FPL) is an electrical utility company owning both coal and nuclear power plants in Florida. Their goal is to provide the best possible service to their customers while keeping up with the steady growth rate in Florida. The FPL property is a conservation easement stretching from the nuclear power plant on Hutchinson Island in St. Lucie County westward across the IRL - Jensen Beach to Jupiter Inlet Aquatic Preserve, the Savannas Preserve State Park, U.S. Highway 1, the NFSLRAP, and the Florida Turnpike, ending just west of Interstate 95. The easement serves as one of two wildlife corridors connecting Savannas Preserve State Park and the NFSLRAP.

Acquisition of Additional Property

The purpose of purchasing undeveloped public lands upstream and adjacent to the preserve is to maintain or improve water quality and to conserve and protect habitat for the conservation and protection of wildlife species, including threatened and endangered species that rely on the North Fork SLR for food, protection, and reproduction. Many of these lands contain important resources, such as bird rookeries, archaeological or historical sites, endangered species habitat, and freshwater source wetlands. Lands that have already been acquired preserve a relatively unspoiled wildlife corridor in the middle of a highly urbanized area. This corridor is connected to Savannas Preserve State Park in two locations, the FPL property south of the Oxbow Eco-Center, and Hogpen Slough just south of Halpatiokee.

Over the past 25 years, state and local programs have done an exceptional job of acquiring land adjacent to the preserve. These lands not only provide access to, and recreational opportunities within the preserve, but also improve water quality by acting as a filter for stormwater runoff prior to its entering the preserve. Approximately 73% (1,920 acres) of the original 2,620-acre riverine corridor proposed for purchase under the Florida Forever program has been acquired (Florida Department of Environmental Protection [DEP], 2003). The remaining parcels represent critical floodplain communities and buffering uplands along the river corridor. Several of the originally proposed parcels have been removed from the acquisition list because of development, which emphasizes the current time-sensitive nature of the acquisition process. In 2004 the North Fork SLR Project was transferred from the Florida Forever program to the Florida Communities Trust (FCT). Counties, municipalities, and non-profit organizations can apply for FCT funding to purchase a property if it is available. However, unlike the Florida Forever program, FCT does not keep a list of prioritized properties for acquisition. Parcels within the Florida Forever boundary are still being considered for acquisition by SFWMD and St. Lucie County Environmentally Sensitive Lands program. This includes proposed acquisition of lands along Ten Mile Creek and the North Fork St. Lucie River Aquatic Preserve (See Appendix B.5.9). Recommendations in the 2003 Draft Buffer Preserve Plan include extension of the Florida Forever boundary upstream to the intersection of Interstate 95 and the Florida Turnpike (DEP, 2003). This would require acquisition of additional parcels, some of which already overlap with Florida Forever and St. Lucie County Environmentally Sensitive Lands program proposed acquisition parcels. Land acquired upstream of the preserve would benefit downstream water quality and therefore would be supported by DEP's Office of Coastal and Aquatic Managed Areas (CAMA).

In addition to acquiring buffering uplands, partners and the public have utilized the formal public meeting process to request that the boundary of the preserve be extended to include its headwaters (Five and Ten Mile Creeks) and small sections omitted from the current



Map 15 / Proposed boundary expansion for the North Fork St. Lucie River Aquatic Preserve.

preserve boundary (See Appendix C). It was proposed that extension into Five Mile Creek should end at the northern boundary of the Savannas Preserve State Park Miller-Wild parcel just south of Edwards Road and the extension in Ten Mile Creek should include the tidally-connected area downstream of the Gordy Road water control structure (See Map 15). Extension to the Gordy Road water control structure would add an additional 4.8 river miles to the north of the existing preserve (currently 16 river miles long).

Loss of native shoreline vegetation reduces water quality and the amount of habitat available to fish and wildlife.

Stormwater outfalls commonly discharge directly into the preserve.

3.1.7 / Surrounding Land Use

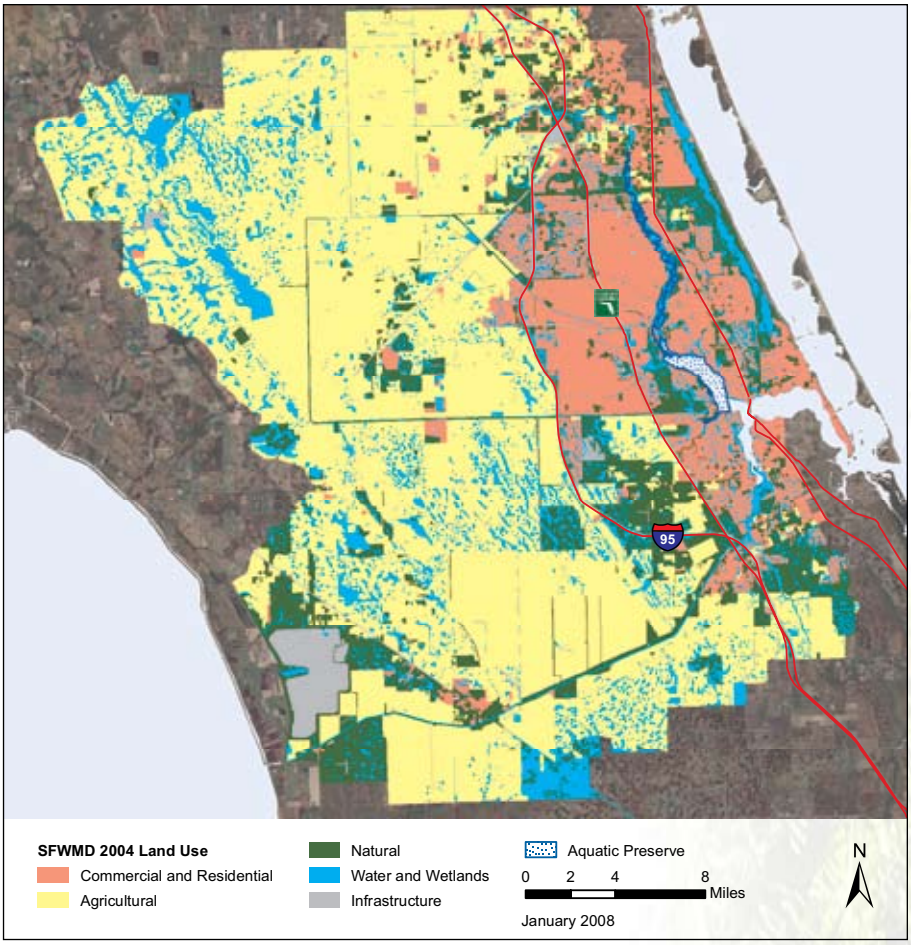
Land use within the NFSLRAP watershed was classified according to the following categories: commercial/residential, agricultural, natural, water/wetlands, and infrastructure (See Map 16). The commercial and residential land use classes include industrial, municipal, business, utility, single-family homes, multi-family homes, mobile homes, rural homes, and estate homes. Agricultural land use includes citrus, row crops, ornamental nurseries, and ranches (cattle, horse, and goat). Natural land use includes undeveloped land, conservation land, and silviculture (tree farming). Water and wetlands land use includes submerged land, and infrastructure land use includes roads.

As of 2004, land use within the North Fork SLR watershed is primarily agricultural (56%) and commercial/residential (17%) (See Map 16); however, urban growth within the last five years has spread westward and accelerated the conversion of agricultural lands to urban lands. Very little natural area is left within this urban corridor. Agricultural lands are now concentrated west of the new development bordering Interstate 95.

Land use directly adjacent to the preserve is primarily commercial and residential (urban), which is intermixed with natural lands (See Map 16). With the exception of the adjacent public conservation lands, the preserve is almost entirely surrounded by urban areas. In many places there is no buffer between the preserve and urban land. In these cases, the natural shoreline has been removed and homeowner's backyards and commercial properties extend to a seawall, upland retaining wall, rip rap, or directly to the mean high water line. Within the City of Port St. Lucie, which surrounds approximately half of the preserve, residential and commercial land use accounts for 84% of the total area (Castellano, 2004).

Both agricultural and commercial/residential land use within the watershed can affect the water quality of the preserve. Low quality water (high turbidity, high nutrients, low dissolved oxygen) enters the preserve from agricultural lands through the C&SF canal system, and from commercial and

residential lands via local drainage canals. In both cases, untreated stormwater runoff from developed lands has heavily impacted not only the preserve, but also its headwaters. Ten Mile Creek and the North Fork SLR have suffered severe water quality degradation and pollution (Graves, Thompson, & Fike, 2002), and have been classified by the U.S. Environmental Protection Agency as impaired waters. According to the University of Florida (2007), urbanization is expected to steadily increase within the preserve watershed. As development increases and agricultural lands are converted to urban lands, it is reasonable to predict that water quality within the preserve will continue to degrade.



Map 16 / Land use within the North Fork St. Lucie River Aquatic Preserve watershed.

DEP personnel sampling water from the North Fork St. Lucie River as part of an ongoing surface water quality monitoring program.

Part Two

Management Programs

Chapter Four

CAMA's Management Programs

The work performed by Coastal and Aquatic Managed Areas (CAMA) is divided into components called management programs. In this management plan all site operational activities are explained within the following four management programs: ecosystem science, resource management, education and outreach and public use.

4.1 / The Ecosystem Science Management Program

The Ecosystem Science Management Program supports science-based management by providing resource mapping, modeling, monitoring, research, and scientific oversight. The primary focus of this program is to support an integrated approach (research, education, and stewardship) for adaptive management of each site's unique natural and cultural resources. CAMA ensures that, when applicable, consistent techniques are utilized across sites to strengthen the State of Florida's ability to assess the relative condition of coastal resources. This enables decision-makers to more effectively prioritize restoration and resource protection goals. In addition, by scientifically characterizing baseline conditions of aquatic habitats, the Ecosystem Science Management Program allows for objective analyses of the changes occurring in the state's natural and cultural resources.

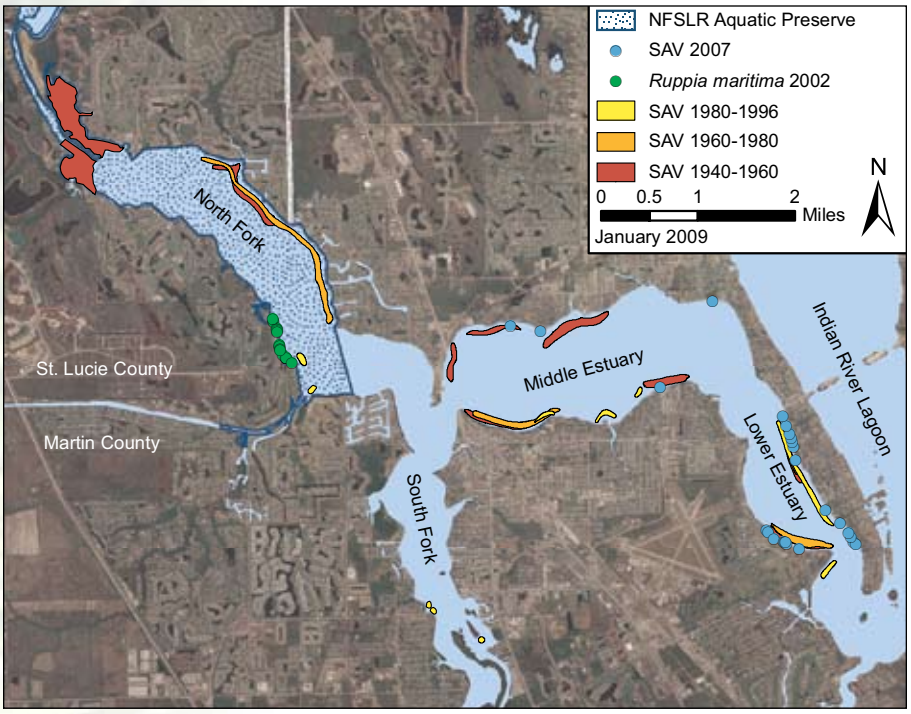
4.1.1 / Background of Ecosystem Science at North Fork St. Lucie River Aquatic Preserve

The foundation for the current Ecosystem Science Management Program (which focuses on mapping, modeling, monitoring, and research) was primarily generated using resources and data from other local, state, and federal agencies, most notably South Florida Water Management District (SFWMD). Much of the research within the St. Lucie River (SLR) has focused on the effects that large-scale water management

practices have on the system. A mapping and data inventory for the North Fork was created by preserve staff in 2007 to document and organize available geographic information system (GIS) resources helpful in natural resource management. Woodward Clyde International-Americas (1998) produced a literature and mapping review for the SLR that minimized the effort necessary to produce this inventory.

Submerged and Emergent Herbaceous Plant Mapping and Monitoring - Submerged and emergent plants (those below and partially above the waterline, respectively) benefit the water quality and biological conditions in the North Fork SLR. Aquatic vegetation has the ability to reduce shoreline erosion and overall turbidity levels in the SLR by slowing the water velocity enough to facilitate settlement of suspended sediments. Accumulation of sediments within vegetated areas supplies the plants with nutrients needed for growth that could otherwise have been used to fuel algal blooms during the warm, wet months. Filtration of suspended sediments also improves the water clarity which ultimately allows more sunlight to penetrate the water column. Plants require sunlight, in addition to nutrients, to grow. Therefore, the less turbid the water the more likely submerged plants are to thrive in the North Fork SLR. Aquatic plants also provide spawning and nursery habitat that ultimately offers fish and invertebrates protection from predators. The economic value of these currently small patches of aquatic vegetation are magnified when one looks at the number of commercially important species using the North Fork SLR (e.g. blue crab, commercial shrimp, snook, and snapper). Resource managers have documented seagrass dynamics in the SLR since the 1940s but little is known about the location, abundance, and species of other submerged and emergent vegetation in the North Fork SLR.

Seagrass mapping efforts in the SLR began in the 1940s and specific location data are available for the following years: 1940-1960, 1960-1980, 1990-1996, 2002 (SFWMD), and 2007 (SFWMD) (Woodward Clyde International-Americas, 1998; Ibis Environmental, Inc., 2007). Historic sighting data indicate the presence of widgeon grass and shoal grass within the southern (wide) portion of the preserve (See Map 17) (Woodward Clyde International-Americas, 1998). Supporting documentation includes observations of: 1) abundant, very sparse, and rare levels of widgeon grass in September 1957, March 1958, and October 1958, respectively, near Britt Creek in the southern portion of the preserve (Phillips and Ingle, 1960); 2) one small patch of widgeon grass along the western shore just north of the C-23 in April 1996, June 1998 (flowering), February 2001, and March 2002 (flowering) (Robbins, 1996; 1998; 2005); and 3) several small patches of shoal grass along the western shoreline just north of the C-23 in April 1996 and June 1998 (See Map 17) (Robbins, 1996; 1998). SFWMD staff surveyed the area just north of the C-23 in April 2005 and July 2007 but no seagrass was located (Robbins, 2005; B. Welch, personal communication, July 27, 2007). As of summer 2007, seagrass distribution was limited to the Lower Estuary near the confluence with the IRL and in small sections of the Middle Estuary (See Map 17) (Ibis Environmental, Inc., 2007). Although seagrass was last observed within the preserve in March 2002, it is expected that the completion of future restoration efforts outlined in the Indian River Lagoon – South (IRL-S) Project Implementation Report (PIR) will promote recolonization and establishment of submerged aquatic vegetation (SAV) in the North Fork SLR (Robbins, 2005). Natural resource managers will use baseline conditions established though historic mapping efforts to measure the future success of proposed IRL-S PIR restoration projects (Ibis Environmental, Inc., 2007). Current SLR SAV targets include expansion of seagrass beds to cover all areas less than 1.0 meter in depth (South Florida Water Management District [SFWMD], 2007a).



Map 17 / Seagrass in the St. Lucie River.

Once the salinity regime is restored, it is possible that tapegrass (*Valisneria americana*), and other

Opossum pipefish spawn in emergent vegetation, such as this smartweed, in the North Fork St. Lucie River.

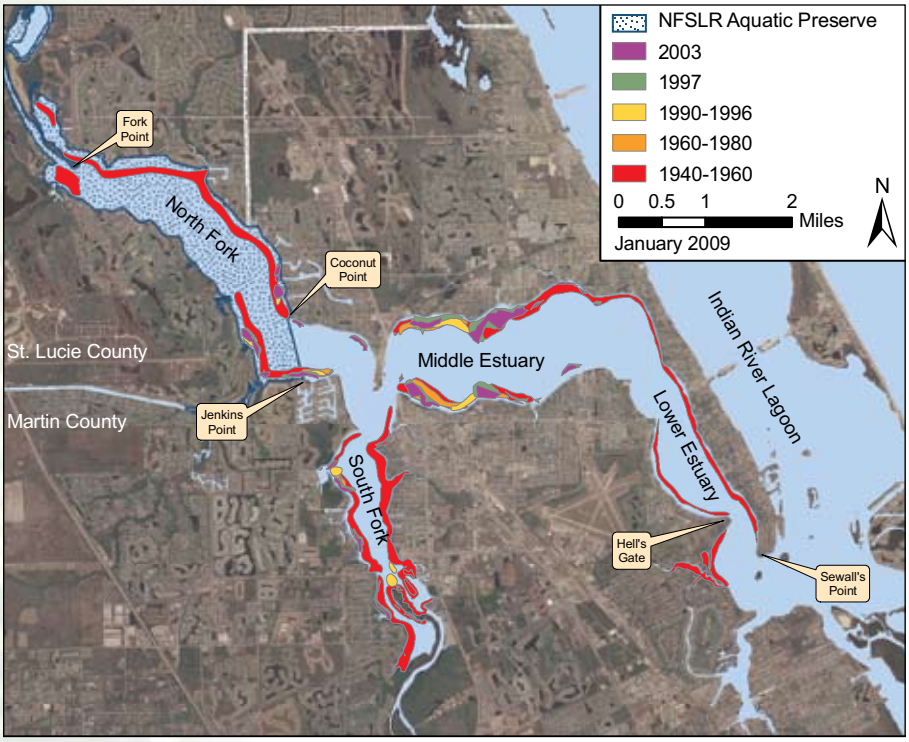
freshwater grasses such as muskgrass (*Chara* sp.), pondweed (*Potamogeton* spp.), and southern water nymph (*Najas guadalupensis*) could be supported in the North Fork SLR.

Emergent vegetation, including rush (*Juncus* sp.) (Robbins, 1996), panic grass (*Panicum* spp.), smartweed (*Polygnum* spp.), giant leather fern (DNR, 1984), swamp lily (DNR, 1984), yellow water lily (*Nuphar lutea*), the common reed (*Phragmites australis*) (now considered native), sawgrass, and pickerel weed have been observed or documented within the SLR. This emergent vegetation has not been mapped within the preserve. Although mapping all submerged and emergent vegetation within the preserve is a priority, the mapping of panic grass and smartweed in the upper reaches of the North Fork SLR are especially important as they are both known to provide spawning habitat for the opossum pipefish, a federally-listed Species of Special Concern (Gilmore, 1999). Locating and mapping these grasses will improve the ability of preserve and regulatory staff to protect opossum pipefish and their habitat when reviewing environmental resource permits within the North Fork SLR.

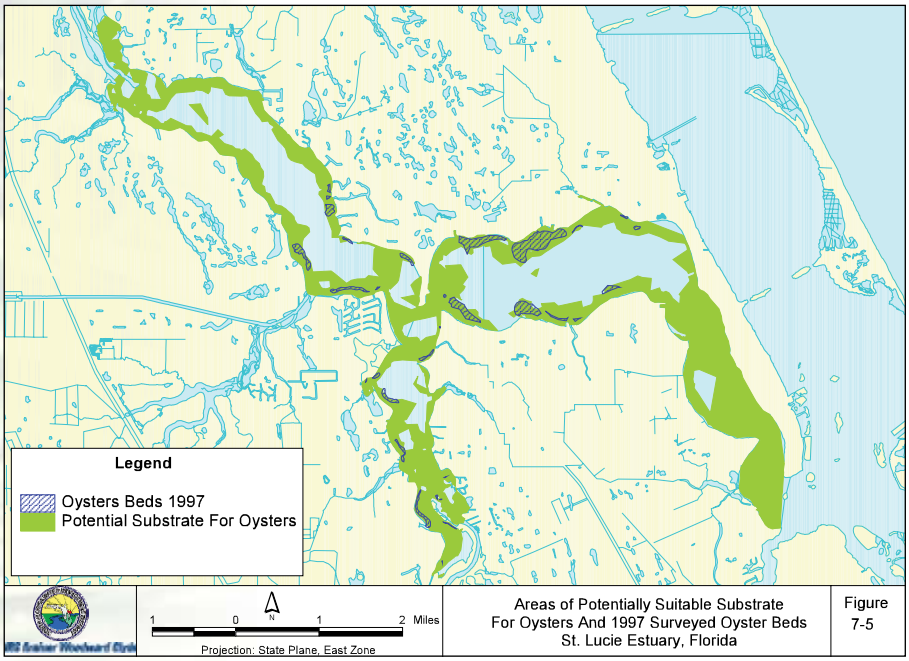
Oyster Reef Mapping, Monitoring and Research - Like seagrass, oyster reefs were first documented in the SLR in the 1940s. GIS data layers have been created for the following years: 1940-1960, 1960-1980, 1990-1996, 1997 (SFWMD), and 2003 (SFWMD). In 1997, SFWMD contracted URS Greiner Woodward Clyde (1999) to map and compare the amount of established oyster reefs to the amount of potentially suitable substrate for oysters within the SLR. Ibis Environmental, Inc. was contracted by SFWMD in 2003 to update the 1997 maps. The 2003 data were used in the Florida Natural Areas Inventory (FNAI) natural lands map and shows 31 acres of oyster material (dead and alive) within the preserve (See Map 12 and Map 18). Gambordella, McEachron, Beals, and Arnold (2007) mapped oyster reefs within five east coast estuaries, including three select oyster reefs within the SLR, in winter 2005-2006. The SLR oyster-mapping effort conducted by Gambordella et al. (2007) was not intended to be a comprehensive update to the 2003 data. Instead, three SLR oyster reefs were used as test sites for new vertical mapping techniques. Results of the 1997, 2003, and select 2005-2006 mapping efforts show that regardless of the availability of potentially suitable substrate, oyster reefs are declining within the SLR (See Map 19). Wilson, Scotto, Scarpa, Volety, Laramore, and Haunert (2005) compared settlement in the SLR and the IRL and found significantly fewer spat in the SLR. Given the established tolerance levels for the Eastern oyster, it is suspected that these differences result from extended exposure to reduced salinity (<10 ppt) associated with freshwater discharges from Lake Okeechobee and the surrounding watershed (URS Greiner Woodward Clyde, 1999; Wilson et al., 2005; Gambordella et al., 2007). Gambordella et al. (2007) noted that oysters in the SLR are the least healthy of those sampled in Lake Worth Lagoon, the Loxahatchee River, SLR, and Sebastian River. The smaller size (mean shell height of 5.9 cm) and density (0.2 relic shells per 0.25 square meter) of the SLR oysters suggests a younger population (possibly due

to recent disturbance) than those in Lake Worth Lagoon and the Loxahatchee River (Gambordella et al., 2007). Current oyster targets, set through the Comprehensive Everglades Restoration Plan (CERP) Research, Coordination, and Verification (RECOVER) teams, include the provision of 900 acres of suitable oyster habitat with the construction and operation of proposed IRL-S PIR projects (South Florida Water Management District [SFWMD], 2007b).

Floodplain Vegetation Monitoring - Six 100-meter transects were established at a wetland reconnection site (Site 5) in April 2001 to monitor change in floodplain vegetation (woody and herbaceous species and canopy density) before and after construction of three berm breaches. Monitoring methodologies were derived from Cox (1990) and pre-construction data were collected in April 2001. Photopoints were established and digital photographs were taken along each transect (ends and middle) and at the opening to the river in June 2001. Non-native species (Brazilian pepper and shoebutton ardesia [*Ardisia elliptica*]) within the restoration site were removed through a DEP Bureau of Invasive Plant Management grant in September 2002. The last vegetation monitoring effort took place in April 2003.



Map 18 / Oyster reefs in the St. Lucie River.



Map 19 / Location of suitable substrate for oyster recruitment in the St. Lucie River (URS Greiner Woodward Clyde, 1999).

Piezoelectric tidal stage dataloggers were installed on the marsh surface at two of the breaches (non-culvert sites) in winter 2001 to monitor changes in residence time and volume of water (See Appendix B.5.3). Datalogger malfunctions in summer 2004 prevented the collection of quality data and both units were damaged during hurricanes Frances and Jeanne in September 2004. The units were returned to the manufacturer in an attempt to recover the collected data. These units were decommissioned because of funding constraints but water level at the site is well correlated with the U.S. Geological Survey (USGS) tide gauge at River Park Marina boat ramp on Prima Vista Boulevard. Thus, data can be extrapolated from this nearby gauge.

Natural Lands Mapping - Currently, natural lands data is limited to the following:

1. 1999 SFWMD mapping project for upland areas (not ground-truthed);
2. 2003 Florida Fish and Wildlife Conservation Commission (FWC) project for upland areas (not ground-truthed);
3. 2003 FNAI mapping project for the North Fork SLR Buffer Preserve that was partially ground-truthed (now the North Fork property managed by Savannas Preserve State Park);
4. 2003 SFWMD oyster mapping;
5. 2007 SFWMD seagrass mapping project; and
6. 2008 North Fork St. Lucie River Aquatic Preserve (NFSLRAP) Management Plan FNAI map (See Map 12) which combines the 2003 FNAI buffer preserve data along with SFWMD data cross-walked to FNAI codes.

With the exception of the 2003 oyster maps, 2003 FNAI data collected for the buffer preserve, and 2007 seagrass mapping data, none of the existing natural land maps for the preserve have been ground-truthed for accuracy. It is important that future natural lands mapping efforts include emergent and submergent vegetation (other than seagrass) and that the map provided in this plan (See Map 12) be ground-truthed in the future to provide a more accurate description of the preserve's current natural lands composition and distribution.

Modeling - SFWMD has led efforts to model southern IRL and SLR using: 1) watershed hydrology and water quality model and 2) receiving water hydrodynamics and salinity model. The receiving waters in this document refer to the SLR and IRL.

Watershed Hydrology and Water Quality Modeling

Watershed modeling in southern IRL and SLR began in 1994 when the general Hydrological Simulation Program Fortran (HSPF) model was modified for south Florida hydrology. The project was completed in 1998 with the generation of the newest version of HSPF (version 12). This version of the model was used in the Southern IRL-S Feasibility study and subsequent IRL-S PIR (Wan, Konyha & Sculley, 2002; USACE & SFWMD, 2004; Wan, Labadie, Konyha & Conboy, 2006).

In order to model watershed water quality the SFWMD initiated another project in 1999 to develop a hydrology and water quality model for the watershed (Wan, Reed & Roaza, 2003). The Watershed Water Quality (WaSh) Model has been implemented in the SLR watershed to simulate the complex natural systems, flat topography, high-water table conditions, operation of structures to control water levels, and irrigation practices. The water quality component of the model is capable of simulating nutrient loading and detailed in-stream processes.

Receiving Water Hydrodynamics and Salinity Modeling

The pioneering estuary modeling work in the SLR was the development of two hydrodynamic/salinity models: Dynamic transport (DYNTRAN) and RMA (Morris, 1987; Hu, 1999). Dynamic equilibrium simulations generated from RMA modeling efforts identify the salinity envelope that oysters can tolerate throughout the estuary (See Figure 4). The outputs generated by these models have provided scientific support to the IRL-S Feasibility study and system operations. The RMA model was also adapted and extended to provide salinity prediction capabilities for establishing the SLR minimum flows and levels. .

Bathymetry and Sediments - Rapid sedimentation rates have promoted the formation of large, oxygen depleted muck deposits within the SLR (Figure 2). Historic bathymetric data have helped water and resource managers target specific sites known to accumulate fine organic sediments for system restoration. Bathymetric data for the SLR were collected between 1872 and 2007 and include map production in 1872, 1887, 1893, 1944 (all U.S. Coast and Geodetic Survey), 1981 (SFWMD), and 2007 (SFWMD) (Woodward Clyde International-Americas, 1998; C. Conrad, personal communication, July 27, 2007). Sediment types and distribution maps were produced in 1999 by URS Greiner Woodward-Clyde (See Map 7). Sediment data has also been collected by Phillips and Ingle (1960), Martin County Environmental Studies Center (ESC) (unpublished data collected between 1987 and 1998), Haunert (1988), and Shropp et al. (1994), but none of these data have been digitized and added as GIS data layers to the growing SLR GIS database.

Alterations - Several large-scale alterations have been made to the North Fork SLR and its surrounding watershed over the past century including dredging of submerged lands and floodplain habitat, and creation and maintenance of drainage canals by USACE, SFWMD, North St. Lucie Water Control

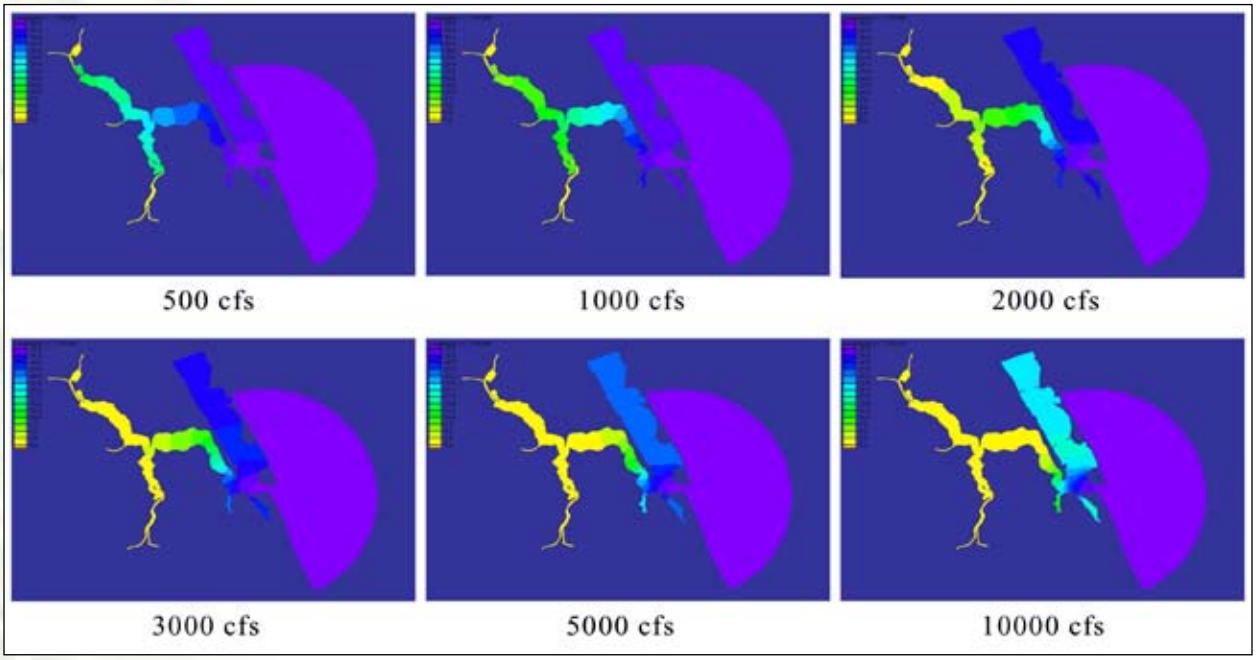


Figure 4 | The effect of six different discharge volumes (in cubic feet per second) on the salinity gradient in the St. Lucie River. Yellow represents freshwater and purple represents full-strength salt water. (Provided by SFWMD.)

District (NSLWCD), Port St. Lucie, and St. Lucie County. Ten Mile Creek and the North Fork SLR were straightened between the 1920s and 1940s by USACE and NSLWCD. A historic rivercourse map produced by Isham Randolf & Company for USACE was created in 1919, just prior to the channelization project (See Map 6) (Dames & Moore, 1996). The following entities provided preserve staff with the drainage alteration GIS shapefiles listed in parentheses: 1) SFWMD (Central and South Florida [C&SF] Flood Control Project and secondary watershed canals), 2) Port St. Lucie (National Pollutant Discharge Elimination System [NPDES] discharge basins and sites, city parks, land use classifications, 2007 aerials, and culverts), 3) NSLWCD (canal system and respective northern watershed boundary), 4) St. Lucie County (parks, communities, zoning, land use, hydrology, and Environmentally Sensitive Lands), and 5) Martin County (2007 aerials and parks). The City of Port St. Lucie created drainage outfalls when the city was plotted in the mid-1950s that are not required to meet today's standards for direct discharge to an Outstanding Florida Waters waterbody (62-302.700 and 62-4.242 F.A.C.). Today, the City of Port St. Lucie has an NPDES program that should improve the quality of water discharged from the 359 documented drainage outfalls within the preserve watershed.

Fish Research and Monitoring - Early studies addressing community structure and the effects of freshwater discharge from water management canals on fish communities were conducted by Springer (1960) and Gunter and Hall (1963). Since then, fish community research and monitoring in the SLR, and more specifically the preserve, has become a collaboration among several state agencies (DEP, FWC, and SFWMD), non-governmental organizations (Florida Oceanographic Society [FOS] and Estuarine, Coastal and Ocean Science, Inc. [ECOS]), and volunteers. FWC Tequesta Field Laboratory initiated a Fisheries Independent Monitoring Program in 1998 in response to reports of poor fish health (e.g. lesions, fungal infections) in the SLR after large regulatory discharges from Lake Okeechobee began in early 1998. This program involves monthly sampling at eight sites within the SLR: two in the North Fork, two in the South Fork, and four at the confluence of the two forks. Data collected through the program, including fish species, species abundance, length, and notation of disease, is stored in a database at the FWC Florida Wildlife Research Institute in St. Petersburg. In 2007, FWC Tequesta Field Laboratory also received funds through the Sportfish Restoration Program to initiate a snook and bass study in the North and South forks of SLR, Loxahatchee River, and the Sebastian River. The objective of this study is to document habitat association, diet, and movement of snook and bass.

Outside of the work conducted through FWC's Tequesta Field Laboratory, most of the recent ichthyological research and monitoring is funded through SFWMD for SLR Issues Team projects or the CERP RECOVER Monitoring and Assessment Program. RECOVER was established under CERP to monitor the success of the proposed restoration projects by using as performance measures valued ecosystem components such as SAV, oysters, and fish. The Monitoring and Assessment Program component of RECOVER is designed

to provide a diverse approach to documenting and describing the impacts of changed freshwater flow to the flora and fauna inhabiting inland landscapes and coastal waters. Priority restoration projects identified in the IRL-S PIR include reconnection of isolated oxbows and floodplain habitat in the North Fork SLR and its headwaters. Two pilot reconnection projects, one floodplain and one oxbow, were completed in 2002 and 2003 respectively. Fish and invertebrate monitoring at the floodplain restoration sites were conducted by CAMA and FWC staff during the highest tides of spring (April – May) and fall (October – November) to trap fish and invertebrates both entering and leaving the floodplain. Sampling took place between 2000 and 2005 at the floodplain reconnection site and included four pre-restoration (before June 2002) and seven post-restoration (after June 2002) sampling events. Due to thick muck deposits at the oxbow reconnection site, no pre-construction sampling was conducted. Three sampling events were conducted post-restoration (after June 2003). Results of the monitoring efforts were presented in poster format at the 3rd National Conference on Coastal and Estuarine Habitat Restoration in New Orleans (See Appendix B.5.4) (Beal et al., 2006).

A fike net was used to document fish and invertebrates migrating into the reconnected oxbow near Platt's Creek.

To date, little effort has been explicitly devoted to locating and monitoring the abundance of mangrove rivulus in the North Fork SLR. Only two individuals of this species have been documented within the preserve. The first individual was captured by Bill Loftus in 1992 within the City of Port St. Lucie in fresh (zero ppt) water (S. Taylor, personal communication, November 26, 2007). The second capture occurred in a Breder trap on the marsh surface at the north (culvert) breach site at Site 5 by Jeff Beal (J. Beal, personal communication, August 9, 2007). Estimating species abundance has been complicated by the fact that this species inhabits a variety of difficult to reach habitat types in fresh and brackish water in the IRL and SLR. They inhabit shallow, mud-bottomed ditches, bays, salt marshes, and other brackish-water environments; and often associate with crab burrows, especially great land crab, and other stressful environments with low oxygen (Taylor, 1990; Taylor et al., 1995; Litweller, O'Donnell & Wright, 2006). The most suitable habitat along the North Fork currently appears to be small depressional wetlands (e.g. sawgrass marshes) that support great land crab, few mangroves, and no other fish (S. Taylor, personal communication, November 26, 2007). These areas may be set back from the shoreline and difficult to access.

This freshwater river shrimp was found in the reconnected wetlands near Prima Vista Boulevard.

Spawning research in the IRL and SLR has recently been funded by SFWMD through CERP RECOVER. Many fish, especially in the drum family, are known to produce sound while spawning. Transects were established in 2005, based on prior research by Dr. Grant Gilmore, to look for new and historical spawning aggregations in the IRL and SLR. One of the spawning sites was located in the Middle Estuary of the SLR near Hell's Gate. Due to large-scale water management practices in the watershed, this spawning site is susceptible to prolonged freshwater exposure. If freshwater is released at a time when the fish, such as

sand seatrout (*Cynoscion arenarius*), spotted seatrout (*Cynoscion nebulosus*), and silver perch (*Bairdiella chrysoura*) (all in the drum family) are spawning, the exposure may negatively affect reproduction (Alshuth & Gilmore, 1994, 1995). In 2006, a remotely-operated hydrophone was installed on a residential dock adjacent to the spawning site. This system remains in place and the acoustic data are currently available only to the researchers. In 2007, SFWMD granted funds to FOS under the oversight of Dan Haunert (SFWMD) and Dr. Grant Gilmore with ECOS to: 1) correlate sound production with egg production of sand seatrout and silver perch, 2) correlate sound production with water quality parameters – especially salinity, 3) study the distribution of eggs and larvae from the spawning site within the SLR, and 4) study the distribution of food for larval fish in the SLR. A large group of government agencies (SFWMD, FWC, and DEP), non-governmental organizations (FOS and ECOS), and volunteers teamed up to conduct bimonthly collections of fish eggs, larvae, and food sources (e.g. copepods) between May and August 2007.

A study by Switzer et al. (2006) documented the initial effect and recovery rate of fish communities in the SLR after direct hits by hurricanes Frances and Jeanne three weeks apart in September 2004 and the associated freshwater releases through the C-23, C-24, and C-44 in 2004 and 2005. Normal salinity patterns and community structure were reestablished within four months following Hurricane Jeanne but were then affected by summer 2005 releases. Findings by Switzer et al. (2006) corroborate previous studies and personal observations by local commercial crabbers indicating that freshwater and oligohaline species migrate south through the North Fork during prolonged (three week or greater) freshwater release events (Haunert & Startzman, 1985; L. Burgess, personal communication, September 6, 2007).

Bird Rookery Research and Monitoring - The North Fork SLR currently has one rookery in Mud Cove that supports wood stork, egrets (Ardeidae), herons (Ardeidae), and anhinga. Reproductive success of the federally and state-endangered wood stork was monitored weekly during the 2004, 2005, and 2006 nesting seasons as part of a Doctor of Philosophy (Ph.D.) dissertation through Florida Institute of Technology (FIT) (Rodgers, Schwikert, Griffin, Brooks, Bear-Hull, Elliott et al., 2008; Griffin et al., *accepted*). Monitoring methods included documentation, determination of start date (based on first sign of incubation), and weekly photographs of each nest location. The number of attending adults and young were also recorded on a weekly basis. Once chicks developed primary flight feathers (approximately eight weeks from hatch date), they were recorded as fledged. Nests were monitored post-fledging in order to ascertain how long fledglings remained at the nest past their fledging date. The number of fledglings were recorded per nest then used for statistical analysis. Based on Griffin et al. (*accepted*) the median nesting success at the North Fork rookery was two chicks in 2004 and 2005 and three chicks in 2006 (See Appendix B.5.5). This rookery has been monitored less frequently since 2004 for species abundance by DEP's Division of Recreation and Parks (DRP), preserve staff, and FWC. Signage at the rookery has been posted by FWC and maintained by preserve staff. Despite the signage, users have been seen to approach the islands and disturb the nesting adults and chicks. Increased patrolling by local and state law enforcement (FWC, St. Lucie County, and Port St. Lucie) may help to reduce rookery disturbance. The Audubon Christmas Bird Count has been organized on the North Fork since 1998 by CAMA and DRP. The results of the survey have been incorporated into the species list for the North Fork SLR property managed by Savannas Preserve State Park and subsequently into this management plan.

Water Quality Monitoring - Water quality monitoring in the SLR is currently conducted by six separate agencies and non-governmental organizations including DEP Surface Water Ambient Monitoring Program (SWAMP), SFWMD, USGS, St. Lucie County Department of Health, and riparian homeowners collecting data for FOS and Marine Resources Council's Volunteer Water Quality Monitoring Networks (See Map 20 and Appendix B.5.6). Synthesis for the protection of natural resources within the preserve has been challenging as different parameters are being sampled at different frequencies during different times by different agencies and organizations. A document was drafted in 2007 by preserve staff that identifies the various groups collecting water quality data within the preserve, their monitoring sites, sampling frequency, parameters collected by each group, how to access individual databases for regular updates, and primary points of contact for questions and public comments. Preserve staff also created a reference library for SLR water quality data reports and peer-reviewed literature.

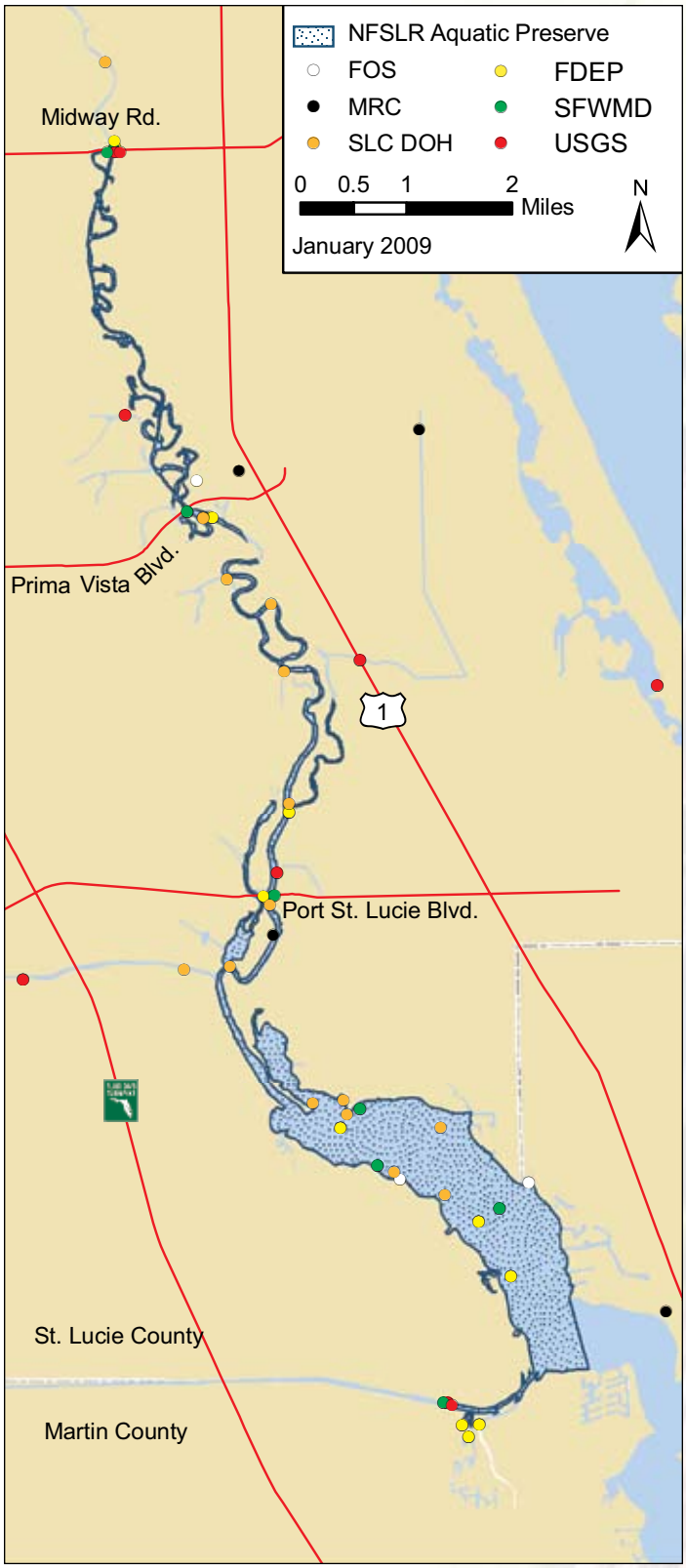
4.1.2 / Current Status of Ecosystem Science at North Fork St. Lucie River Aquatic Preserve

Effective resource management begins with knowing the location, condition, extent, and biology of the resources in need of protection. The preserve's Ecosystem Science Management Program contains the tools (e.g. monitoring, mapping, research, and modeling) that preserve staff use to assess the natural resources in the North Fork SLR. Ecosystem Science goals for the preserve include: 1) formation and maintenance of partnerships to capture resource data necessary to understand and manage the system, 2) data analysis and interpretation, and 3) facilitation of information exchange among groups collecting data within the preserve.

Mapping - Although a more recent tool used by staff, mapping has proven to be essential to resource management within the preserve. Because of the highly modified watershed, complex interactions occur within the SLR that may be difficult to comprehend without a visual representation. With the exception of collecting global positioning system (GPS) waypoints within the preserve, preserve staff currently obtain most GIS data for mapping (e.g. bathymetry, seagrass, oysters) from external sources (e.g. SFWMD). Continuing to develop partnerships with GIS staff at other agencies and organizations is critical to obtaining GIS data, maintaining a current GIS database, and assembling maps for the preserve. Staff currently has adequate training to assemble maps for the preserve; however, additional training will be needed to analyze GIS data, such as changes in habitat, over time.

Baseline habitat mapping (using FNAI codes) for areas within and adjacent to the preserve is one of the fundamental needs for natural resource management. The North Fork property of Savannas Preserve State Park was mapped using FNAI codes in 2003, seagrass was last mapped in 2007, and oysters were last mapped in 2003. Thus, mapping of submergent and emergent vegetation is needed throughout the preserve, and mangrove habitat mapping is needed within the preserve outside of the 2003 mapping effort for the former North Fork SLR Buffer Preserve (which includes mangrove/tidal swamp). Ground-truthing FNAI habitat types within the preserve (SAV, oyster reef, emergent vegetation, etc.) every five years will allow preserve staff to measure the amount of change over time. Future mapping efforts of seagrass and oysters are expected to continue through SFWMD. Proposals for additional habitat mapping efforts will be submitted for funding through IRL National Estuary Program (NEP), St. Lucie River Initiative, and the IRL License Plate Trust Fund. Mapping may be suggested as a public interest project for development permitted within the preserve. Once created, the habitat maps will serve as a base layer for listed species sighting data and ultimately link species location data with habitat types.

Modeling - Often times a static map of biological and chemical factors does not adequately represent their interactions, especially in systems that have large seasonal fluctuations. Models produced by SFWMD can aid preserve staff in understanding these interactions and the effects they have on the natural resources within the NFSLRAP.



Map 20 / North Fork St. Lucie River Aquatic Preserve water quality monitoring sites.

Watershed Hydrology and Water Quality Modeling

The WaSh model is currently being used by DEP to develop total maximum daily loads (TMDL) for the St. Lucie basins.

Receiving Water Hydrodynamics and Salinity Modeling

SFWMD recently developed two hydrodynamic models, the Curvilinear Hydrodynamics in Three Dimensions (CH3D) and Environmental Fluid Dynamics Computer Code (EFDC) hydrodynamic/salinity/water quality model, to assist with the development of stormwater management strategies and evaluate the effectiveness of pollutant reduction strategies.

Listed and Rare Species Monitoring - Wood stork nesting activities have been monitored at the Mud Cove rookery since 2004 by preserve staff, Savannas Preserve State Park, FWC, and one Ph.D. student from FIT. Preserve staff will continue to monitor wood stork nesting activities at this rookery and look for additional nesting activity within the preserve each year. Monitoring data will be circulated appropriately and kept in a database for species protection efforts. The need also exists to monitor other listed, rare, and declining species. Mangrove rivulus and opossum pipefish are listed by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA NMFS) as a Species of Special Concern which means that NOAA is concerned about their status but insufficient information is available to indicate a need to list the species under the Endangered Species Act. Partnerships with other agencies, academic institutions, and non-governmental organizations will be formed to survey and monitor these species within the preserve. Great land crab burrows are known to support mangrove rivulus in the region (Taylor et al., 1995). Because of this association and the declining trend of southeast Florida great land crab populations, preserve staff will also initiate a great land crab monitoring project that is compatible with methodologies established though other programs.

Bird Rookery Monitoring - In addition to wood stork, preserve staff will continue to monitor other bird species (currently great egret, snowy egret, cattle egret, tricolored heron [*Egretta tricolor*], and anhinga) utilizing the Mud Cove and/or newly established rookeries within the preserve. When collecting and distributing these data, it is important for recipients to be able to compare provided monitoring data at different geographic levels (e.g. local, regional, state, federal, and global). Currently, an inconsistency exists among agencies and universities collecting nesting data. Preserve staff will ensure that wood stork and other species monitoring data will be compatible with other sources, especially DRP and FWC.

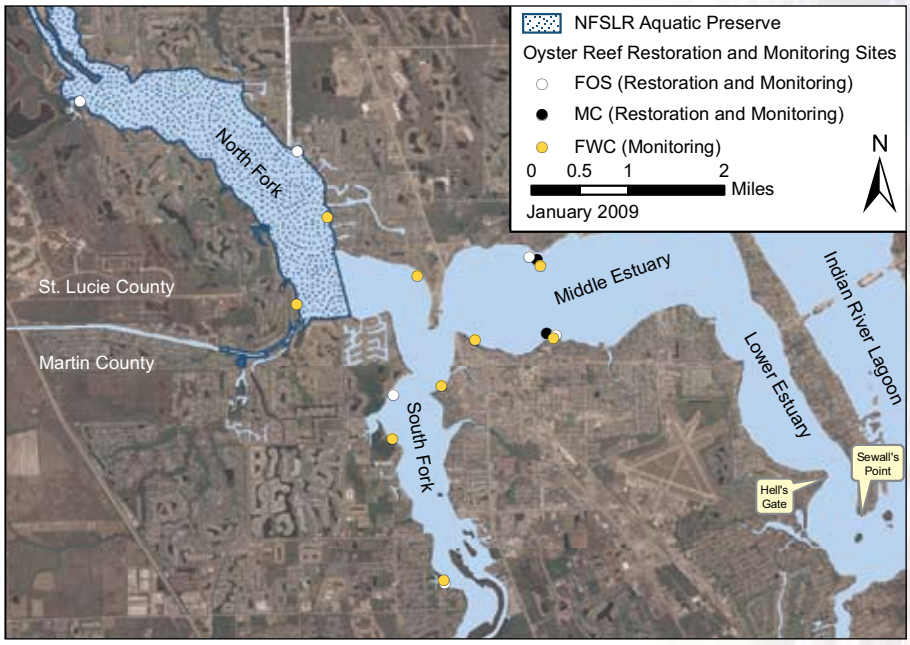
Submerged and Emergent Herbaceous Plant Monitoring - The North Fork SLR has been designated an Impaired Waterbody by DEP and the U.S. Environmental Protection Agency (See Map 9). Measures to reduce the amount of nutrients (nitrogen and phosphorus) and increase the amount of dissolved oxygen in the SLR are currently in the process of being created through a state TMDL program. As strategies are implemented to improve the water quality, the abundance and health of submerged vegetation is expected to increase. Although widgeon grass and shoal grass were historically located in the southern section of the preserve, the last documented sighting was an ephemeral patch of widgeon grass in 2002 (See Map 17). SFWMD biologists have been dedicated to monitoring the occurrence of submerged vegetation in the SLR to date. Preserve staff will assist SFWMD with future North Fork SLR monitoring efforts and seek funding to map emergent vegetation. The methodology used for 1997 and 2007 submerged vegetation (seagrass) mapping efforts in the SLR will be used for future projects and can be found in the final report by Ibis Environmental, Inc. (2007).

Oyster Reef Monitoring - Oyster research and monitoring in the SLR is currently being conducted by FOS and FWC (See Map 21). Under the Monitoring and Assessment Program component of CERP, SFWMD provides funds to FWC to monitor four aspects of oyster ecology: 1) spatial and size distribution patterns of adult oysters, 2) distribution and frequency patterns of the oyster diseases "dermo" (*Perkinsus marinus*) and MSX (*Haplosporidium nelsoni*), 3) reproduction and recruitment, and 4) juvenile oyster growth and survival in coastal areas subject to freshwater discharge from the C&SF canal system (See Figure 4). FWC monitoring sites are located in Biscayne Bay, Lake Worth Lagoon, Loxahatchee River (South Fork and Northwest Fork), and SLR (North Fork, South Fork, and Middle Estuary). Two reference sites not connected to the C&SF canal system, Sebastian River and Mosquito Lagoon, are monitored by FWC for comparison purposes. Monitoring efforts by FWC began in January 2005 and are expected to continue until 2010. FOS established an oyster reef restoration program in 2006 that involves placement of juvenile oysters on existing natural reefs and seeding of newly created recycled oyster shell reefs. A monitoring component has been established by FOS to document restoration success. Specific monitoring activities entail measuring: 1) growth and mortality of cage-raised juveniles prior to release onto existing oyster reefs within the SLR, and 2) density (oysters per square meter) and growth

on augmented oyster reefs (both natural reefs and recycled-oyster shell reefs) (See Appendix B.5.7). Monitoring by FOS staff is expected to continue throughout 2009.

Floodplain Vegetation Monitoring - SFWMD has recently established four belt transects to identify and examine the health of floodplain vegetation communities of the North Fork SLR and Ten Mile Creek. The current project will follow a similar floodplain vegetation monitoring project conducted along the Northwest Fork of the Loxahatchee River in 2005 (South Florida Water Management District [SFWMD] and Florida Department of Environmental Protection [DEP], 2006). Project results, expected by January 2010, will allow SFWMD staff to make recommendations on the impact of enhancing current freshwater flow and salinity patterns to these wetland systems and the river. Better management of flow is anticipated to improve water quality and reduce sediment deposition in the SLR. The current study will also support the need for restoration of the North Fork floodplain identified in the IRL-S PIR (USACE & SFWMD, 2004). A reference collection of floodplain vegetation will be created by a contractor and housed at the Southeast Florida Aquatic Preserves (SEFLAP) Field Office for future reference.

Florida Oceanographic Society biologists use oyster rakes to monitor the density of oyster reefs in the St. Lucie River.



Map 21 | St. Lucie River oyster reef monitoring and restoration sites.

Water Quality Monitoring - An extensive water quality monitoring network exists for the SLR system that includes several sites within the preserve (See Map 20 and Appendix B.5.6). To date, preserve staff have not collected water quality data or established regular communication with water quality monitoring groups that sample within the preserve. Because of the extensive

degradation of water quality in the SLR as a whole, it is imperative that preserve staff establish a mode of communication with SFWMD, DEP SWAMP, St. Lucie County Department of Health, USGS, FOS, and Marine Resources Council and use the data collected by these groups to better understand average fluctuations in water quality within the preserve and then disseminate the information through education and outreach events. Although critical to understanding and managing this impaired waterway, an additional position at the SEFLAP Field Office would be necessary to accomplish this task. With added support, a database for water quality data collected within the preserve could be established and used to help preserve staff identify and address problematic areas.

Recent use and testing of technical (some prototype) equipment, such as side scan and Dual Frequency Identification Sonar (DIDSON) units, remotely operated vehicles with unattended water quality sampling units and plankton samplers that transmit data via satellite telemetry, Kilroy units that collect and transmit real-time water quality data back to a computer, and unattended hydrophones that can be remotely activated and transmit sound waves via satellite telemetry to study spawning fish populations have introduced new opportunities for continued research and monitoring of all marine protected areas, including the preserve. Due to the limited amount of resources available to manually collect such data, it is vital that continued use and testing of new technology by SFWMD, ECOS, and Ocean Research & Conservation Association, be supported by preserve staff.

Research - Recent spawning research indicates that egg production in drums (e.g. spotted seatrout) is directly proportional to sound production at this site. In the future, biologists and managers anticipate being able to remotely use sound production to determine the arrival and success of spawning aggregations that may be negatively affected by freshwater releases. Continued use of available technology and future use of unattended sampling units will greatly increase our understanding of this drastically altered, and therefore even more complicated, system.

Often times preserve staff are not aware of research being conducted in the North Fork SLR. To improve communication, preserve staff will establish a voluntary program to collect information (project proposals and final reports) from local and visiting researchers within the preserve. The system will be similar to the Special Use Request program established for research and monitoring activities within Florida state parks. Preserve staff currently maintain a library of scientific literature that relates to research projects within and adjacent to the preserve. Staying informed about the research and monitoring conducted within and adjacent to the preserve enables preserve staff to make educated management decisions. Some of the current research projects being conducted within the preserve include a snook dietary study (FWC), fish spawning and plankton research (SFWMD, ECOS, and FOS), oyster cultivation and stocking research (FOS), and benthic infaunal research (Smithsonian Marine Station). Although preserve staff may assist with various project aspects, most research conducted within the preserve is headed by other agencies and non-governmental organizations. Preserve staff plan to create and maintain a list of needed research and monitoring projects within the preserve. These ideas will eventually be promoted to professors at local educational institutions such as Harbor Branch Oceanographic Institute (HBOI) at Florida Atlantic University (FAU), Smithsonian Marine Station, Indian River State College (IRSC), and FIT. Future studies conducted by college students and professors will hopefully result from: 1) the desire to transform the Treasure Coast into a hotspot for marine and biomedical science, 2) expansion of FAU to Port St. Lucie and HBOI, and 3) the incorporation of four-year degree programs into the IRSC system.

4.2 / The Resource Management Program

The Resource Management Program addresses how CAMA manages the NFSLRAP and its resources. The primary concept of NFSLRAP Resource Management projects and activities are guided by CAMA's mission statement: "To protect Florida's Coastal and Aquatic Resources." CAMA aquatic preserves accomplish resource management by physically conducting management activities on the resources for which it has direct management responsibility and by influencing the activities of others within and adjacent to its managed areas and within its watershed. Watershed and adjacent area management activities, and the resultant changes in environmental conditions affect the condition and management of the resources within the preserve's boundaries. CAMA-managed areas are especially sensitive to upstream activities affecting water quality and quantity. CAMA works to ensure that the most effective and efficient techniques used in management activities are utilized consistently within its sites, throughout its program, and when possible throughout the state. The strongly integrated Ecosystem Science, Education and Outreach, and Public Use Programs provide guidance and support to the Resource Management Program. These programs work together to provide direction to the various agencies that manage adjacent properties, the preserve's partners, and the preserve's stakeholders. Preserve staff also collaborates with these groups by reviewing

various protected area management plans. The sound science provided by the Ecosystem Science Program is critical to the development of effective management projects and decisions. The conditions of natural and cultural resources within the preserve are diverse. This section explains the history and current status of the preserve's resource management efforts.

4.2.1 / Background of Resource Management at North Fork St. Lucie River Aquatic Preserve

The North Fork SLR was artificially straightened by USACE and NSLWCD in the early 1900's to provide flood control and improve navigation (See Map 6). During this process, original riverbends and adjacent wetlands were isolated from the river as the banks of the newly channelized area were lined with large dredge spoil deposits (See Figure 5). Erosion of the banks along the shoreline increased turbidity in the preserve while isolation of floodplain habitat and oxbows dramatically decreased the residence time of water within the North Fork. Reduced residence time ultimately decreased the amount of nutrient absorption and settlement of suspended solids before the water reached seagrass and oyster reef habitat in the southern section of the preserve and the Middle Estuary. Restoration goals identified in the IRL-S PIR include restoration of North Fork floodplain hydrology through oxbow and floodplain reconnections, muck removal in the SLR (including southern section of the preserve), and creation of habitat suitable for the establishment of oyster reefs (USACE & SFWMD, 2004).

Hydrologic Restoration - Restoration of historical water movement patterns through oxbows and floodplains is expected to improve water quality and reduce the amount of muck deposited in the lower portion of the preserve. A feasibility study was drafted by PBS&J in 2003. This study identified 42 hydrologic restoration sites (21 oxbow reconnection and 21 floodplain reconnection sites) in Ten and Five Mile creeks and the North Fork north of the Prima Vista Boulevard bridge. Additional reconnection sites were identified in the North Fork, Ten Mile Creek, and Five Mile Creek by St. Lucie County Mosquito Control District (SLCMCD) staff in 2007 in an attempt to reduce the amount of water lettuce and other habitat regularly used by breeding mosquitoes. In 2008, a multi-agency team including CAMA, DRP, SLCMCD, FWC, and SFWMD was formed to combine both sets of hydrologic restoration data and create a ranking matrix that identifies priority projects (See Appendix B.5.2) (Herren, Tucker, Beal, Sharpe & Conrad, in prep).

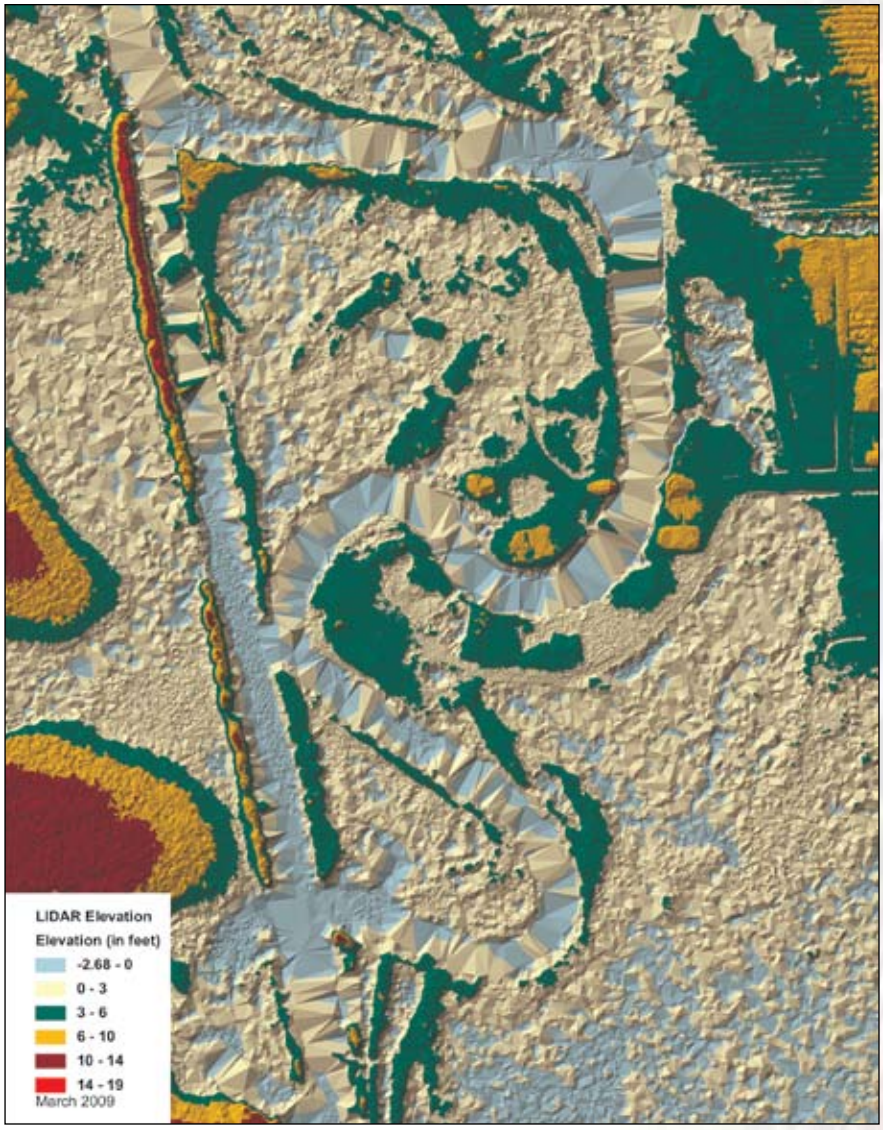


Figure 5 / Light Detection and Ranging (LiDAR) data are used to identify hydrologic restoration areas along the North Fork St. Lucie River and its headwaters. (Data provided by SFWMD.)

Hydrologic restoration of the North Fork began in June 2002 when preserve staff reestablished flow to an isolated portion of the

North Fork floodplain approximately one half mile north of Prima Vista Boulevard (See Map 22). This site, referred to as Site 5, is an island that was created during the straightening process. Restoration efforts included construction of three breaches in the spoil berm lining the bank of the river (one culvert and two creek-like systems). Biological monitoring of the site by preserve and state parks staff and FWC three years post-construction indicates successful use of the reconnected wetlands by fish and invertebrates (Beal et al., 2006). A second pilot hydrologic restoration project, the reconnection of an oxbow on SFWMD's Strazulla Tract located just south of Platt's Creek, was completed in July 2003 (See Map 22). Although north of the preserve boundary at Midway Road, reconnection of this historic riverbend to the North Fork is expected to improve the quality of water reaching the preserve. Biological sampling at the reconnection site by FWC, preserve staff, and state park staff indicates movement of fish and invertebrates into the oxbow. Original, unaltered riverbends generally contain more submergent and emergent vegetation near the shoreline and, based on unpublished electroshocking data, appear to attract more native fauna than the channelized area (G. Gilmore, personal communication, February 1, 2008). The culvert at Site 5 has also been documented to effectively move water into the floodplain wetland (J. Beal, personal communication, August 9, 2007). However, few fish and decapod species have been captured moving through the culvert, unlike studies conducted in local estuarine marshes (Brockmeyer, Rey, Virnstein, Gilmore & Earnest, 1997).

Eroded shoreline at White City Park.

Reconnection of isolated oxbows will improve water quality by decreasing nutrients and suspended solids.

Water quality parameters (turbidity and dissolved oxygen) were monitored pre- and post-construction at the three Site 5 breaches and the oxbow reconnection site. Water quality monitoring data at the Site 5 breaches indicated that elevated turbidity levels associated with construction activities were reduced to background (river) levels within weeks of construction. Data also suggest significant post-construction improvements in dissolved oxygen levels within the restored wetlands and oxbow (J. Beal, personal communication, August 9, 2007).

Shoreline Stabilization - To date, shoreline stabilization projects along the North Fork have been associated with the three breaches at Site 5 and the oxbow reconnection on SFWMD Strazulla Tract (See Map 22). Stabilization of the berm breaches at Site 5 entailed lining the two creek-like breaches with rip rap (on filter cloth at the toe of the slope) and reducing the slope of the adjacent shoreline. Red mangrove and leather fern were planted in the rip rap. Emergent vegetation, including swamp lily, leather

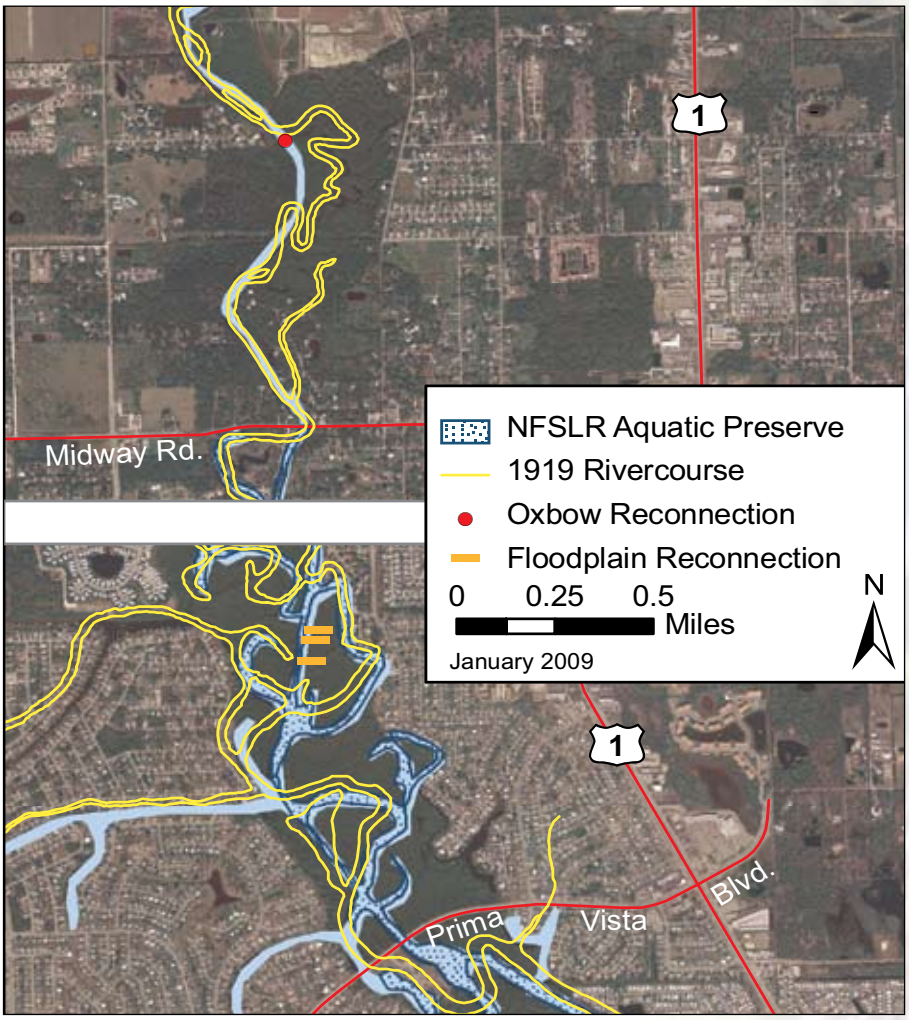
fern, and arrowhead, were interspersed in the intertidal zone. The adjacent (upland) shorelines were lined with jute and planted with red maple, wild coffee, marlberry, white stopper, and *Spartina bakeri*. A turbidity screen has been in place to protect the emergent vegetation since 2004. Most plantings survived the direct hits by hurricanes Frances and Jeanne in September 2004 and winds from the northern bands of Hurricane Wilma in October 2005. The stability of the shoreline is increasing and the turbidity screens will be removed during spring 2009. No rip rap was needed at the culvert but the adjacent shoreline was enhanced in the same manner as the shoreline adjacent to the stream-like breaches. Photodocumentation of the stabilization projects was conducted annually by preserve staff during 2003-2009 (See Appendix B.5.8). Rip rap and native plantings, such as leather fern and swamp lily, were used to stabilize the shoreline along the oxbow reconnection.

Land Acquisition – A land acquisition map series and associated database based on proposed Florida Forever additions was created in 2009 by preserve staff (See Appendix B.5.9). The parcels have not been prioritized, so adjacent public lands and planned hydrologic restoration sites were identified on the map series to facilitate the ranking process.

Muck Removal – Although it is generally accepted that removal of large muck deposits from the SLR would be favorable, several monetary and environmental concerns have slowed the process (St. Lucie River Initiative, 2004). Three pilot muck removal projects, Lake Okeechobee (2002), South Fork SLR (2002), and North Fork SLR (2003), have provided answers to questions regarding such issues as equipment and techniques, sediment toxicity, nutrient loading of upland deposition sites, and plant response to deposition on various upland deposition sites. However, the process will be expensive, and cost-effective beneficial uses of St. Lucie muck sediments remain to be identified (He et al., 2004).

Oyster Reef Restoration – The FOS initiated an oyster reef restoration program in the SLR in 2006 following the releases associated with the 2004 and 2005 hurricane seasons. This program has two principle components: 1) oyster gardening and release, and 2) seeding of newly created reefs made of recycled shell material from local establishments. The gardening component, which began in 2006, relies on year-round support from local dock owners that grow (i.e. garden) the juvenile oysters under their docks for three months at a time before they are released onto a nearby oyster reef (See Appendix B.5.7). In 2008, FOS initiated a second project in which staff grow oyster larvae and seed them on to recycled shell reefs positioned within containment booms. Four oyster reefs comprising 400 square feet of habitat will be created in the Lower Estuary in the spring of 2009.

Martin County initiated a community based River Reefs Project to support the identified need to enhance and restore marine habitat such as oyster reefs in the IRL and SLR (USACE &



Map 22 / Sites of completed hydrologic restoration projects on the North Fork St. Lucie River.

SFWMD, 2004). Funds to create additional oyster reef habitat along the northern and southern shorelines of the Middle Estuary were received from SFWMD IRL License Plate Trust Fund in 2005. Martin County worked closely with FOS, Martin County ESC, and Continental Shelf Associates International, Inc. in the creation, deployment, and monitoring of these artificial reefs (CSA International, Inc., 2007). Eighty-eight reef patches (44 patches along each shoreline) totaling 1,029 square meters were created in 2005 and 2006 (CSA International, Inc., 2007). These reefs have successfully increased the abundance of filter feeding organisms and provide refuge for juvenile fish and invertebrates in the SLR.

Stabilization of the shoreline at a wetland reconnection site near Prima Vista Boulevard.

Creation of oyster reefs in the Middle Estuary. (Image provided by Continental Shelf Associates, Inc.)

Permitting - The SEFLAP Field Office was established in 1986 at which time most of the management activities entailed regulatory review of permit applications for construction activities within the preserve. Agency reorganization, acquisition, and approval of the North Fork SLR State Buffer Preserve Management Plan between 1994 and 1997 marked a transition at which preserve staff decreased the amount of time on regulatory review and increased the amount of time spent on removal and maintenance of non-native species, restoration, research, and monitoring within the buffer and aquatic preserves. The buffer preserve is now managed as the North Fork property of Savannas Preserve State Park but both state park and aquatic preserve staff continue to focus on restoration activities that improve the quality of the aquatic preserve. Regular communication has been established with DEP Southeast District regulatory staff and notices of proposed activities within the preserve are regularly received via post and e-mail. Lists of potential projects that would help applicants meet their public interest criteria (e.g. conservation easements, habitat mapping and habitat and hydrologic restoration) have been provided to local regulatory staff. Onsite mitigation through the acquisition and protection of adjacent buffering lands and habitat and hydrologic restoration are encouraged for proposed construction activities within the preserve.

4.2.2 / Current Status of Resource Management at North Fork St. Lucie River Aquatic Preserve

Most knowledge of the natural resources within the preserve is gained through the preserve's Ecosystem Science Program. Actions taken by preserve staff and their partners as a result of the information gained through mapping, modeling, monitoring, and research activities within the SLR falls under the realm of resource management. The preserve's Resource Management Program currently focuses on information dissemination, group coordination, and ecosystem restoration.

Hydrologic Restoration – A multi-agency team has identified and ranked the most appropriate hydrologic restoration sites along the North Fork and its headwaters (See Appendix B.5.2) (Herren et al., in prep). Information gained during the completion of two restoration projects, one oxbow reconnection at SFWMD's Strazulla Tract and one floodplain reconnection at Site 5 in the state park, will facilitate future project development. The FWC, state park biologists, and the SLCMCD are partnering to reconnect a second oxbow along the north side of Ten Mile Creek on the North Fork parcel (Miller-Wild property) of Savannas Preserve State Park in fiscal year 2009-2010. Current and future efforts to foster partnerships among FWC, CAMA, DRP, DEP Southeast District regulatory office, SFWMD scientists, SFWMD regulatory staff, USACE regulatory staff, St. Lucie County Environmental Resources Department, and SLCMCD are necessary to reach hydrologic restoration goals.

Staff at Florida Oceanographic Society places oyster spat (juvenile oysters) in cages hung from private docks, allows the spat to grow for three months, and then transplants them onto existing reefs in the St. Lucie River.

Shoreline Stabilization - No additional shoreline stabilization has been completed since the stabilization of the floodplain reconnection sites north of Prima Vista Boulevard and on the SFWMD Strazulla Tract. Preserve staff will continue to photodocument the stabilization of these sites, identify other locations in need of stabilization, form partners with SLC Environmental Resources Department, DEP state parks, and DEP and SFWMD regulatory staff, Boy Scouts of America, and request funds from the St. Lucie River Initiatives Team and the IRL License Plate Trust Fund to complete additional stabilization projects. Suitable submerged and emergent vegetation will be included in the planting plans for future stabilization projects (Appendix B.5.10).

Land Acquisition - Prioritization of the parcels identified on the land acquisition map series in Appendix B.5.9 is needed. A multi-agency team will be formed to identify ranking criteria and conduct field visits. Adjacent public lands and planned hydrologic restoration sites were identified on the map series to facilitate the ranking process.

Muck Removal - In 2008, the City of Port St. Lucie submitted an Environmental Resource Permit application to remove approximately 13 acres of muck from eight canals that discharge into the preserve (Elkcam, South Coral Reef, Degan, Harbor, Schooner, Surfside, Sagamore, and Ocean Breeze).

Oyster Reef Restoration - Restoration of oyster habitat is occurring within and adjacent to the preserve (See Map 21). Although Martin County has plans to create additional oyster reefs in the Middle Estuary as part of their River Reefs Project, FOS is the only organization that currently has permitted projects aimed at restoring oyster reefs within the SLR. Two of the six restoration sites are located in the preserve: one at Britt Creek and one at Harbor Ridge (See Appendix B.5.7). Support of Martin County's future oyster reef creation efforts and FOS's oyster gardening and release program within the southern section of the preserve is a priority. St. Lucie County also creates fish habitat by deploying artificial materials offshore and recycled oyster shell material in the IRL through their Artificial Reef program. Preserve staff would support expansion of this program, especially creation of oyster reefs using recycled shell material, into

the southern section of the preserve within St. Lucie County. An oyster reef restoration project within the Loxahatchee River began in 2008 that will test the effectiveness of potential substrates (e.g. limestone rock, bagged relict oyster shell, and concrete oyster reefballs) that could be used as cultch in future reef creation and restoration projects. Results from this project will help guide future efforts in the SLR.

Permitting – Preserve staff comment on environmental resource permits submitted for lease or construction activities on sovereign submerged lands within the preserve. Dredging and construction projects permitted within the preserve must be in the public interest (18-20 F.A.C). Beneficial public interest projects have been identified and communicated to the local regulatory staff but preserve staff will maintain and regularly distribute an updated list to local regulators. In addition to the dissemination of updated project ideas, preserve staff will provide regulators with resource updates for the preserve and offer one boat tour of the preserve each year to help familiarize new staff with the aquatic resources and discuss specific regulatory and resource protection issues within the preserve. Use of ecosystem science data should be used to strengthen the aquatic preserve rule (18-20 F.A.C.) and county comprehensive plan sections that directly relate to development adjacent to the preserve. Such improvements would allow regulatory staff to minimize the amount of natural resource impacts within the preserve.

Mitigation - Impacts to natural resources must be avoided or minimized by applicants wishing to construct within the preserve (Chapter 18-20 F.A.C.). Regardless of compromising efforts to minimize impacts, resources often are degraded or completely removed from the preserve through the regulatory process and must be mitigated. In such situations, preserve staff are able to use information gained through multiple partners to recommend mitigation options (e.g. land acquisition, habitat and hydrologic restoration, water quality improvement projects, shoreline stabilization with native plants, planting of emergent and submergent vegetation) that would directly benefit the quality of natural resources within the preserve. A list of potential mitigation options for the preserve has been established for quick reference and consideration by preserve and regulatory staff. Compared to the high amount of visible resources, mainly seagrass and mangroves, in the adjacent estuarine IRL, the upper reaches of the preserve are a fresh, blackwater system that supports visible mangroves (to a latitude just north of Prima Vista Boulevard) and emergent vegetation. The remaining resources are primarily unconsolidated substrates (76% of the preserve) and possibly submergent vegetation (which has been identified as a mapping need). Unconsolidated substrates in the North Fork SLR support infaunal organisms and bottom-dwelling fish such as gobies (especially the hyphen goby [*Gobionellus oceanicus*]) and sleepers (FNAI & DNR, 1990 and G. Gilmore, personal communication, February 1, 2008). Emergent and submergent vegetation found throughout the preserve is critical for larvae, juveniles, spawning, and nursery ground for fish and invertebrates (G. Gilmore, personal communication, February 1, 2008). Because of the lack of submergent vegetation, both emergent and submergent vegetation located within the preserve should be considered valuable habitat (Resource Protection Area 1 or 2) worthy of mitigation when reviewing permit applications. Once water quality and clarity improves and seagrass begins to recruit within the preserve, all possible measures to avoid impact should be taken by regulatory staff and applicants.

Incident Response - Most incidents in the preserve involve harassment of wildlife, primarily adults and chicks at the Mud Cove bird rookery, reports of illegal fishing activities (e.g. use of gill nets), unlawful speed, cutting of mangroves, and potential permit violations. Each complaint is documented by preserve staff by completing a complaint form that identifies the caller, their contact information, incident description, action taken, and results. Depending on the reported incident, preserve staff coordinates with FWC wildlife officers, DEP or SFWMD compliance and enforcement staff, SLC Environmental Resources Department or St. Lucie or Martin county parks and recreation departments. Maintaining a strong partnership with compliance and enforcement staff is critical to the success of incident response within the preserve. Preserve staff also encourage stewardship among homeowners, who often serve as the eyes and ears of the preserve. Future coordination with law enforcement officials will help preserve staff document additional incidents and incident locations within the preserve that are not reported through the SEFLAP Field Office (e.g. near misses between various user groups, issued speeding tickets and warnings). Identified trends will be documented and discussed with law enforcement officials for localized support.

4.3 / The Education and Outreach Management Program

The Education and Outreach Management Program components are essential management tools used to increase public awareness and promote informed stewardship by local communities. Education programs include on and off-site education and training activities. These activities include: field studies for students and teachers, the development and distribution of media, the dissemination of information at local events, the recruitment and management of volunteers and training workshops for local citizens

St. Lucie County's Oxbow Eco-Center plays a lead role in educating children and adults about the North Fork St. Lucie River.

and decision-makers. The design and implementation of education programs incorporates the strategic targeting of select audiences. These audiences include all ages and walks of life; however, each represents key stakeholders and decision-makers. These efforts by staff, utilizing the components of the Education and Outreach Program, allow the preserve to build relationships and convey knowledge to the community, invaluable components to successful management.

4.3.1 | Background of Education and Outreach at North Fork St. Lucie River Aquatic Preserve

The SEFLAP Field Office is small, remote, and not well-suited for on-site educational programs. The majority of the preserve's "Education and Outreach" has been in the form of volunteer coordination and outreach. Spreadsheets were created in 2006 to track volunteer-based projects and outreach events.

Education - In the late 1980s to mid 1990s, the SEFLAP Field Office was divided into two sections: Education and Outreach and Natural Resource Management. At that time, the educational staff established a program in which bimonthly canoe trips were launched from White City boat ramp on Midway Road. Canoe trips were scheduled for both the general public and local decision-makers. Educational staff also created an aquatic preserve coloring book, *Aquatic Preserves are Exceptional*, which is now distributed state-wide. The two-section approach to managing the NFSLRAP dissolved in 1997 with the management authority over the new North Fork St. Lucie Buffer Preserve. Since then, the primary educational programs supported by preserve staff have been the IRL Envirothon and the Treasure Coast Environmental Education Council (TCEEC). The IRL Envirothon, Inc. is a non-profit organization established in 1993 to bring local environmental education into regional (St. Lucie, Martin, Indian River, Okeechobee, and Brevard counties) middle and high school classrooms. TCEEC is comprised of over 50 agencies and organizations with environmental education interests in the Treasure Coast area, and was established in 2005 to 1) allow for networking opportunities and idea-sharing among local environmental educators, and 2) facilitate large-scale environmental education projects beyond the scope of each individual agency or organization. TCEEC designed portable outdoor classrooms that are available to Treasure Coast teachers, presented a curriculum resource fair for St. Lucie County teachers, and created a TCEEC logo.

The quantity and quality of education about the North Fork and the natural resources within the preserve were greatly improved with the establishment of St. Lucie County's educational facility known as the

Oxbow Eco-Center. The Oxbow Eco-Center was built in 2000, on a 220 acre parcel purchased with funds from St. Lucie County's Environmentally Sensitive Lands and SFWMD Save Our Rivers programs. The land, which buffers the preserve, is managed to sustain its native wildlife, utilizing boardwalks, trails, bridges, observation towers, and a canoe launch that allow visitors to experience nature without disrupting it. Oxbow Eco-Center's staff have taken the lead role in educating St. Lucie County students and local residents about the SLR and the natural resources located within the preserve by incorporating indoor displays with outdoor programming. Monthly canoe trips along the narrow and scenic upper reaches of the preserve are also offered by their educational staff. The Oxbow Eco-Center is known for the incorporated green building technologies (e.g. passive light design, solar panels, recycled and recyclable materials, a cistern system used to capture rainfall to flush the toilets, and floors made from salvaged pine trees lost in the St. Johns River in the early logging days) and serves as a model for sustainability.

Preserve signage at Veteran's Memorial Park at Rivergate.

Outreach - The primary form of outreach for the preserve has been the delivery of PowerPoint presentations at various group meetings and use of educational displays and field equipment demonstrations at local events and festivals hosted by other environmental educators and conservation groups. Outreach events for the North Fork have primarily included participation in Oxbow Eco-Center's Earth Day Celebration, St. Lucie Conservation Alliance's Party in the Park at Fort Pierce Inlet State Park, Port Salerno's Seafood Festival, the Manatee Center's Naturefest, and SLC Agricultural Tour. Over the years, preserve staff have keyed in on the educational materials and information that have been of most interest to local residents attending the outreach events. Gradual incorporation of new approaches based on these observations has facilitated communication and understanding during these organized events.

Signage - Preserve signage has been posted at two of the six preserve access points, White City Park and Veteran's Memorial Park at Rivergate (See Map 4).

Volunteers - Volunteers are an integral part of preserve staff's ability to reach management goals. The volunteer coordination process was streamlined in 2006 by appointing all coordination efforts to one employee. At this time, a spreadsheet was also created to help track volunteer events and hours contributed to NFSLRAP projects. Over 4,000 volunteer hours have been dedicated to such projects as clean-up events, a derelict vessel survey, and a public and private access survey between July 2006 and February 2009. The streamlining process has allowed for more effective communication with the volunteers through a well-maintained e-mail distribution list, volunteer applications, and an emergency contact list.

4.3.2 | Current Status of Education and Outreach at North Fork St. Lucie River Aquatic Preserve

Current Education and Outreach programs for the NFSLRAP focus on creating stewards who educate and engage others as well as promote responsible natural resource use.

Education - Educational tools for the NFSLRAP include GIS maps of the preserve and the surrounding watershed, children's aquatic preserve coloring books, plant and animal species identification posters, PowerPoint presentations, a brochure, and educational materials regarding specific resources within the preserve (e.g. manatees, seagrasses, oysters, mangroves). Due to the limited amount of space and resources, educational programs that incorporate preserve issues are currently conducted by SLC Oxbow Eco-Center's educational staff. Although formal educational programs will probably not be incorporated into the preserve's management plan, it is important that preserve staff support the Oxbow Eco-Center's educational efforts by providing supportive staff, boats, technical assistance, and educational materials produced through the SEFLAP Field Office to increase local knowledge of the preserve. It is also important for preserve staff to facilitate communication with DEP's Savannas

Preserve State Park Educational Center staff. The Savannas Educational Center was built in 2000 within the state park on the north side of Walton Road. Current features include interactive environmental and historical exhibits relating to the Savannas Preserve State Park and the surrounding area. Although management authority of the North Fork SLR Buffer Preserve was transferred to Savannas Preserve State Park in 2004, it is important that preserve staff work with the state park staff to develop displays and educational materials for the North Fork property.

In addition to playing a supportive role to the Oxbow Eco-Center and Savannas Preserve State Park Environmental Education Center, preserve staff remain active in the IRL Envirothon and TCEEC programs.

Outreach - Outreach for the North Fork has historically focused on participation in events organized by other organizations. In the future, staff would like to reach out to several target audiences by delivering presentations to appropriate homeowner associations, local businesses, and environmental groups such as St. Lucie and Martin county chapters of Audubon and SLC Conservation Alliance, to promote knowledge and stewardship of the preserve. Preserve staff will also coordinate with SLC's Oxbow Eco-Center, DEP's Savannas Preserve State Park Education Center, and Martin County's ESC to incorporate presentations about the preserve and the associated resources into their existing lecture series.

The existing NFSLRAP brochure is extremely outdated. Preserve staff are in the process of creating a new tri-fold brochure specific to the preserve. The new brochure provides useful information including, but not limited to, the reasons behind the aquatic preserve designation, associated statutes and codes, points of contact for potential violations, and a map that identifies the preserve boundary, public access points, and recreational opportunities.

Signage - Signage within and at access points to the preserve needs to be improved. Currently, only two of four public access points have signage posted that indicate that the waterway is an aquatic preserve. Future efforts to construct and raise educational kiosks that inform users about the preserve are a high priority for preserve staff. The signage at Veteran's Memorial Park at Rivergate is in good condition and does not need to be replaced. The existing signage at White City Park is weathered and is currently in need of replacement. Preserve staff will work with volunteers, Eagle Scouts, and managers of each access point to build and raise educational kiosks at White City Park, the Oxbow Eco-Center, the Halpatiokee stop-over along Evan's Creek, and River Park Marina. Preserve staff will work with SLC's Oxbow Eco-Center staff to determine the most appropriate form of signage for their access point as a kiosk would distract from the natural view that staff are trying to protect.

Volunteers help preserve staff remove debris from the North Fork St. Lucie River.

Because of the lack of signage at the public access points and rapid growth, some visitors are unaware that a large portion of the North Fork is an aquatic preserve. To address this, preserve staff will work with FWC Division of Law Enforcement Boating and Waterways section to install signage on channel markers that inform boaters that they are entering the NFSLRAP.

Volunteers - Although SEFLAP Field Office volunteers have traditionally helped within the IRL - Vero Beach to Fort Pierce Aquatic Preserve, more emphasis is currently being placed on the North Fork SLR. These projects include, but are not limited to, construction and maintenance of educational kiosks at public access points, assistance with bird rookery monitoring, resource management surveys, citizen patrolling, clean-up events (especially removal of monofilament within the vegetation along the White City Park oxbow and along the fishing piers at River Park Marina and Veteran's Memorial Park at Rivergate), outreach opportunities, information gathering, and office-related projects. The opportunities have been well-received by the public, and preserve staff anticipate successful implementation of many strategies outlined in Chapter 5 through the support of volunteers.

As the volunteer network for the preserve increases and SEFLAP Field Office staff reestablishes the Stewards for the Southeast Florida Aquatic Preserves Inc. Citizens Support Organization (CSO), preserve staff would like to interact with both the preserve volunteers as well as the state park's CSO, Friends of Savannas Preserve State Park, Inc. Programs that benefit both the buffering state park land as well as the preserve (e.g. non-native species removal, shoreline stabilization, and hydrologic restoration) may be of interest to both groups of volunteers. Preserve staff will continue to use a volunteer database created in 2006 to document the need for a future full-time volunteer coordinator position, a responsibility that is currently being covered by an Other Personal Services (OPS) (time-limited) employee with several other responsibilities.

4.4 / The Public Use Management Program

The Public Use Management Program addresses the delivery and management of public use opportunities at the preserve. The components of this program focus on providing the public recreational opportunities within the site's boundaries which are compatible with resource management objectives. The goal for public access management in CAMA managed areas is: "To a degree that is consistent with our goals for natural and cultural resource protection, we will promote and manage public use of our preserves and reserves that supports the research, education, and stewardship mission of CAMA."

While access by the general public has always been a priority, the conservation of CAMA's sites is the primary management concern for CAMA. It is essential for staff to analyze existing public uses and define management strategies that balance these activities where compatible in a manner that protects natural, cultural, and aesthetic resources. This requires gathering existing information on use, needs, and opportunities, as well as a thorough consideration of the existing and potential impacts to critical upland, wetland, and submerged habitats. This would include the coordination of visitor program planning with social science research. One of CAMA's critical management challenges during the next 10 years is balancing anticipated increases in public use with the need to ensure preservation of site resources. This section explains the history and current status of our public use efforts.

4.4.1 / Background of Public Use at North Fork St. Lucie River Aquatic Preserve

The North Fork SLR is accessible to the public year-round for consumptive and non-consumptive use. No public use surveys have been conducted within the preserve to date. Such surveys would help document the user's age, activity, and frequency of use by locals and visitors. These data would ultimately allow preserve staff to target specific user groups and issues. Primary public use concerns identified to date have been boating safety (conflicts between motor boaters and paddlers) and poor water quality conditions (See Appendix C). Anecdotal reports from locals indicate that the sport fishing has been negatively affected in the preserve due to freshwater releases from the drainage network in the watershed (Murdock, 1954b). Despite water quality concerns, anglers are regularly seen using the preserve from boats, public boat ramps, and fishing piers.

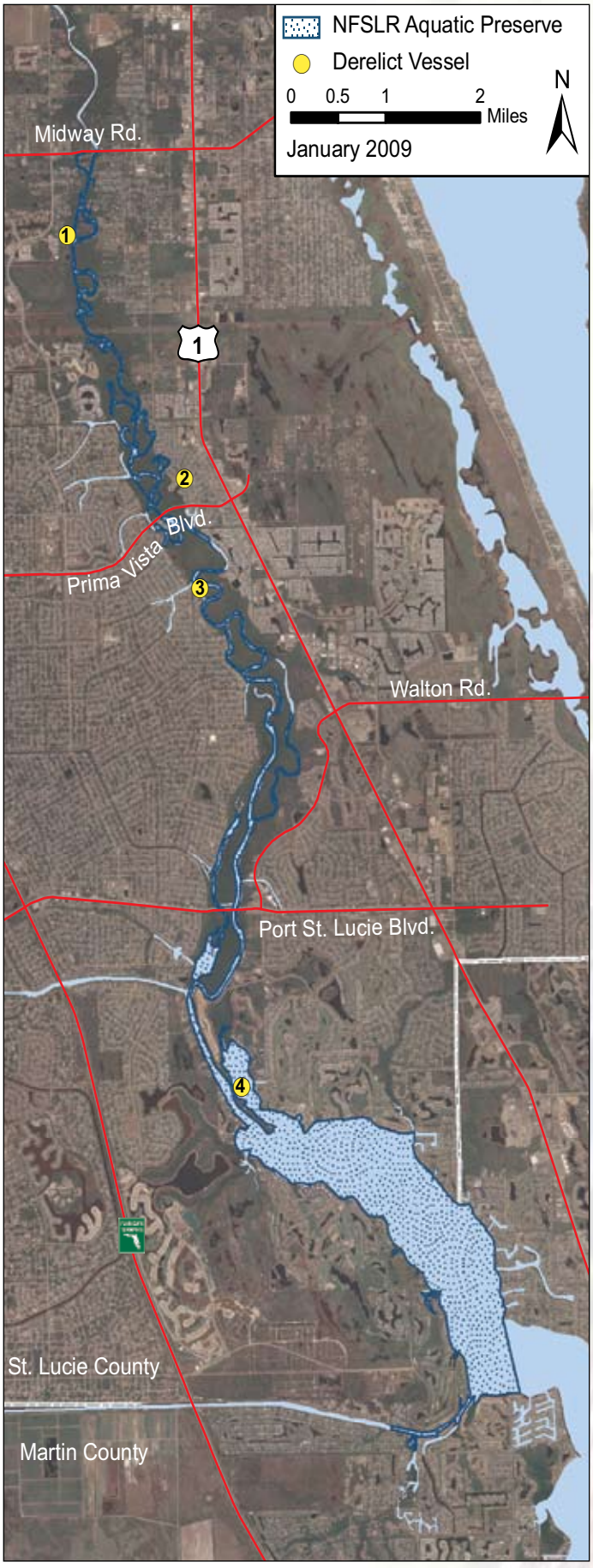
Public Access – An access survey within the NFSLRAP was completed in June 2007. At that time, four public boat ramps, one public marina, three public canoe stopovers, and three public fishing piers (located at public boat ramps) were located within the preserve. The four public boat ramps are located at White City Park, River Park Marina, Veteran's Memorial Park at Rivergate, and Club Med - Sandpiper. The only marina in the preserve is a public marina operated by Club Med - Sandpiper. Public canoe stopovers have been built by St. Lucie County and FDEP at the Oxbow Eco-Center, Idabelle Island, and the Halpatiokee Parcel of Savannas Preserve State Park North Fork Property. Although not technically within the preserve, public lands adjacent to the North Fork (north of Midway Road) and Ten Mile Creek provide additional public access and recreational opportunities. An additional eight private boat ramps, 379 private docks, and 12 private multi-slip docks have been permitted within the preserve.

Boating/Derelict Vessels – Four public boat ramps are available to boaters within the preserve. Because the preserve can be accessed from the IRL, boaters may access the preserve from any IRL or SLR public ramp. The number of derelict vessels increased after hurricanes Frances, Jeanne, and Wilma passed in 2004 and 2005. In June 2007, six abandoned/derelict vessels (ranging from a paddle boat to large sailboats) were documented within the preserve. Two of these six vessels have been removed. The locations of the four remaining vessels can be seen on Map 23.

Consumptive Use - Predominant consumptive public uses of the NFSLRAP are fishing and crabbing. There are three public fishing piers within the preserve located at White City Park, River Park Marina, and Veteran's Memorial Park at Rivergate. These piers are the easiest way for the public to access the

preserve, and therefore receive regular use. Both commercial and recreational anglers use boats to fish in the preserve. Net and hook and line methods are used to catch target species such as mullet, croakers, sheepshead, snapper, and snook. Commercial castnetters rely on the North Fork SLR south of Veteran's Memorial Park at Rivergate for mullet, croakers, and sheepshead. Some sell wholesale to local markets, but little is currently known about the success of these operations. The North Fork also supports year-round commercial and recreational blue crab operations. One commercial crabber has relied on North Fork resources as a sole source of income since 1985. Crabs harvested from the preserve are sold wholesale to commercial markets in Port St. Lucie and Jensen Beach and are occasionally sold along Midway Road in White City. Anecdotal evidence from recreational and commercial fishermen and crabbers relates the abundance and health of their catch to water quality in the preserve. Runoff after large storm events and conversion of natural to hardened shorelines, both associated with increased development in the watershed, have had the largest impact on the blue crab business since the mid-1980s (URS Greiner Woodward Clyde, 1999; L. Burgess, personal communication, September 6, 2007). Recreational crabbers that use the North Fork are responsible for adding features that make recreational traps legal and are limited to fewer traps than commercial operations. Although the North Fork has fewer crabs, hence fewer crabbers, than other areas along the east coast, the crabs are of high quality (L. Burgess, personal communication, September 6, 2007).

Non-Consumptive Use - Opportunities for non-consumptive public uses of the preserve include canoeing, kayaking, motor boating, sailing, water skiing, wake boarding, catch-and-release fishing, and nature viewing. Two eco-tour operations, the River Lilly Cruise and Sunshine Wildlife Tours, provide pontoon trips to educate residents and visitors about the biology and ecology of the North Fork SLR. A highlight of both tours is a visit to the bird rookery in Mud Cove during the peak of the nesting season (February to July). Tours leave from public boat ramps in Port St. Lucie and Stuart. Club Med - Sandpiper, which occupies over 1,000 acres along Kitching Cove in Port St. Lucie, provides recreational opportunities to guests that are directly



Map 23 | Abandoned and derelict vessel location map (as of February 2009).

associated with the preserve. A privately-owned wave runner and sport boat concession, World Water Tours, operates out of Club Med - Sandpiper's Discovery Center. Year-round boat rentals have been available for recreation within the preserve for nearly 20 years. An orientation covering the rules associated with manatee protection zones and the commonly visited bird rookery in Mud Cove is provided prior to leaving Club Med - Sandpiper. The guided tours span from St. Lucie Inlet to the Prima Vista Bridge with a focal point being the bird rookery, particularly between February and July. Other water-related activities at Club Med - Sandpiper include triathlons, swimming, and sunbathing on the preserve's only sandy beach. St. Lucie County Canoe and Kayak rents to paddlers that wish to explore the North Fork between Prima Vista Boulevard and White City Park. Maps are provided, and interest for additional preserve information has been expressed because guided tours are not provided.

Derelict vessels, such as this sailboat removed in February 2009, have been identified for future removal from the preserve.

4.4.2 / Current Status of Public Use at North Fork St. Lucie River Aquatic Preserve

One challenge for Florida's aquatic preserve program is to promote sustainable use of the preserve while minimizing adverse user impacts to the natural resources. The success of government conservation programs is proportional to public support of those programs, and public support is most often derived from public use. Many users are not aware of how their daily activities impact preserve resources or other user groups. Therefore, many of the identified future needs within the Public Use Management Program overlap with that of the Education and Outreach Management Program.

Public Access - The Club Med - Sandpiper public marina is the only marina located within the preserve. An informational package and PowerPoint presentation about the DEP Clean Marina and Clean Vessel programs will be presented to Club Med - Sandpiper decision-makers. Preserve staff know where public and private access points are along the preserve, but it is also important for managers to know the type, frequency, and intensity of use the preserve is subjected to. Assistance from volunteers will be requested to conduct a public use survey at each of the four public boat ramps within the preserve (See Map 4). Communications with the rental facilities will be improved by providing preserve brochures and delivering presentations. This will help proprietors gain the information they need to educate and inform their customers about the preserve and its natural resources.

Boating/Derelict Vessels - Four derelict vessels were located within the preserve as of February 2009, all in St. Lucie County (See Map 23). Photographs, location data, and technical assistance with map production and grant proposals will be provided to local governments, FWC law enforcement, and regulatory staff to facilitate their removal.

Consumptive Use - Fishing and crabbing are popular consumptive uses of the preserve. Monofilament line from fishing activities is regularly seen around boat ramps, fishing piers, and entangled around the Mud Cove bird rookery. Birds (adults and chicks) at the Mud Cove Rookery have died from entanglement

in monofilament line. Support from local volunteers will be requested to help remove monofilament line on and around the public boat ramps and fishing piers and at all bird rookeries located within the preserve just prior to the nesting season. These sites have been identified as debris hotspots that require constant attention (based on preserve staff observations and the results of debris removal efforts). Educational programs are expected to cultivate a sense of stewardship and behavioral change. Monofilament recycling containers are currently located at two of four public boat ramps. Staff will work with local governments and Florida SeaGrant to install and maintain the polyvinyl chloride (PVC) monofilament containers at all public boat ramps and fishing piers along the preserve.

Non-Consumptive Use - The most popular non-consumptive use of the preserve is boating. Clean boating practices will be advocated to the boating community though a stronger partnership with Florida SeaGrant and managers of public boat ramps and marinas. Preserve staff will also promote low-impact recreational opportunity (e.g. paddling) to help prevent unforeseen damage to natural resources within the preserve.

Interpretation - Signage identifying the NFSLRAP is located at only two of the four public boat ramps with access to the preserve. Preserve staff will construct and establish educational kiosks at each of the public boat ramps along the preserve. These kiosks will depict GIS maps outlining the preserve boundary and associated natural resources, identify the public access points along the preserve, document statutes and code that will facilitate enforcement by law enforcement officers, and highlight recreational opportunities provided by other groups such as the Savannas Preserve State Park and SLC Environmentally Sensitive Lands hiking trail systems and ecotour operations. Additional information will also be included in the kiosks regarding native and non-native species, rules and regulations that govern aquatic preserves, and SEFLAP Field Office contact information.

Emergent swamp lily is found in the upper reaches of the North Fork St. Lucie River.

Chapter Five

Issues

5.1 / Introduction to Issue-Based Management

The hallmark of Florida's aquatic preserve program is that each site's natural resource management efforts are in direct response to, and designed for unique local and regional issues. When issues are addressed by an aquatic preserve it allows for an integrated approach by the staff using principles of the Ecosystem Science, Resource Management, Education and Outreach, and Public Use Programs. This complete treatment of issues provides a mechanism through which the goals, objectives, and strategies associated with an issue have a greater chance of being met. For instance, an aquatic preserve may address declines in water clarity by monitoring levels of turbidity and chlorophyll (Ecosystem Science - research), planting eroded shorelines with marsh vegetation (Resource Management - habitat restoration), creating a display or program on preventing water quality degradation (Education and Outreach), and offering training to municipal officials on retrofitting stormwater facilities to increase levels of treatment (Education and Outreach).

Issue-based management is a means through which any number of partners may become involved with an aquatic preserve in addressing an issue. Because most aquatic preserves are managed with very few staff, partnering is a necessity, and by bringing issues into a broad public consciousness, partners who wish to be involved are able to do so. Involving partners in issue-based management ensures that a particular issue receives attention from angles that, possibly, the aquatic preserve may not normally address.

This section will explore issues that impact the management of the North Fork St. Lucie River Aquatic Preserve (NFSLRAP) directly, or are of significant local or regional importance that the aquatic preserve's participation in them may prove beneficial. While an issue may be the same from preserve to preserve, the goals, objectives and strategies employed to address the issue will likely vary depending on the ecological and socioeconomic conditions present within and around a particular aquatic preserve's boundary. In this management plan, the preserve will characterize each of its issues and delineate the unique goals, objectives, and strategies that will set the framework for meeting the challenges presented by the issues.

Each issue will have goals, objectives, and strategies associated with it. Goals are a broad statement of what the organization plans to do and/or enable in the future. They should address identified needs and advance the mission of the organization. Objectives are a specific statement of expected results that contribute to the associated goal, and strategies are the general means by which the associated objectives will be met. Appendix D contains a summary table of all the goals, objectives, and strategies associated with each issue.

To be successful, the strategies identified in this plan will be accomplished in partnership with local citizens, city, county, state, and federal officials, college and university students and faculty, non-governmental organizations, and the business community. Full implementation of the strategies identified in this management plan is dependent upon administrative support for reassigning or otherwise acquiring staff, volunteers, contract services, equipment, training, and supplies. Management will seek additional administrative staffing support to process contracts and grants to expand its ability to pursue outside funding and process contracts for services.

5.2 / Issue One: Water Quality

The degradation of water quality within the St. Lucie River (SLR) and the effects of stormwater discharges on the estuarine system are well-documented (Murdock, 1954a; Haunert & Startzman, 1980, 1985; Rudolph, 1990; Graves & Strom, 1992, 1995a, 1995b; Chamberlain & Hayward, 1996; Doering, 1996; Graves et al., 2002; Graves, Wan & Fike, 2004). Primary factors affecting water quality in the SLR are the quantity, quality, timing, and distribution of stormwater runoff from urban and agricultural sources. More specifically, the system suffers from salinity imbalances, turbid water, high nutrient and sediment loading, hypoxia, and heavy metal and pesticide accumulation in the sediments (Wang, Krivan, & Johnson, 1979; Haunert, 1988; Rand, Carriger, Lee, & Pfeuffer, 2003). The consequences of these physical and chemical disturbances include fish kills, chronic fish abnormalities (fin rot, ulcerations, scoliosis, abnormal lateral lines, scale disorientation, discolored patches, live rot on body, eye and body deformities, growths, bleeding, and severe parasite infestation),

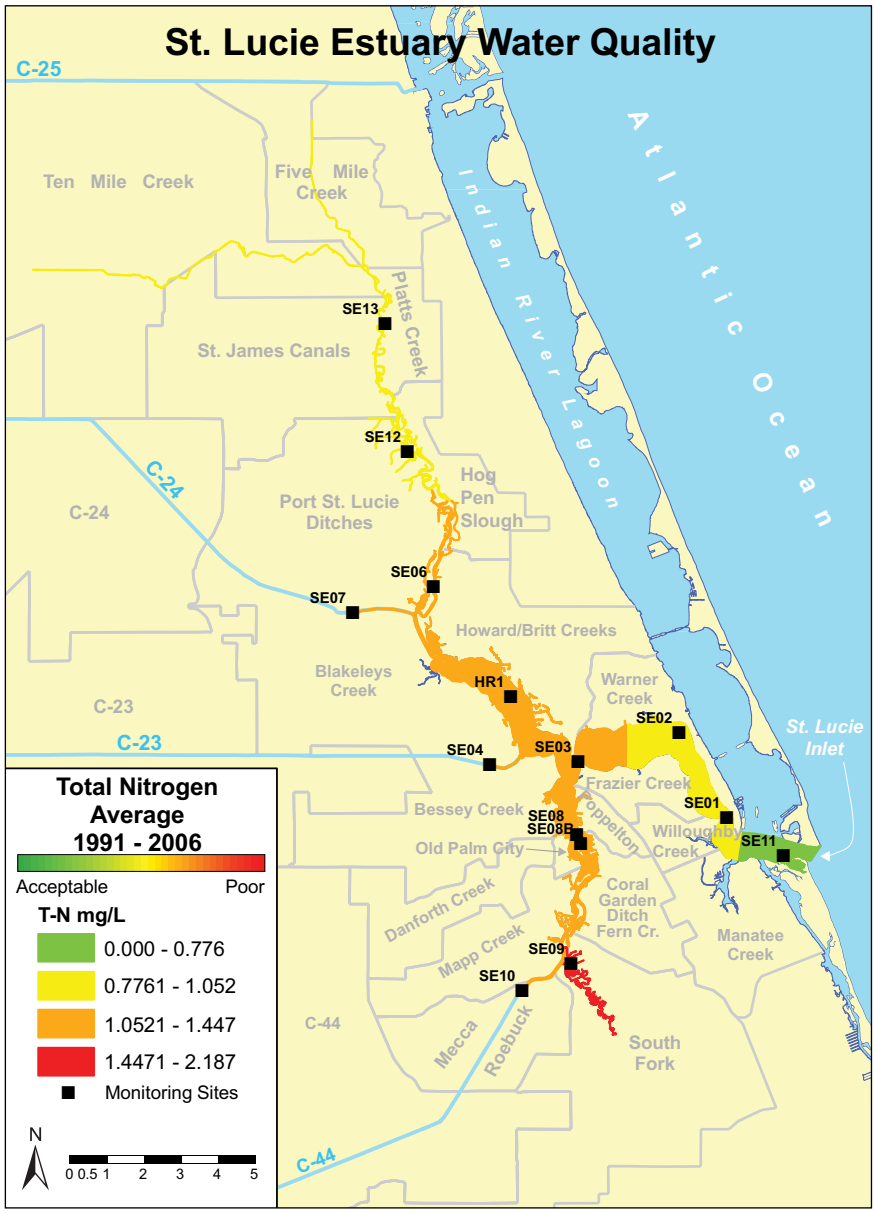


Figure 6 / Average total nitrogen in the St. Lucie River from 1991 to 2006 (SFWMD 2009).

algal blooms, a shift from nekton to plankton-dominated system, low transparency, and a lack of submerged aquatic vegetation (SAV) and oyster reefs (Murdock, 1954b; Chamberlain & Hayward, 1996; Doering, 1996; Ewing, Browder, Kandrashoff, & Kandrashoff, 2006).

The initial stormwater runoff during a rain event has the highest concentration of contaminants believed to degrade the SLR. Herr (1995) estimates that 60% of the pollutant load of nutrients (phosphorus and nitrogen) and suspended solids is contained in the first one-quarter inch of runoff, and 95% contained in the first one inch. Stormwater draining into the SLR has: 1) low levels of dissolved oxygen, 2) sediment and nutrient loads that correspond with specific land use practices (See Appendix B.5.11), and 3) heavy metals (especially arsenic from citrus groves and golf courses) and pesticides (mainly simazine from citrus groves)(See Appendix B.5.11) (Graves et al., 2004).

As a Class III waterbody, the preserve should be suitable for human recreation and maintenance of a healthy, well-balanced population of fish and wildlife (62- 302.400 F.A.C.). Poor water quality has made locals question the safety of swimming, boating, and fishing in the river (Murdock 1954b). Historically, SAV and oyster populations were located within the preserve; now they are primarily found in the middle and lower estuaries. In November 2006, 22 waterfront owners filed suit against the U.S. Army Corps of Engineers (USACE) for degrading the quality of the water in the SLR (including the preserve) which ultimately violates riparian homeowners' right to safely use and enjoy the water adjacent to their land. According to St. Lucie River Initiative members, if the case goes to trial and the riparian homeowners are compensated for their losses, all allocated funds will be used to improve water quality within the SLR (e.g. muck removal).

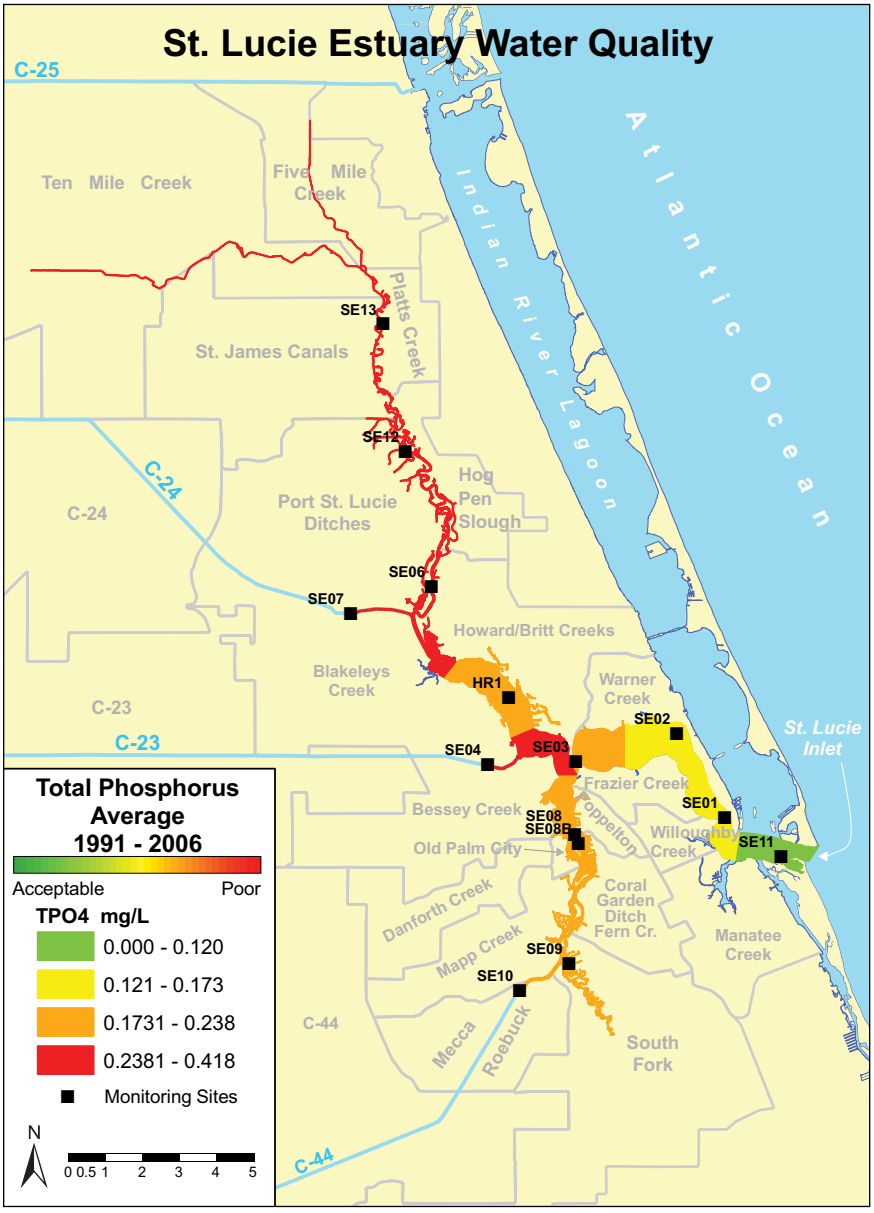


Figure 7 | Average total phosphorus in the St. Lucie River from 1991 to 2006 (SFWMD, 2009).

Large muck deposits in the SLR serve as a sink for heavy metals, pesticides, and nutrients entering the system. State water quality standards have been exceeded in the SLR for copper, lead, arsenic, zinc, ethion, diazinon, simazine, malathion, chlorpyrifos ethyl, and endosulfan (Wang et al., 1979; Haunert, 1988; Florida Department of Environmental Protection [DEP], 1999; Graves et al., 2004; Graves & Strom, 1995a; Rand et al., 2003; Rand, Schuler & Hoang, 2007). Pesticides from agricultural and urban practices have been linked to large fish kills in Ten Mile Creek (Graves & Strom, 1995a). These pesticides have also been documented in the sediments of the preserve (near Midway Road) and are believed to

have traveled downstream from the headwaters (Graves & Strom, 1995a; 1995b; Graves, 1996). Most (65%) of the wastewater residual sludge from utility operations in South Florida (Miami-Dade, Broward, Palm Beach, Martin, and St. Lucie counties) is currently disposed of in St. Lucie County through a land spreading agreement. Approximately 34,000 tons of residuals were spread in western St. Lucie County in 2004 (South Florida Water Management District [SFWMD], 2009). St. Lucie County is aware of the potential for environmental degradation associated with this process and is currently researching alternatives to land spreading (e.g. gasification). Spreading of waste materials on agricultural lands that drain into the central and south Florida canals, and ultimately the preserve, contribute to its impaired waterbody status (Graves et al., 2002; SFWMD, 2009). The long-term effects of contaminants and excess nutrients are exacerbated by episodic re-suspension events (e.g. storms) that promote release back into the water column. Removal of SLR muck formations and decreased pesticide and fertilizer application in the watershed are necessary to reduce nutrient and heavy metal loading in the SLR.

As an impaired waterbody (See Map 9) (Graves et al., 2002), the SLR is not meeting its Class III designated use to support human recreation, and propagation and maintenance of a healthy, well-balanced population of fish and wildlife (62- 302.400 F.A.C., Chamberlain & Hayward, 1996; Doering, 1996; Graves & Strom, 1995a; Graves et al., 2002). St. Lucie County Department of Health, DEP, Marine Resources Council, and Florida Oceanographic Society monitor enteric bacteria counts (bacteria that normally inhabit the intestinal tract of human and non-human animals) in the North Fork SLR. The presence of enteric bacteria (fecal coliform and enterococci) is an indication of fecal pollution, which may come from stormwater runoff, pets and wildlife, and human sewage. If they are present in high concentrations in recreational waters and are ingested while swimming or enter the skin through a cut or sore, they may cause human disease, infections or rashes (Florida Department of Health, 2007b). Health warnings were issued for the SLR because of high levels of *Enterococcus* spp. and fecal coliform bacteria from September 2004 to October 2005 (Florida Department of Health, 2007a). Belanger and Price (2007) were funded by the St. Lucie River Issues Team to quantify nutrient and bacterial contributions of waterfront on-site sewage disposal systems (OSDS or septic systems) to the SLR. Results from their study indicate that even properly functioning OSDS have the potential to exacerbate

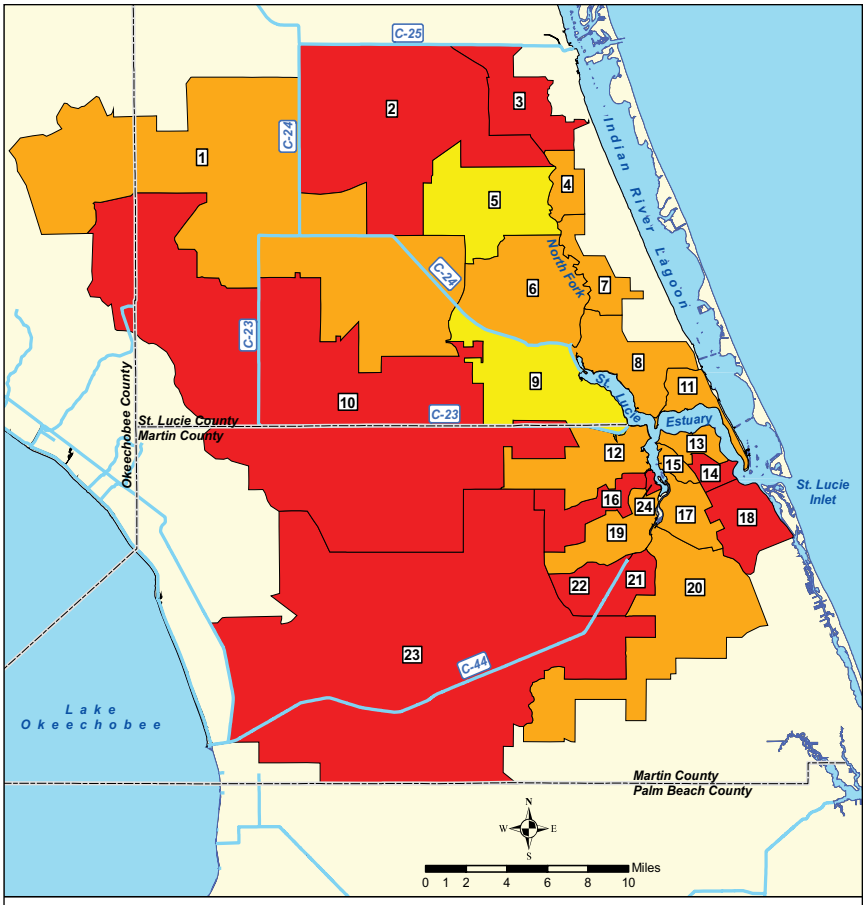


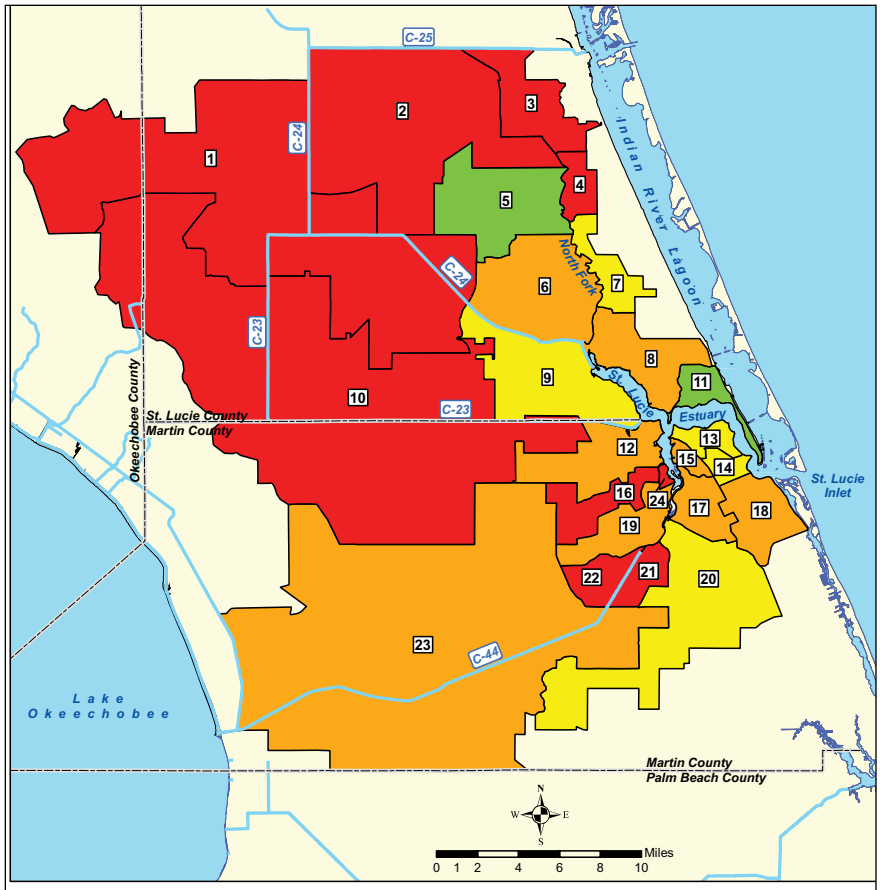
Figure 8 / Contribution of total nitrogen from each sub-basin in the St. Lucie Estuary watershed (SFWMD, 2009).

nutrient loading within the SLR (especially phosphate). However, the sandy characteristic of the soils adjacent to the drain field appear to make them effective bacteria filters which capture the coliform bacteria before it reaches the water (Belanger & Price, 2007).

The need to improve water quality within the SLR is being addressed at the state and federal levels through the development of total maximum daily loads (TMDL), an SLR Watershed Protection Plan (WPP), and the creation and implementation of a Basin Management Action Plan (BMAP).

Total Maximum Daily Loads

The development of TMDLs for the SLR is mandated by Section 303(d) of the Clean Water Act which requires that each state list those waters within its boundaries that are not meeting water quality standards applicable to such waters. Overseen by the U.S. Environmental Protection Agency, DEP is required to develop TMDLs for each water quality parameter that exceeds Class III standards for the SLR (See Appendix B.5.11 and B.5.12) (62-302.530 F.A.C). A list of the impaired basins and their anticipated TMDL development dates is located in Appendix B.5.13. Recent analysis of water quality data collected by SFWMD between 1991 and 2006 shows that average phosphorus and nitrogen levels in the SLR do not meet an acceptable level for supporting healthy biological communities (Figures 6 and 7). TMDLs are currently being developed for nutrients (nitrogen and phosphorus) and dissolved oxygen in the C-24, North St. Lucie, and Bessey Creek basins to help address this issue. Graves et al. (2004) also detected levels of copper in stormwater runoff that exceeded the set standard (See Appendix B.5.11). Risks to aquatic organisms within the preserve depend on the individual species' sensitivity, the length of exposure, and the contaminant mixture and concentration (Wilson & Foos, 2006; Schuler & Rand, 2007; Rand et al., 2007). These copper levels and other impairments will be addressed in the next rounds of TMDLs due in 2009 and 2011.



Total Phosphorus From Each Sub Basin in the St. Lucie Estuary Watershed

TPO4 mg/L

- Good (0.000 - 0.058)
- Fair (0.058 - 0.111)
- Degraded (0.111 - 0.186)
- Poor (0.186 - 0.350)

1 C-24
2 Ten Mile Creek
3 Five Mile Creek
4 Platts Creek
5 St. James Canals
6 Port SL Canals
7 Hogpen Slough
8 Britt/Howard Creeks
9 Blakleys Creek
10 C-23
11 Warner Creek
12 Bessey Creek
13 Frazier Creek
14 Willoughby Creek
15 Poppelton Creek
16 Danforth Creek
17 Coral Garden Ditch
Fern Creek
18 Manatee Creek
19 Mapp Creek
20 South Fork
21 Roebuck Creek
22 Hog Creek
23 C-44
24 Old Palm City

Figure 9 / Contribution of total phosphorus from each sub-basin in the St. Lucie Estuary watershed (SFWMD, 2009).

St. Lucie River Watershed Protection Plan

The 2007 "Northern Everglades" legislative bill (Senate Bill #392) appropriated funds to develop a WPP, watershed construction plan, and a research and water quality monitoring plan for the St. Lucie and Caloosahatchee watersheds. These plans include construction of water quality improvement

projects, investigation and implementation of pollutant control and alternative technologies, and research and water quality monitoring. The SLR WPP incorporates the restoration goals of supporting documents, such as the Indian River Lagoon – South Project Implementation Report (IRL-S PIR), the IRL Surface Water Improvement and Management (SWIM) Plan, and the IRL CCMP, and provide the basis for the BMAP by identifying and ranking many of the construction projects, pollution control measures, and water quality monitoring efforts.

Basin Management Action Plan

Once TMDLs have been developed for the sub-basins identified in Appendix B.5.13, DEP will begin working with local municipalities to draft an action plan intended to increase the dissolved oxygen levels and reduce the amount of nitrogen and phosphorus reaching the SLR. DEP and the local municipalities will identify high-priority areas using data recently analyzed by SFWMD (See Figures 8 and 9) (SFWMD, 2009). BMAP implementation will be directly linked with many of the construction projects, pollution control measures, and water quality monitoring efforts identified in the SLR WPP. Additional management actions beyond the SLR WPP will also be included in the BMAP, developed in cooperation with local stakeholders.

Additional Restoration Programs

The SLR has been targeted for restoration under the IRL-S PIR, a portion of the Comprehensive Everglades Restoration Plan (CERP) (USACE & SFWMD, 2004). An entire section of the implementation report is dedicated to the information and restoration needs of the North Fork. The IRL SWIM Plan (Steward et al., 2003) and the IRL CCMP (St. Johns River Water Management District [SJRWMD], South Florida Water Management District [SFWMD], & United States Environmental Protection Agency [USEPA], 1996) also address the immediate restoration needs of the SLR. These plans also identify restoration goals that aim toward improving the health of the SLR, not restoring the system to historic conditions. The SLR WPP will incorporate the improvement projects outlined in the IRL-S PIR, the IRL SWIM Plan, and the IRL CCMP and serve as an overall umbrella over the three documents.

St. Lucie and Martin counties and the local municipalities will need to pool resources to improve water quality in the SLR. Both St. Lucie and Martin counties are retrofitting stormwater systems, including the creation of retention ponds to treat stormwater runoff in residential neighborhoods. St. Lucie County has built a 20-acre reservoir at the Platt's Creek Restoration Area that presently collects and treats local stormwater runoff from an approximately 1,000 acre drainage basin prior to its reaching the SLR. Plans are currently being discussed to determine the best use of this parcel to improve water quality, foster scientific education and research, and provide a passive recreational outlet that focuses on the natural history, biology, and ecology of the SLR. Both counties also support the efforts set forth in the IRL-S PIR.

All IRL-S PIR restoration projects are expected to improve the quality of the SLR; however, those that most directly affect the preserve include hydrologic restoration through floodplain and oxbow reconnections, muck removal, and placement of substrate (cultch) that are capable of supporting oyster recruits. Coastal and Aquatic Managed Areas (CAMA) contracted PBS&J to develop a hydrologic needs assessment of the North Fork in 2003 and then conducted a riverbank breaching pilot study to re-hydrate floodplain wetlands within the preserve. An historic oxbow was also reconnected north of the preserve, near Platt's Creek, to help slow the flow of water and allow adequate time for suspended solids to settle before reaching areas downstream within the preserve. Reconnaisance work in the North Fork SLR was performed by Taylor Engineering in 1993 and pilot muck removal projects were conducted in 2002 (South Fork SLR and Lake Okeechobee) and 2003 (North Fork SLR) (Schropp, McFetridge & Taylor, 1994; St. Lucie River Initiative, 2004). The need to remove deep, oxygen-depleted muck layers in the lower portions of the preserve are widely agreed upon but technical, logistic, and financial problems need to be further evaluated before agencies are ready to proceed with large-scale removal efforts. Much of the historically suitable habitat in the lower North Fork has been covered over by fine grain sediments (muck) that prevent recruitment of oyster spat and establishment of SAV. Once large muck deposits have been removed and proposed sediment traps created, natural and artificial substrates will be used to promote reestablishment of oysters. As a blackwater river, the North Fork and its tributary streams contain tannins from watershed plants giving the water a brown to black color. Blackwater streams should be dark and clear. The North Fork and its streams are often brown in color

with little or no clarity because of high turbidity and nutrient loadings. The North Fork, and most of the downstream SLR, contains no SAV because of these poor water quality conditions. Projects that improve water clarity, such as those identified in the IRL-S PIR, will be the most beneficial for the re-establishment of SAV.

Routine water quality monitoring in the North Fork is being performed by local, state, and federal government agencies and non-governmental organizations but improved coordination and information dissemination among involved groups is needed. Many aquatic preserve offices around the state monitor water quality within their boundaries. Because of a well-established water quality monitoring network, the lack of suitable office space, and limited staffing, the Southeast Aquatic Preserve Field Office (SEFLAP) has expended their limited time and resources on other management areas. A more suitable role for the SEFLAP Field Office is to serve as a liaison between entities collecting water quality data. As the TMDL process and implementation of CERP restoration efforts proceed, an entity such as the SEFLAP Field Office is needed to facilitate information exchange and to help partners disseminate water quality updates in a way that promotes local knowledge. Additional staffing (one full-time position) would be necessary for the SEFLAP Field Office to fill this coordination-based role.

Water Quality (WQ)

WQ Goal 1 / **Maintain and improve water quality within and entering the preserve to meet the needs of the natural resources.**

WQ Objective 1.1 / **Regularly assess water quality conditions within the preserve and the potential impacts on natural resources.**

Integrated Strategies

WQ1.1.1 / **Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions (ecosystem science).** Water quality data in the SLR are collected by multiple agencies and non-profit groups. A water quality guide that identifies how to access raw data from each of the entities collecting water quality data will be drafted and maintained for use by the general public. Summaries produced by those collecting water quality data will allow staff to better understand water quality conditions and how these conditions may be impacting the natural resources within the preserve. Initiated Fiscal Year (FY) 2007-2008, recurring.

Performance Measures: 1. A user-friendly guide that identifies the location of water quality monitoring stations within the preserve and how to access raw data from each of the entities collecting water quality data.

WQ1.1.2 / **Identify natural and manmade sources of toxins and pathogens in the SLR (ecosystem science).** The IRL Biotoxin and Aquatic Animal Health Working Group was formed through the IRL National Estuary Program (NEP) to facilitate research, promote sharing of pertinent data, and disseminate related information to the general public. Preserve staff will support the working group by attending meetings, providing copies of related literature to the coordinating entity, St. Johns River Water Management District (SJRWMD), and disseminating learned information to the public though outreach events. Initiated FY 2007-2008, recurring.

Performance Measures: 1. IRL NEP sponsored IRL Biotoxin and Aquatic Animal Health Working Group meeting summaries.

WQ Objective 1.2 / **Protect natural resources by restoring altered areas that contribute to low water quality conditions within the preserve.**

Integrated Strategies

WQ1.2.1 / **Reconnect artificially isolated oxbows and floodplain habitat (resource management).** Hydrologic restoration projects, such as oxbow and floodplain reconnection, will be implemented to increase the residence time of water entering the North Fork. Using the foundation provided by PBS&J (2003) and St. Lucie County (SLC) Mosquito Control District, a multi-agency team was formed in 2008 to compile information and rank the identified restoration projects (See Appendix B.5.2) (Herren et al.,

in prep). Biological and water quality monitoring, similar to that performed at the pilot reconnection sites (See Map 22), will also be conducted for one year pre-construction and for at least three years after completion of all large-scale hydrologic restoration projects. An annual progress report will be submitted to the permitting agency and partners each year. Initiated FY 2002-2003, recurring.

Performance Measures: 1. Completion of a technical report that uses the historic (1919) rivercourse, Light Detection and Ranging (LiDAR) data, and site-specific information to identify and rank hydrologic restoration sites within the North Fork SLR and its headwaters, Ten Mile Creek (See Appendix B.5.2). 2. Annual progress reports associated with pre- and post-biological and water quality monitoring at hydrologic restoration sites (minimum three years of post-restoration monitoring).

WQ1.2.2 / Stabilize eroding shorelines using natural materials and appropriate native plants (resource management). Preserve staff will implement projects to reduce shoreline erosion. Shoreline stabilization projects will include gradation and planting along the eroding shoreline, planting of submergent and emergent vegetation (See Appendix B.5.10), and quarterly monitoring. An annual progress report will be produced for each stabilization site. Once submergent and emergent vegetation are established, biological monitoring will be conducted to document species use and abundance. FY 2010-2011, recurring.

Performance Measures: 1. Completion of a technical report that identifies and ranks shoreline stabilization sites within the preserve and provides a preferred species list for use in the restoration process (See Appendix B.5.10). 2. Annual progress reports for growth and biological and water quality monitoring for at least three years post-project completion.

WQ1.2.3 / Restore oyster reefs to historic structure and function using natural, biodegradable materials (resource management). Oyster reef habitat maps for the SLR date back to the 1940s (See Map 18). These historic maps and current field conditions should be used to guide future oyster reef restoration plans. Use of loose oyster shell when appropriate is preferred. When material is necessary to hold oysters in place (e.g. oyster bags), CAMA will support the use of natural, biodegradable materials within the preserve. FY 2010-2011, recurring.

Performance Measures: 1. Annual progress reports that indicate the success of the project (for a minimum of three years).

WQ1.2.4 / Support restoration efforts that will promote reestablishment of submerged grasses (resource management). Although historically present, submerged grasses were last seen in the preserve in 2002 (See Map 18) (Robbins, 2005). Supporting plans (drafted and in prep), including the IRL-S PIR, IRL SWIM, IRL CCMP, SLR WPP, and SLR BMAP, identify the need to improve water quality for the benefit of such natural resources as submerged grasses. Current SLR SAV targets include expansion of seagrass beds to cover all areas less than 1.0 meter in depth (SRWMD), 2007a). Initiated FY 2002-2003, recurring.

Performance Measures: 1. Letters of support, meeting summaries or active participation in water quality improvement projects within the preserve and its watershed.

WQ1.2.5 / Support large-scale muck removal projects within the SLR (resource management). Removal of 7.9 million cubic yards of muck has been identified as a priority in the IRL-S PIR (2004) to improve water quality conditions and promote establishment and growth of oysters and seagrass within the Middle Estuary and North and South Forks of the SLR. Pilot muck removal projects were completed in 2002 in the South Fork and 2003 in the North Fork to help streamline the process for larger-scale projects. Preserve staff will draft letters of support to agencies for the removal of muck in the preserve as it is expected to increase the amount of suitable substrate necessary for seagrass and oyster recruitment in the lower portions of the preserve (Kitching Cove to Bessey Creek). Initiated FY 2008-2009, recurring.

Performance Measures: 1. Letters of support to agencies for the removal of muck in the preserve.

WQ1.2.6 / Actively support Northern Everglades restoration efforts that will benefit the preserve (resource management). The IRL-S PIR restoration projects are aimed at restoring the North Fork SLR floodplain. These projects will improve the quality of water entering the preserve from the

watershed and create habitat, such as oyster reefs, that will improve the quality of water located within the SLR. Preserve staff will work with partners to support proposed projects by attending meetings, providing comments and recommendations, and drafting letters of support for restoration projects. This includes playing an active role in the adaptive management of the Northern Everglades performance measures for salinity, water quality, oyster habitat, benthic macroinvertebrates, SAV, and fish (South Florida Water Management District [SFWMD], 2007c). Initiated FY 2004-2005, recurring.

Performance Measures: 1. Written comments that facilitate adaptive management of the Northern Everglades performance measures. 2. Letters of support or active participation in restoration projects identified by the IRL-S PIR.

WQ1.2.7 / **Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon (resource management).** Preserve staff will review and comment on: 1) CERP documents that affect the North Fork SLR, especially the North Fork Floodplain Restoration Plan projects identified in the IRL-S PIR (USACE and SFWMD 2004), 2) TMDL development and drafts of the BMAP for the North Fork SLR, 3) urban and agricultural best management practices (BMP) documents, 4) IRL CCMP revisions, 5) SLR WPP drafts from SFWMD, 6) local comprehensive plan revisions for St. Lucie County (originally adopted in 1990 with two revisions - 2002 and 2004), Port St. Lucie (originally adopted in 1990 with two revisions-1998 and 2007), Martin County (originally adopted in 1990) and Stuart (originally adopted in 2002 and codified in 2005), and 7) other relevant plans that may arise. Preserve staff will also support St. Lucie County's effort to identify feasible alternatives to land spreading of nutrient-rich utility waste within the preserve watershed. Initiated FY 2008-2009, recurring.

Performance Measures: 1. Formal comments encouraging the incorporation of SLR restoration strategies into relevant protective plans. 2. Letters of support for feasible alternatives to land spreading practices within the watershed.

WQ Objective 1.3 / **Reduce water quality impacts caused by stormwater and septic system sources within the watershed.**

Integrated Strategies

WQ1.3.1 / **Inventory stormwater retrofit systems to help identify future improvement needs (resource management).** Preserve staff will facilitate coordination among the city of Port St. Lucie, St. Lucie County, city of Stuart, and Martin County to document collective retrofit efforts, identify gaps, and prioritize future needs for the cross jurisdictional preserve watershed boundary. Geographic information systems (GIS) shapefiles that document collective retrofit efforts within the watershed will be requested from local government and municipalities. Preserve staff will then produce maps that show cumulative accomplishments and future needs. Preserve staff will also work with local governments and homeowner associations to identify large (one acre or larger) retention ponds adjacent to the preserve that could be enhanced to filter nutrients, provide habitat for wildlife, and improve the aesthetics of the neighborhood. FY 2011-2012, 2 years.

Performance Measures: 1. GIS map that identifies gaps and clearly shows cumulative accomplishments and future needs. 2. List of large (greater than one acre) retention ponds adjacent to the preserve that could be enhanced to filter nutrients, provide habitat for wildlife, and improve the aesthetics of the neighborhood.

WQ1.3.2 / **Form a working group to address stormwater drainage issues and relevant best management practices (resource management).** A water quality working group with representatives from University of Florida's (UF) Institute of Food and Agricultural Sciences (IFAS), local governments, utilities, water control districts, and other appropriate entities will be formed to help address local urban and agricultural stormwater issues and provide achievable recommendations for improving current conditions. The working group will meet on an annual basis to help preserve staff facilitate information exchange and general understanding of current conditions at the watershed level. Information exchanged during the meetings and subsequent meeting summaries will be used to identify and prioritize future needs. Lists of priority projects will be evaluated and adjusted during each annual meeting. FY 2012-13, recurring.

Performance Measures: 1. Establishment of a water quality working group that collectively produces a list of priority stormwater projects.

WQ1.3.3 / Promote the standardization of local stormwater drainage ordinances (resource management). A meeting with St. Lucie County, Port St. Lucie, Fort Pierce, Stuart, and Martin County representatives will be organized to discuss current stormwater drainage ordinances. The focus of the meeting will be to document which ordinance components are effective and which may need to be adjusted for each entity and then discuss ways to standardize across jurisdictional boundaries. A summary report with recommendations will be drafted and distributed to local government agencies. A follow-up meeting will be scheduled to document changes that have been incorporated since the initial meeting. FY 2010-2011, recurring, as necessary.

Performance Measures: 1. Summary report from the local ordinance meeting with recommendations to local agencies.

WQ1.3.4 / Encourage local governments to convert high-priority areas to sewer (resource management). Preserve staff will facilitate coordination among local municipalities to document location of sewer mains and supported areas, identify gaps, and prioritize future needs for the cross-jurisdictional preserve boundary. Once priorities have been identified, preserve staff will meet with local utility managers and local and state regulatory staff to discuss the need to convert high priority areas from on-site sewage disposal systems (OSDS or septic systems) to sewer, document limiting factors that could prevent conversion, and help find solutions. FY 2010-2011, recurring.

Performance Measures: 1. Summaries from meetings with local utility managers and local and state regulatory staff to discuss the need to convert high priority areas to sewer.

WQ1.3.5 / Promote best management practices (BMPs) that maintain or improve water quality (resource management). UF IFAS develops BMP guidelines for all agricultural commodities, which are implemented through the efforts of the Florida Department of Agriculture and Consumer Services, Office of Agricultural Water Policy. Regulatory staff review permit applications for various upland and inwater construction projects and are routinely exposed to new BMP technologies for urban redevelopment. Urban areas within the St. Lucie watershed are also permit-holders under the National Pollutant Discharge Elimination System (NPDES), Municipal Separate Storm Sewer System program. This program is implemented entirely through the use of BMPs to control the impacts of urban stormwater upon water resources. Preserve staff will coordinate with UF IFAS, regulatory staff at DEP and SFWMD, and local NPDES coordinators to maintain a current understanding of the available BMPs and their effectiveness. FY 2010-2011, recurring.

Performance Measures: 1. Summaries from meetings with UF IFAS, DEP and SFWMD regulatory staff, and local NPDES coordinators that result in a maintained list of available agricultural and urban best management practices scientifically demonstrated to improve water quality in the North Fork SLR and its watershed.

WQ Objective 1.4 / Protect lands to conserve the water quality and natural resources of the preserve.

Integrated Strategies

WQ1.4.1 / Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources (resource management). Much of the buffering land along the North Fork and Ten Mile Creek are in the public trust, and help to improve the quality of the SLR (See Map 15) but additional undeveloped or minimally-developed private parcels are available for acquisition (See Appendix B.5.9). A multi-agency team will be established to rank the parcels and produce a priority list which will be used to support management decisions. Preserve staff will draft letters of support for land acquisition projects along the preserve and its headwaters. Initiated FY 2008-2009, recurring.

Performance Measures: 1. Prioritized list of parcels with an associated database. 2. Letters of support for land acquisition projects along the preserve and its headwaters.

WQ Goal 2 / **Increase public awareness about water quality issues within the preserve.**

WQ Objective 2.1 / **Inform the public and partners about water quality conditions within the preserve.**

Integrated Strategies

WQ2.1.1 / **Distribute water quality information to the public and partners (education and outreach).** Multiple agencies and non-profit groups are collecting water quality data within the preserve (See Appendix B.5.6). Preserve staff will coordinate with entities collecting water quality data to help accurately disseminate information in a way that promotes local knowledge. Available media resources (e.g. local television, local radio, PowerPoint presentations, handouts) and active, hands-on opportunities will be used to maximize educational efforts. Recommendations to help improve the quality of water within the preserve will be included in all education and outreach activities. FY 2011-2012, recurring.

Performance Measures: 1. Current condition summaries that can be disseminated to the public.

WQ Objective 2.2 / **Facilitate knowledge and understanding of how activities in the watershed impact the preserve.**

Integrated Strategies

WQ2.2.1 / **Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students (education and outreach).** A PowerPoint presentation will be created to highlight the progression of watershed alteration including residential development and drainage projects, current urban and agricultural practices, how these actions directly affect the health of the system, species that utilize the North Fork SLR, and recommendations for river-friendly alternatives to traditional practices. Urban interest groups will be targeted through the Association of Homeowners' Associations in St. Lucie County and select Martin County homeowner associations. Agricultural interests will be targeted through UF IFAS. Presentations will also be delivered to appropriate businesses, academic institutions, and environmental groups. Initiated FY 2008-2009, recurring.

Performance Measures: 1. Delivery of PowerPoint presentations to homeowners associations, businesses, academic institutions, and environmental groups.

WQ2.2.2 / **Provide educational boat tours to inform the public about the effect of watershed practices on the preserve's natural resources (education and outreach).** Partnerships with eco-tour operators (pontoon boat and paddle craft) will be formed to organize two boat tours within the preserve each year to discuss the effect of watershed practices (urban and agricultural) on the preserve's natural resources. FY 2013-2014, recurring.

Performance Measures: 1. Sign in sheets from tours.

WQ2.2.3 / **Reactivate the Stewards for the Southeast Florida Aquatic Preserves, Inc. Citizen Support Organization (education and outreach).** Stewards for the Southeast Florida Aquatic Preserves, Inc. Citizen Support Organization (CSO) was established in 1996 to: 1) increase awareness of the aquatic preserve program and issues that affect it, 2) foster stewardship in the volunteers and members, and 3) assist the staff with implementing the aquatic preserve management plans through environmental education and outreach, resource management, ecosystem science, and public use. The Stewards for the Southeast Florida Aquatic Preserves, Inc. CSO has been in inactive status since 2004. Preserve staff will reactivate the CSO and promote prolonged success by meeting all requirements, including submission of annual reports, prior to the established deadlines. Once reactivated, it is anticipated that Stewards for the Southeast Florida Aquatic Preserves, Inc. will help preserve staff reach the goals outlined in this Plan. FY 2011-2012, 1 year.

Performance Measures: 1. Meeting summaries.

WQ2.2.4 / **Create and promote a *Homeowner's Guide to Living on the North Fork SLR Aquatic Preserve* (education and outreach).** Preserve staff will research, draft, print, and distribute an educational package that includes environmentally responsible alternatives to traditional practices for riparian homeowners within the preserve watershed. Associated materials will

include recommendations for retention of stormwater, native landscaping and lawn care that span the wide salinity range (fresh to brackish) along the preserve, alternatives for cleaning docks and boats, watershed history that highlights alterations and their effects on the SLR, a preserve boundary map, a list of phone numbers for common questions and concerns, information on how to minimize individual carbon footprints, and a list of volunteer opportunities within the preserve. The Homeowner's Guide will support such existing programs as the Florida Yards Program and DEP's boat and dock BMPs. Packages will be distributed by local volunteers and staff at a workshop designed to provide hands-on opportunities to promote the information presented in the guide. Packages will also be distributed at outreach events and meetings with homeowners' associations. Funds will be requested from the IRL License Plate Trust Fund (SFWMD) or the IRL NEP (SJRWMD) for materials and printing. Preserve staff will also organize a workshop with hands-on demonstrations and vendors that support the information incorporated into the *Homeowner's Guide to Living on the North Fork SLR Aquatic Preserve*. FY 2010-2011, 1 year.

Performance Measures: 1. Copy of the *Homeowner's Guide to Living on the North Fork SLR Aquatic Preserve*. 2. Organization of a workshop with hands-on demonstrations and vendors that support the information incorporated into the homeowners guide.

WQ2.2.5 / **Inform students about local issues (education and outreach).** Educational materials will be provided to SLC Oxbow Eco-Center and the Savannas Preserve State Park Education Center to help educate students (K-12) about watershed and natural resource issues within the SLR. Presentations regarding local issues will also be prepared for college students and advertise presentation dates and times through contacts in the Indian River State College (IRSC) and Florida Atlantic University (FAU) Natural Science Departments. FY 2013-2014, recurring.

Performance Measures: 1. Educational materials provided to SLC Oxbow Eco-Center and the Savannas Preserve State Park Education Center. 2. Sign-in sheets for PowerPoint presentations highlighting local issues delivered to IRSC and FAU students.

WQ2.2.6 / **Expand the Indian River Lagoon drain stenciling and signage program in highly developed areas adjacent to the preserve (education and outreach).** A list of appropriate drain stenciling sites acceptable by local homeowner associations and local governments will be prepared by preserve staff. Grant proposals will be submitted for funding by the IRL License Plate Trust Fund (SFWMD), the IRL NEP (SJRWMD), or the St. Lucie River Initiative Team for services. FY 2014-2015, 1 year.

Performance Measures: 1. Grant proposals submitted to complete identified drain stenciling needs.

5.3 / *Issue Two: Natural Resource Management*

Management within the North Fork SLR has been limited since the adoption of the 1984 management plan primarily because of the lack of resources (i.e. funding and staffing) coupled with a large geographic area of responsibility (encompassing four aquatic preserves and one buffer preserve). In 2004, management authority of all state buffer preserves, including the North Fork St. Lucie River Buffer Preserve, was transferred to the state park system overseen by DEP's Division of Recreation and Parks (DRP). To date, most of CAMA's management activities along the SLR have focused on the North Fork SLR Buffer Preserve (until 2004, when management authority was turned over to Savannas Preserve State Park), regulatory review of permit applications, site inspections, educational outings, and more recently, biological surveys and restoration. Most agencies with jurisdiction along the SLR currently focus on water quality monitoring and status and health of valued ecosystem components, such as SAV and oysters in the southern end of the preserve. SFWMD is also modeling water quality and the salinity envelope. In 2008, SFWMD initiated a floodplain vegetation study that is to be modeled after a similar project along the Loxahatchee River floodplain. Although the SLR collectively receives much attention, additional mapping and monitoring efforts are still needed to properly manage the natural resources within the preserve.

Creation of habitat maps that identify type, location, and extent of habitats within the preserve is essential for protection of natural resources and are fundamental for future management within the preserve. Habitat maps lay the foundation necessary for natural resource managers to properly manage protected areas. These maps are an essential tool in understanding and protecting species-

Sailfin molly (Poecilia latipinna) *captured at a hydrologic restoration site.*

habitat interactions. Only three data sources are currently available to create a NFSLRAP - specific habitat map (excluding the adjacent buffering lands). The first is a habitat map that was created using FNAI classifications for the North Fork SLR Buffer Preserve in 2003 before management authority was transferred to DEP's DRP (DEP, 2003). The boundary of the buffer preserve was located at mean high water so some sections of this map were used to map habitats within the aquatic preserve. The second is from a 2003 oyster reef mapping effort funded by SFWMD. The third is a seagrass mapping effort conducted in 2007 (Ibis Environmental, Inc., 2007). Remaining mapping needs include the documentation of current oyster reefs (live, dead, and potentially suitable habitat for restoration/ creation efforts), mangrove fringe, clam beds, and non-seagrass submergent and emergent vegetation. Mapping of these productive habitats will help to establish a baseline from which to measure change. It is important to note that seagrass was historically present in the North Fork SLR but has not been documented since 2002 (Robbins, 2005; See Map 17). Reestablishment of grasses within the preserve is a priority. Once reestablished, regular (<3 year) mapping efforts will be necessary to manage and protect this important resource.

As a tidally connected tributary to the IRL, the SLR provides habitat for a variety of commercially important, listed, and rare aquatic species. Natural resource managers need more documentation of species-habitat associations to help protect the resources within the preserve. A species list created for the 1984 management plan has been carefully updated to include additional species documented in the adjacent buffering lands (through CAMA and Division of Recreation and Parks, in the Department of Environmental Protection), peer reviewed literature, and personal communication with local experts. Although documentation and maintenance of the species list for the preserve is important, there is a need for preserve staff to use ArcGIS software to analyze, better understand, and disseminate information regarding the interactions between particular habitats and species of concern (native and non-native) for natural resource protection.

Communication between CAMA and regulatory staff will heighten awareness and improve natural resource protection within the preserve. Regulatory staff is encouraged to communicate with preserve staff regarding permit applications for submerged land leases and construction projects within the preserve. Conversely, preserve staff should provide available data collected from monitoring and mapping efforts to inform regulatory staff of current and historic conditions at the proposed project site. Preserve staff should also assist regulatory officials by suggesting public interest projects that will have the most benefit.

Expansion of natural resource monitoring through a collaborative effort among preserve staff, academic institutions, commercial fishermen, and volunteers is necessary to document current natural resource conditions within the preserve. Periodic monitoring of the natural resources by preserve staff began in 2002 with fish and invertebrate sampling at recent hydrologic restoration sites, nesting surveys at the Mud Cove rookery, and annual Audubon Christmas Bird Counts along the North Fork SLR. Little information is known about most populations, including those monitored to date utilizing the preserve. New partnerships and internal monitoring programs will focus on monitoring great land crab populations (which also support the rare mangrove rivulus), opossum pipefish, oysters, and SAV. Sound monitoring programs will support CERP restoration efforts by establishing a baseline for comparison with post-restoration data.

Natural Resource Management (NR)

NR Goal 1 / **Document the natural resources within the preserve.**

NR Objective 1.1 / **Establish a baseline of the current locations, extents, and conditions of the different habitat types.**

Integrated Strategies

NR1.1.1 / **Survey and map each habitat type located within the preserve (ecosystem science).** FNAI natural land maps are not complete for the preserve. Partial FNAI maps, created by CAMA staff in 2003, are available for the historic North Fork SLR Buffer Preserve and include some mangrove (tidal swamp) habitat located within the preserve. Fundamental management needs for the preserve include mapping of oyster reef habitat (last mapped in 2003), mangroves (partial mapping in 2003 by DEP CAMA), submergent and emergent vegetation (seagrass last mapped 2007), and clam beds. Seagrass was historically present in the North Fork SLR but has not been documented since 2002 (See Map 18) (Robbins, 2005). Reestablishment of grasses within the preserve is a priority. Once reestablished, regular (<3 year) mapping efforts are necessary to manage this important resource. Mapping needs will be presented to regulatory staff as public interest projects (18-20 F.A.C.), performed by other agencies, or preserve staff will request funds through the St. Lucie Issues Team, the IRL NEP, and the IRL License Plate Trust Fund to perform the work. FY 2010-2011, 3 years.

Performance Measures: 1. Collective GIS-based natural lands (FNAI) map for the area within the preserve boundary.

NR1.1.2 / **Ground-truth habitat maps on a five-year cycle (ecosystem science).** Once FNAI maps are created for the preserve, maps should be ground-truthed every five years to document change over time. Regular accuracy checks will improve preserve staff's ability to make educated management decisions and protect natural resources. FY 2015-2016, 3 years.

Performance Measures: 1. Updated GIS-based habitat maps for the area within the preserve boundary.

NR Objective 1.2 / **Associate aquatic species, especially rare and protected species, with specific habitats located within the preserve.**

Integrated Strategies

NR1.2.1 / **Develop a GIS database and maps that link aquatic species locations to specific aquatic habitats (ecosystem science).** The consolidated FNAI natural lands map will serve as a base layer in ArcGIS for overlaying aquatic species sighting data. This will ultimately facilitate understanding of species-habitat association patterns and improve protection efforts. Documentation of these associations, especially when working with rare, listed, and commercially important species, will help justify the need for protection when reviewing permit applications for construction activities within the preserve. Association maps will also provide preserve staff with the necessary documentation to better understand and comment on the cumulative impacts of permitted projects on natural resource communities (i.e. seagrass, oyster, emergent vegetation) and individual species (i.e. opossum pipefish or mangrove rivulus) with specific habitat requirements within the preserve. FY 2011-2012, 1 year.

Performance Measures: 1. Waypoint list (including date, species, and observer) for collected/observed rare and listed aquatic species. 2. GIS map with species sighting data overlain on the FNAI natural lands map.

NR1.2.2 / **Maintain a comprehensive species inventory (resource management).** The existing species inventory database (including source data) will be maintained by preserve staff as new species are documented in the preserve. Species may be documented through peer-reviewed literature, personal observations from preserve staff or other users, and photographs. To ensure accuracy, preserve staff will verify newly documented species within the preserve. The species list will be available on the NFSLRAP website and from the SEFLAP Field Office. Initiated FY 2007-2008, recurring.

Performance Measures: 1. Annually updated species list for the preserve posted on the NFSLRAP website.

NR Objective 1.3 / **Monitor changes to the resources resulting from Northern Everglades restoration efforts.**

Integrated Strategies

NR1.3.1 / **Map the location of the estuarine-freshwater transition zone of the North Fork St. Lucie River every two years (ecosystem science).** The salinity regime in the preserve is severely altered, and naturally estuarine conditions in the lower portion of the preserve can rapidly fluctuate from estuarine to freshwater within days because of water management practices. SFWMD has modeled the salinity envelope and expects, with the construction of CERP restoration projects, to restore historic (pre-drainage) salinity regimes to the SLR. The current estuarine-freshwater transition zone is just north of the Prima Vista Boulevard. This transition area will be documented using Global Positioning System (GPS), and vegetation maps (e.g. swamp lily versus red mangrove). This transition zone should be evaluated every two years to document changes. This will set the baseline condition and help to record changes as restoration efforts to restore the salinity regime are implemented. FY 2009-2010, recurring.

Performance Measures: 1. GIS maps showing the vegetation-based estuarine-freshwater transition zone.

NR1.3.2 / **Document seagrass and oyster recruitment sites within the preserve (ecosystem science).** Seagrass and oyster recruitment are expected to occur in the southern portion of the preserve as CERP restoration projects, such as muck removal and capture and treatment of stormwater, are implemented. Section 3.3.3.3 of the Research, Coordination, and Verification (RECOVER) Monitoring and Assessment Program specifies SAV mapping to document coverage and variability of that coverage to help establish the pre-CERP reference state for SAV in the SLR. Preserve staff will help document current (shifted baseline) conditions so that recruitment of these species can be documented and protected. FY 2015-2016, recurring.

Performance Measures: 1. GIS maps that show changes in seagrass and oyster reef cover within the preserve.

NR Goal 2 / **Implement management practices that maintain or improve viable habitats and populations within the preserve.**

NR Objective 2.1 / **Establish and implement routine biological monitoring programs for essential habitats and rare and listed species.**

Integrated Strategies

NR2.1.1 / **Monitor bird rookeries (ecosystem science).** All nesting colonies and nesting activities (abundance and diversity) within the preserve will be documented on a monthly basis each nesting season. Preserve staff will use a data collection method (datasheet) that will facilitate comparison with other nesting data collected around the state. Data collected from rookeries will be analyzed and distributed to the Savannas Preserve State Park office, Florida Fish and Wildlife Conservation

Commission (FWC), U.S. Fish and Wildlife Service, St. Lucie and Martin county Audubon Society chapters, and other interested parties. Presentations will be delivered to St. Lucie and Martin County Audubon chapters to educate and facilitate informational exchange. Initiated FY 2006-2007, recurring.

Performance Measures: 1. Annual monitoring summaries.

NR2.1.2 / **Monitor great land and fiddler crab locations and densities (ecosystem science).** A need has been identified by the National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) to document the correlation between great land and fiddler crab (*Uca* spp.) burrows and mangrove rivulus, a federally listed species of special concern (SCC). Great land crab populations are declining in southeast Florida because of habitat destruction and direct human interactions (vehicle mortality and harvest). This species is located in and relies upon the preserve for reproduction. Little is known about the great land and fiddler crab populations within the preserve or the association of local populations of these species and the rare mangrove rivulus. Some of the locations that support great land crabs, and potentially mangrove rivulus, are small pocketed depressional wetlands that may be visible only on aerial photographs or from the air. Preserve staff will look at FNAI maps and aerial photographs to identify potential sites that need to be looked at from the air. Once a list of potential sites is created, staff will visit the sites during the active summer months to look for these species. Once the sites have been selected, preserve staff will document great land and fiddler crab locations and densities using a methodology that will facilitate the comparison of population data collected by other great land crab researchers in Florida and the Caribbean. These sites will serve as a foundation for establishing a monitoring program for the mangrove rivulus. FY 2011-2012, 3 years.

Performance Measures: 1. Creation of a monitoring spreadsheet to document great land and fiddler crab densities (using a methodology that will facilitate the comparison of population data collected by other great land crab researchers in Florida and the Caribbean).

NR2.1.3 / **Monitor mangrove rivulus populations at sites documented to support great land and fiddler crabs (ecosystem science).** Great land and fiddler crab sites identified in the previous strategy will be used as a foundation for establishing a monitoring program for the mangrove rivulus. Staff will work with Dr. Scott Taylor to design the sampling equipment (traps and nets) and to refine the sampling protocol for the North Fork SLR. FY 2012-2013, 2 years.

Performance Measures: 1. Paper submitted to a peer-reviewed journal that highlights the correlation between great land and fiddler crab burrows and mangrove rivulus (a federal SCC) in the North Fork SLR.

NR2.1.4 / **Document and monitor fish aggregation, spawning, and recruitment sites within the preserve (ecosystem science).** Spawning and aggregation sites for commercially important species of drum have been documented in the middle estuary of the SLR and the preserve, which provide essential nursery grounds for these and other commercially important and rare fish species. Preserve staff are responsible for communicating with ichthyologists to document and protect important spawning, aggregation, and preferred nursery sites. The opossum pipefish, a federal SSC, migrates from the Atlantic Ocean through St. Lucie Inlet to spawn in select species of emergent freshwater vegetation. Preserve staff will document and advocate protection of spawning sites for opossum pipefish and other rare species with specific habitat requirements. FY2010-2011, recurring.

Performance Measures: 1. GIS map identifying locations of important aggregation, spawning, and recruitment sites.

NR2.1.5 / **Monitor benthic community structure (ecosystem science).** Preserve staff will support location, mapping, and monitoring efforts for all benthic community structure (e.g. oyster reef, submerged grasses, clam beds, etc.) within the preserve. These efforts are currently being conducted by FOS, FWC, and SFWMD and monitoring protocols may vary. FY2010-2011, recurring.

Performance Measures: 1. Written protocols for monitoring the different benthic habitats within the preserve.

NR2.1.6 / Assist partners with natural resource monitoring efforts (ecosystem science). RECOVER subteams are responsible for determining the most effective way to monitor the success of CERP restoration projects. The key to determining this success is to establish the current baseline, although shifted, on which to compare future monitoring efforts. Thus, several research and monitoring activities are in place in the SLR to establish baseline conditions for the implementation of the regional component of CERP, the IRL-S restoration projects. Preserve staff will continue to assist with all CERP-related monitoring within the preserve, especially floodplain vegetation monitoring conducted through SFWMD, and seagrass, fish, oyster, and other invertebrate monitoring. Initiated FY1986-1987, recurring.

Performance Measures: 1. Staff time dedicated to non-CAMA initiated natural resource monitoring within the preserve, especially baseline CERP/IRL-S projects such as floodplain vegetation monitoring, oyster reef, seagrass, fish, and other invertebrate monitoring.

NR2.1.7 / Collaborate with academic institutions to meet research and monitoring needs (ecosystem science). A list of research needs necessary to address management questions within the preserve will be created and maintained by preserve staff. Meetings will be held with professors and scientists at IRSC, FAU, Harbor Branch Oceanographic Institute, Smithsonian Institution Marine Field Station at Fort Pierce, UF, and other academic institutions to discuss research needs and funding opportunities. FY 2009-2010, recurring.

Performance Measures: 1. Summaries from meetings with professors and scientists at academic institutions.

NR Objective 2.2 / Synthesize and distribute species and community data to inform policy, regulatory, and natural resource management decisions.

Integrated Strategies

NR2.2.1 / Establish a program to collect information from researchers and commercial fishermen within the preserve (resource management). A program was implemented in Florida's state parks in which researchers collecting data on these public lands are required to complete a non-regulatory permit application which would help managers document the work and obtain a copy of the written reports to make educated management decisions about the resources within the park. A similar voluntary-based program has been established at Rookery Bay National Estuarine Research Reserve in Naples. Staff will use these existing documents to create a similar research form that local and visiting scientists can voluntarily complete to help the preserve manager document research being conducted within the preserve. The completed research/collection application will be promoted on the preserve website, via e-mail, and at meetings. The ultimate goal of this strategy is to increase communication among scientists and natural resource managers by serving as a clearinghouse for information exchange and dissemination. FY 2016-2017, 2 years.

Performance Measures: 1. A non-regulatory, voluntary research/collection application form designed to help the preserve manager document research, monitoring, and collection/harvest being conducted within the preserve.

NR2.2.2 / Provide resource updates to regulatory staff issuing permits within or adjacent to the preserve (resource management). Preserve staff will create an e-mail distribution list comprised of key local, state, and federal regulatory staff to facilitate frequent communication. Updates will include information relevant to permitted projects, sensitive resources, cumulative effects, new resource mapping efforts, and potential mitigation and public interest projects. PowerPoint presentations regarding multi-component restoration efforts that may be used as mitigation or public interest projects will also be delivered to communicate existing preserve needs. Preserve brochures will be provided to the DEP, SFWMD, and county regulatory offices for distribution to permit applicants. FY 2011-2012, recurring.

Performance Measures: 1. Delivery of PowerPoint presentations aimed at informing regulatory staff of potential mitigation and public interest projects and resource maps and data that may be useful in the application review process.

NR Objective 2.3 / Document and reduce the abundance and diversity of non-native aquatic species within the preserve.

Integrated Strategies

NR2.3.1 / Create a non-native species database and sightings map (resource management). A non-native species sighting database that includes waypoints, the observer, and observation date will be created and maintained. Species sighting data will be overlain on natural lands (habitat) maps to better understand habitat association for each non-native species within the preserve. FY2013-2014, one year.

Performance Measures: 1. A non-native species sighting database. 2. GIS map showing location data and the associated habitat within the preserve.

NR2.3.2 / Assist other agencies in controlling non-native aquatic species (resource management). DEP and FWC are the lead agencies for control and eradication of many non-native plants and animals. Preserve staff will work with government agencies, non-profit organizations, and community groups to identify, inform, and implement eradication strategies for non-native species, especially priority invasive non-native species. FY2015-2016, recurring.

Performance Measures: 1. Staff time dedicated to working with government agencies, non-profit organizations, and community groups to implement non-native plant and animal control strategies within the preserve.

NR Goal 3 / Protect the preserve's natural resources at an ecosystem scale.

NR Objective 3.1 / Work with partners to protect the preserve's headwaters.

Integrated Strategies

NR3.1.1 / Collaborate with partners to evaluate the proposal to expand the preserve boundary based on scientific data (ecosystem science). During the public meetings held as a part of the management review process, requests were made by partners and the public to include the headwaters of the North Fork SLR (Ten and Five Mile Creeks) into the preserve boundary to protect the downstream areas designated as aquatic preserve (See Appendix C). The expanded area proposed by the public would need to be incorporated into the aquatic preserve rule (Chapter 18-20 F.A.C.) and then should be added to the list of managed areas protected by the Outstanding Florida Waters rule (Chapter 62-302.700). Expansion would facilitate natural resource protection to the extent currently offered within the existing preserve, and would not be intended to prevent planned project development. Preserve staff will provide unbiased, scientific data to partners and agencies as needed through the evaluation process. FY2010-2011, recurring as necessary.

Performance Measures: 1. Scientific data provided to partners and agencies as requested.

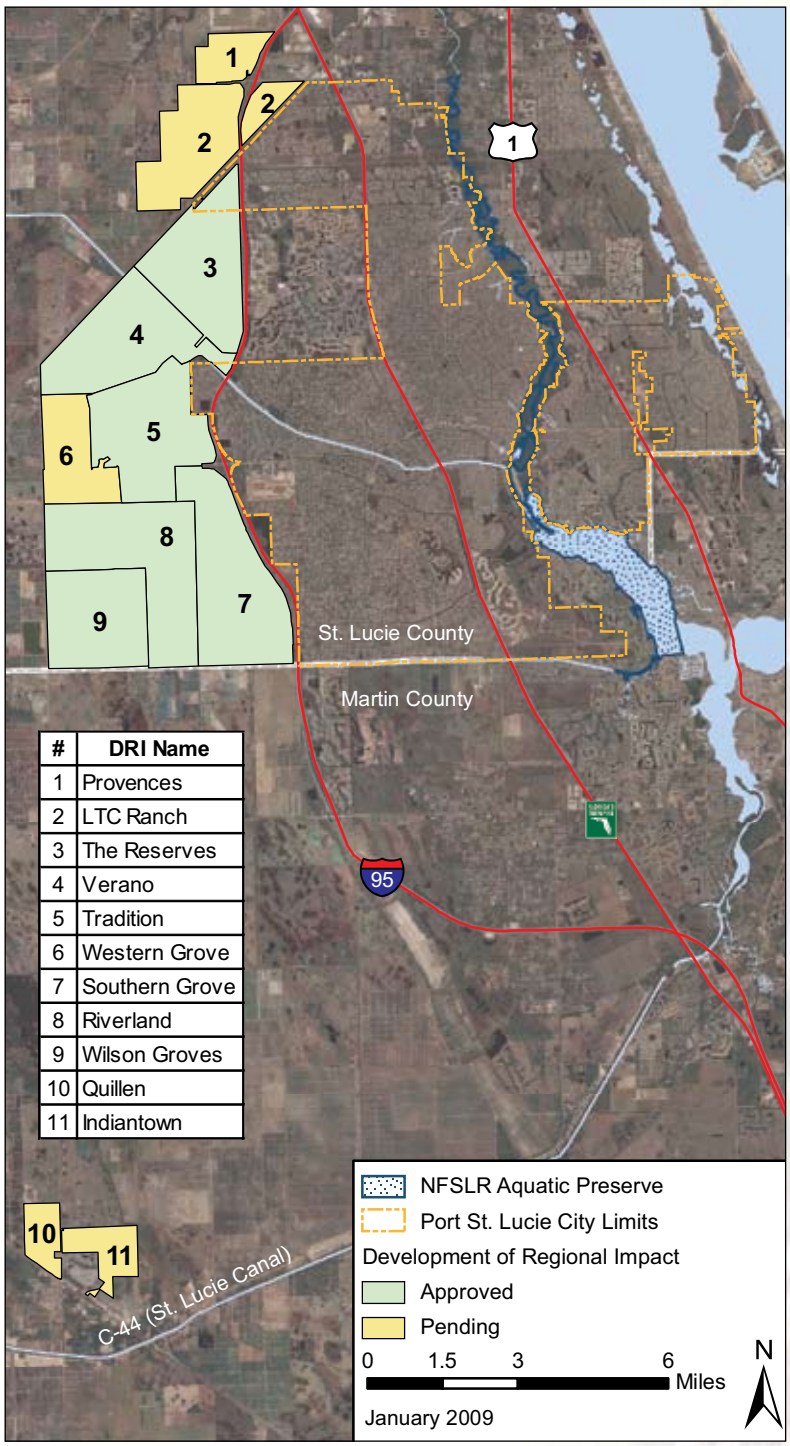
5.4 / Issue Three: Coastal Development

The harmful effect of coastal development on adjacent waterways is not unique to southeast Florida but local development practices coupled with intense watershed and shoreline alteration severely impact water quality in the North Fork SLR. The preserve is primarily located in St. Lucie County, one of the fastest growing counties in Florida. It is imperative that preserve staff work with local, state, and federal regulatory and planning personnel to minimize development-related impacts.

The Development of Regional Impact (DRI) process was created by the Environmental Land and Water Management Act of 1972 and is the state's longest-standing growth management tool. The process requires regional and state oversight of large-scale land development projects deemed to have a regional impact. Pursuant to Chapter 380 F.S., regional planning councils, including the local Treasure Coast Regional Planning Council (TCRPC), are charged with the coordination of multi-jurisdictional agency review of such large-scale development projects that may impact more than one county. Two DRIs were present along the North Fork at the time the original management plan was adopted in 1984; Sharrett (22,000 projected residents) on the northwest boundary and Harbor Ridge (1,700 projected residents) on

the southwest boundary. A remarkable amount of urban sprawl has occurred in the watershed since the adoption of the last management plan. Since 2005, six approved DRIs occupying 18,162 acres and five pending DRIs occupying 6,169 acres (total of 24,331 acres or 5% of the watershed) have been proposed for conversion to residential housing in the preserve watershed (See Map 24) (Treasure Coast Regional Planning Council, unpublished data). Recent DRIs (approved and pending) constitute 31% of the current residential/commercial land use. With the exception of a small portion of LTC Ranch, all DRIs are west of Interstate 95 and they form a solid line from the southern boundary of the Ten Mile Creek Water Preserve Area to the C-23 canal. In St. Lucie County, all approved and proposed DRI's, with the exception of the Provences, are located in recently annexed portions of the City of Port St. Lucie. Quillen and Indiantown are located in unincorporated Martin County. Very little undeveloped land exists east of Interstate 95 and the land west of Interstate 95 is primarily used for agriculture. The negative effects of rapid conversion from agricultural and natural lands to urban development on the quality of the preserve are exacerbated through the large network of canals designed to rapidly drain urban and agricultural areas into the SLR. Collaboration with regulatory personnel, environmental educators, the public, and elected officials are essential steps toward addressing and reducing the associated impacts of DRI's in the watershed and the more direct effects of adjacent high-density housing within the City of Port St. Lucie.

Since adoption of the 1984 management plan, most of the land directly adjacent to the preserve has either been developed or put into public trust. The increasing density, both over time and as one gets closer to the preserve, tends to concentrate the environmental degradation within the North Fork SLR and its headwaters. In 2000, Port St. Lucie reported a population density of 1,175 people per square mile, compared to 2,320 in Stuart, 336 in St. Lucie County (up from 281 in 1993) (Florida NetLink, n.d.), 228 in Martin County (up from 192 in 1993) (Florida NetLink, n.d.), 296 in Florida, and 80 in the U.S. (U.S. Census Bureau, n.d.). Urban planning practices have promoted crowding and the need for additional infrastructure that negatively impacts the quality of the preserve. The impacts of this growth have included degradation of water quality and habitat loss. Because of the tidal nature of the



#	DRI Name
1	Provences
2	LTC Ranch
3	The Reserves
4	Verano
5	Tradition
6	Western Grove
7	Southern Grove
8	Riverland
9	Wilson Groves
10	Quillen
11	Indiantown

Map 24 / Proposed or permitted developments of regional impact within the North Fork St. Lucie River Aquatic Preserve watershed since 2005.

Submerged lands near upland retaining walls can provide habitat for fish and wildlife if planted with sufficient native vegetation.

SLR, urban development practices affect the SLR as a whole. Additional coastal construction proposed by the City of Port St. Lucie that will directly affect the preserve include a boat launch, a river walk with hotels and restaurants, and a third east-west river crossing (six-lane bridge) over the Aquatic Preserve and potentially the Halpatiokee Conservation and Recreation Land (CARL) parcel managed as part of Savannas Preserve State Park.

In addition to the dramatic watershed changes, shoreline and benthic communities have been severely impacted by shoreline alterations and adjacent upland activities. Shoreline and intertidal areas of the North Fork that once were populated by mangroves and other emergent and submergent species now support very little vegetation. In many areas, seawalls, docks, and rip rap have replaced mangroves and seagrass. The natural shoreline once helped stabilize the substrate, dissipate wave action, filter stormwater runoff, and provide quality habitat for aquatic species. It is important to promote soft, living shorelines to regulatory staff and riparian homeowners researching stabilization options.

All coastal areas, including many of Florida's 41 aquatic preserves are increasingly susceptible to sea level rise associated with climate change. As part of an ongoing program to evaluate global climate change, the U.S. Environmental Protection Agency issued a grant to the Southwest Florida Regional Planning Council in 2000 to coordinate a sea level rise study for the State of Florida. The TCRPC, which oversees Indian River, St. Lucie, Martin, and Palm Beach counties, produced maps that identify the most susceptible areas within the Treasure Coast to sea-level rise. Of the four Treasure Coast counties, St. Lucie has the most wetland acreage which is primarily associated with the North Fork SLR and the IRL. The wetlands and islands within the IRL and North Fork are expected to be the first to be impacted. Development adjacent to the North Fork, largely encompassing the city of Port St. Lucie, has precluded inland migration of wetlands. Furthermore, as sea level rises the saltwater wedge may migrate north through the North Fork SLR resulting in conversion of freshwater marshes in the upper reaches of the river to an estuarine system (Treasure Coast Regional Planning Council, 2005).

The effect that the growing population will have on the preserve over the next two decades partly depends upon the degree to which residents learn from preserve staff and partnering resource managers. However, as the populations of Martin and St. Lucie counties increase, it is reasonable to expect an

increased rate of environmental decline, especially if the issues of water quality degradation and habitat loss are not addressed. SLC Oxbow Eco-Center and the Savannas Preserve State Park Education Center currently conduct most of the environmental educational programs in St. Lucie County. Preserve staff will continue to support their efforts related to coastal development on the North Fork SLR.

Coastal Development (CD)

CD Goal 1 / **Protect the preserve from impacts related to land use changes that disrupt the ecological functions of the natural resources.**

CD Objective 1.1 / **Coordinate with regulatory programs, local government, and adjacent land owners to reduce impacts to the preserve from adjacent development activities.**

Integrated Strategies

CD1.1.1 / **Review and provide recommendations for local comprehensive plans that address development adjacent to the preserve (resource management).** Aquatic Preserve management plans and local comprehensive plans should work synergistically to protect the SLR. A list of scheduled comprehensive plan updates and recommendation letters supported by the NFSLRAP management plan and other related plans will be drafted. FY 2010-2011, recurring.

Performance Measures: 1. Recommendation letters for local comprehensive plans that support the NFSLRAP management plan and other related plans.

CD1.1.2 / **Comment on proposed large-scale coastal developments adjacent to the North Fork St. Lucie River and its headwaters (resource management).** Large developments adjacent to and upstream of the North Fork SLR have the potential to negatively impact the preserve. Permit applications for proposed development will be reviewed and recommendations to help minimize impacts will be submitted to the regulatory reviewer. FY 2010-2011, recurring.

Performance Measures: 1. Written comments to regulatory and planning staff that suggest ways to minimize impacts to the preserve.

CD1.1.3 / **Comment on permit applications for construction activities on sovereign submerged lands within the preserve (resource management).** Comments on environmental resource permit applications for construction activities within the preserve will be submitted to DEP and SFWMD regulatory staff. It is important that these comments suggest ways to minimize impacts to the preserve and support eco-friendly engineering designs. A maintained list of high priority projects that could help applicants meet the public interest requirements outlined in the aquatic preserve rule (Chapter 18-20 F.A.C.) will also be provided to regulatory staff. Initiated FY 1986-1987, recurring.

Performance Measures: 1. Written comments to regulatory staff that suggests ways to minimize impacts to the preserve. 2. A maintained list of high priority projects that would help proposed activities meet the public interest requirements within the preserve.

CD1.1.4 / **Recommend use of soft, living shorelines to decrease erosion and protect the water quality and resources within and upstream of the preserve (resource management).** Most hardened shorelines within the preserve are devoid of aquatic vegetation which is important for absorbing wave energy, improving water quality, and providing habitat for aquatic species and birds. Staff will create GIS maps that show the extent of hardened shorelines within the preserve and draft recommendations for the use of living shorelines to riparian homeowners and regulatory staff when shoreline erosion is a concern. If a structure is unavoidable, we will support the use of upland retaining walls that use best management practices with the goal of establishing dense emergent vegetation planted on the seaward side to help provide the energy absorption, water quality, and habitat benefits offered by unaltered shorelines. FY 2010-2011, recurring.

Performance Measures: 1. Letters of recommendation for the use of living shorelines along the North Fork SLR and its headwaters.

CD Objective 1.2 / Inform local residents about their contribution to global issues that impact the preserve.

Integrated Strategies

CD1.2.1 / Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions (education and outreach). Without direct interaction with the SLR, it may be challenging for locals to fully appreciate the potential affect that climate change and sea level rise may have on the preserve and surrounding lands. Preserve staff will organize volunteer opportunities that allow direct interaction with the SLR to facilitate understanding of the potential transformations that climate change and sea level rise may have on the preserve and surrounding lands. This will not only allow residents to understand the connection between sustainable decisions made at home and the quality of the preserve, but also provide valuable assistance necessary to accomplish the action strategies outlined in this Plan. Promotion of volunteer opportunities will occur through an e-mail-based distribution list, and various media outlets (radio, television, and newspaper announcements) to increase local knowledge and understanding while helping to improve the quality of the preserve. Initiated FY2007-2008, recurring.

Performance Measures: 1. Sign-in sheets from organized volunteer events that facilitate understanding of the potential transformations that climate change and sea level rise may have on the preserve and surrounding lands.

CD1.2.2 / Inform residents about climate change and sea-level rise, and how they could affect the preserve (education and outreach). Information about climate change and the impacts that sea-level rise will most likely have on natural resources within the preserve (e.g. oyster reefs and mangroves) and adjacent land will be incorporated into education and outreach events and documents. Preserve staff will coordinate with the TCRPC and The Nature Conservancy to locally address global warming issues. FY 2014-2015, recurring.

Performance Measures: 1. Educational materials that incorporate information on ways that climate change may affect the preserve.

CD1.2.3 / Provide options to residents for reducing their carbon footprint (education and outreach). In addition to educating locals about the causes and effects of global warming, Preserve staff will encourage behavioral change by suggesting simple ways to reduce the amount of carbon used by individuals and households. Suggestions will range from no cost changes (e.g. unplugging unused lamps and appliances) to high-cost investments (e.g. use of solar and wind-generated systems). FY 2010-2011, recurring.

Performance Measures: 1. List of suggestions to reduce the amount of carbon used by individuals and households.

5.5 / Issue Four: Public Use and Access

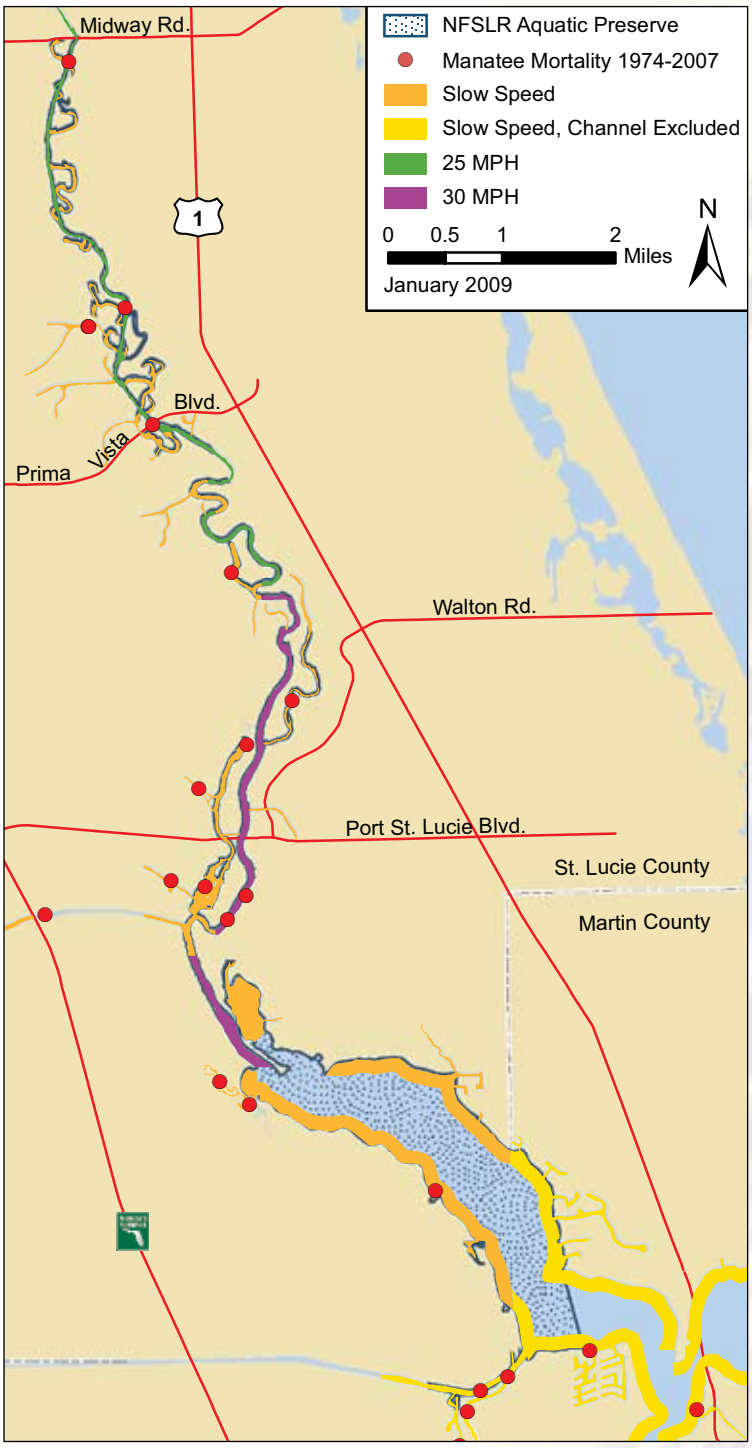
The preserve currently contains four public boat ramps, one public marina, and three public canoe stopovers along the river. Boat ramps, fishing piers, restrooms, and picnic tables are located at White City Park, River Park Marina (which also has a canoe launch), and Veteran's Memorial Park at Rivergate (See Map 4). A fourth public boat ramp, which has little parking space and no amenities, was constructed at the Club Med - Sandpiper facility on Kitching Cove along with the preserve's only public marina. Public canoe stopovers have been constructed at the Oxbow Eco-Center, Idabelle Island, and Savannas Preserve State Park's Halpatiokee CARL parcel. The canoe stopovers are connected to hiking trails at the Oxbow Eco-Center and Halpatiokee. The hiking trails at the Oxbow Eco-Center link to the educational building and a second trail system maintained by River Place Development to the south. With the exception of Club Med - Sandpiper, public access points to the preserve are associated with adjacent public lands purchased through Save Our Rivers and Florida Forever programs and are managed by local, state, and non-governmental entities.

As of June 2007, 393 private docking facilities were documented within the NFSLRAP. Docking facilities are broken down into three categories according to the aquatic preserve rule (Chapter

18-20 F.A.C.): 1) Revenue-generating (commercial, industrial, etc.), 2) private residential multi-slip, and 3) private residential single-family. Most docking facilities (379) within the preserve are private residential single-family docks. Twelve private residential multi-slip docks are located in the wide, southern portion of the preserve including, but not limited to, the Anchorage, Kitching Cove Estates, Tarpon Bay Yacht Club, Tarpon Bay Moorings, Ballantrae Yacht Club, the Estuary Association, Palm Cove Yacht Club, and Harbour Ridge. Club Med - Sandpiper is a public marina and the only revenue-generating docking facility within the preserve. Club Med -Sandpiper has an economic stake in the health of the North Fork SLR as the resort promotes swimming, motor boating, and use of WaveRunners within the preserve.

Debris from user groups, primarily recreational anglers, is a continuous challenge within the preserve. Results from past clean-up events show that monofilament line is most concentrated around White City Park as many users fish from the shoreline and cannot remove monofilament line that becomes entangled in overhanging oaks and palm trees. Other debris hotspots include the fishing piers at other public boat ramps.

A manatee survey was conducted for St. Lucie County in the early 1990s by present day FWC Division of Law Enforcement to determine appropriate speed limits and identify slow speed zones within the North Fork SLR. Speed limits outside of the manatee and other slow speed zones are 25 miles per hour (mph) north of and 30 mph south of the upstream end of Evans Creek (See Map 25). Current speed limits coupled with the narrow, curved shape of the preserve has promoted user conflicts between motor boats and paddlers (those using canoes and kayaks). Unlike federal, state, and local law enforcement officers, CAMA does not have authority to regulate boat speed within the preserve. However, local governments (St. Lucie County and the City of Port St. Lucie) have the authority to adopt local ordinances that limit the speed in areas where human safety is an issue.



Map 25 / Speed zones in the St. Lucie River based on 1992 manatee surveys in St. Lucie and Martin counties.

Public Use and Access (PU)

PU Goal 1 / Maintain a safe environment for fish, wildlife, and user groups.

PU Objective 1.1 / Reduce the amount of debris and contaminants associated with user group activities.

Integrated Strategies

PU1.1.1 / **Organize two community-based clean-up events each year (resource management).** Two community-based clean-up events will be organized within the preserve each year. Results from past clean-up events indicate a recurring need at White City Park and to a lesser degree other boat ramps that support fishing activities. Boats are necessary to remove hook and line debris from the oaks overhanging the water in the oxbow at White City Park. Preserve staff will draft and distribute an electronic summary to all participants and stakeholders after each event, which compares current findings to historic efforts and links types of debris to user groups to help direct future education efforts. Staff will work with the local media (e.g. newspapers, television, radio) to facilitate local education. Initiated FY 2007-2008, recurring.

Performance Measures: 1. Clean-up event summaries.

PU1.1.2 / **Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season (resource management).** The only rookery currently located within the North Fork SLR is found in Mud Cove (See Map 3). Fatalities of nesting birds from entanglement in monofilament fishing line have been documented during the nesting season. To reduce the chances of entanglement, debris from the Mud Cove rookery, and any future rookeries located within the preserve, will be removed before each nesting season (December). A summary of the amount and types of debris will be drafted after each annual clean-up event to help evaluate the need for higher protection efforts at the rookeries (e.g. designation as a critical wildlife area). Initiated FY 2007-2008, recurring.

Performance Measures: 1. Annual summary that identifies the rookery location, cleanup date, and debris removed.

PU1.1.3 / **Promote DEP's Clean Marina Program to Club Med - Sandpiper (education and outreach).** One public marina currently exists within the preserve (Club Med - Sandpiper). Club Med - Sandpiper has expressed interest in DEP's Clean Marina Program but is not currently designated a Clean Marina. The clean marina designation lets boaters know that the facility meets or exceeds marina environmental measures and BMPs program criteria. Preserve staff will organize a meeting with the decision-makers at Club Med - Sandpiper marina to discuss the Clean Marina Program (which includes Marina BMPs drafted in 2003) and how participation would benefit the preserve and their businesses. Preserve staff will also work with Florida SeaGrant and Club Med - Sandpiper to find innovative solutions for day-to-day marina operations that help protect the environment. Educational brochures that explain the importance of the preserve will be provided to the marina for distribution to the general public and special interest groups. FY 2010-2011, 1 year.

Performance Measures: 1. Delivery of a PowerPoint presentation and written material.

PU1.1.4 / **Install and maintain monofilament recycling containers at all public boat ramps and fishing piers (resource management).** Preserve staff will coordinate with Florida SeaGrant and land owners/managers to install the recycling tubes at public boat ramps and fishing piers. Preserve staff will follow up with Florida SeaGrant to document the success of the recycling program within the preserve. FY 2009-2010, 1 year.

Performance Measures: 1. Installation and maintenance records for monofilament recycling containers at all public boat ramps and fishing piers within the preserve.

PU1.1.5 / **Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve (resource management).** To protect the natural resources, water quality, and to improve safe navigation, preserve staff will provide written notification of abandoned vessels within the preserve to FWC law enforcement officers to promote proactive removal of vessels by the responsible party. Staff will also coordinate with local government, FWC law enforcement, and DEP regulatory staff to identify and remove derelict vessels from the preserve. A list and location map of abandoned and derelict vessels with associated photographs, registration, location, and make/model data created in June 2007 will be updated as necessary. Staff will draft a procedure for responding to abandoned and derelict vessels within the preserve and place a copy

in each of the vessel logs. Submerged debris, such as old boat trailers and tires, has also been documented in the preserve. Side scan sonar is effective in locating submerged debris. If feasible, location and removal of submerged debris will be recommended as a potential public interest project to the DEP and SFWMD regulatory staff. Initiated FY 2006-2007, recurring.

Performance Measures: 1. A list and GIS map showing existing and removed vessel and debris locations. 2. Written notification of abandoned vessels within the preserve provided to FWC law enforcement officers. 3. Procedure drafted for staff responding to abandoned and derelict vessels with the preserve. 4. Removal of submerged debris in the preserve recommendation submitted to DEP and SFWMD regulatory staff as a public interest project.

PU1.1.6 / **Post signage about debris in aquatic environments at public access points (education and outreach).** Partnerships with public access managers will be formed to install educational kiosks at all public boat ramps within the preserve. Preserve signage currently exists at two public ramps, White City Park and Veteran's Memorial Park at Rivergate, but it is outdated and difficult to read. Informational and aesthetic displays that highlight the ramifications debris can have on fish and wildlife and navigation within the preserve will be constructed at each of the public boat ramps. FY 2013-2014, 1 year.

Performance Measures: 1. Display information about debris-related threats to fish and wildlife at public boat ramps.

PU Objective 1.2 / **Better understand the impact of current speed limits on the preserve and its user groups.**

Integrated Strategies

PU1.2.1 / **Document and monitor boating impacts to natural resources (ecosystem science).** A manatee survey was conducted for St. Lucie County in the early 1990s by present day FWC Division of Law Enforcement to determine appropriate speed limits and identify slow speed zones within the North Fork SLR. With the exception of a few slow speed zones, speed limits were determined to be 25 mph north of and 30 mph south of the upstream entrance to Evans Creek (See map 26). Human safety and natural resource protection are two concerns raised by the public during the management plan revision process (See Appendix C). Both of which may be affected by the set speed limits within the preserve. Preserve staff will partner with Savannas Preserve State Park to monitor boater impacts, especially from boat wakes in the narrow upper reaches of the river, to natural resources in the preserve. Partnerships with local law enforcement officers will facilitate documentation of near misses of non-motorized boats (canoes and kayaks) by motorboats within the preserve. FY 2015-2016, 3 years.

Performance Measures: 1. Summary of monitoring results. 2. Documentation of near misses by motorboats.

PU Objective 1.3 / **Increase the amount and frequency of law enforcement and citizen patrol within the preserve.**

Integrated Strategies

PU1.3.1 / **Facilitate regular communication with law enforcement for rapid response to illegal activities (resource management).** An annual meeting with local and state law enforcement officers (FWC, other branches of DEP, SLC Marine Unit, Martin County Marine Unit, Coast Guard Auxiliary, law enforcement volunteers, and the City of Port St. Lucie law enforcement officers) will be organized to discuss speed limits, boater safety, derelict vessels, harassment or take of protected fish and wildlife, gill netting, mangrove impacts, user group conflicts, and other pertinent issues. Staff will produce quick-reference lists that identify local, state, and federal law enforcement points of contact in Martin and St. Lucie counties. FY 2011-2012, recurring.

Performance Measures: 1. Meeting summaries. 2. Quick-reference lists with points of contact for law enforcement in Martin and St. Lucie counties.

PU1.3.2 / **Coordinate with local citizens to help patrol the preserve (resource management).** Unlike preserve staff, riparian homeowners are able to watch over the well-being of the preserve on a daily basis. Current responsibilities, which span to three other aquatic preserves from Indian River to Palm Beach County, limit the ability of staff to regularly patrol the preserve. Staff will request assistance from riparian homeowners by attending homeowner association meetings, direct communication, and meeting with local law enforcement volunteer groups. Other users will be requested to patrol the preserve and notify staff of suspicious activities or conditions. When suspicious activities are reported, preserve staff will visit the site and if necessary, coordinate with regulatory and/or law enforcement staff to address the problem. FY 2011-2012, recurring.

Performance Measures: 1. List of citizen patrols.

PU Goal 2 / **Promote low-impact recreational opportunities.**

PU Objective 2.1 / **Support the addition of canoe stopovers and launches on public lands.**

Integrated Strategies

PU2.1.1 / **Identify and support appropriate locations for canoe stopovers and launches (resource management).** CAMA will support low-impact recreational opportunities within the preserve as long as natural resources are not being impacted by the cumulative effort to do so. SLC Environmentally Sensitive Lands office has recently installed one canoe stopover between Prima Vista Boulevard and Midway Road. The City of Port St. Lucie is proposing to build an education center with a canoe launch. Preserve staff will work with Martin County, St. Lucie County, the City of Port St. Lucie, and DEP regulatory staff to promote environmentally-friendly projects that support the goals outlined in the preserve management plan. FY 2010-2011, 1 year.

Performance Measures: 1. GIS map showing appropriate canoe stopover locations within the preserve. 2. Letters of support for proposed low-impact recreational opportunities that do not cumulatively impact the natural resources of the preserve.

PU Objective 2.2 / **Promote complete inclusion of the preserve into county waterway programs.**

Integrated Strategies

PU2.2.1 / **Promote waterway program consistency (resource management).** Both Martin and St. Lucie counties support paddling efforts in the SLR. Preserve staff will coordinate with both agencies to promote regional consistency within the preserve. Staff will also generate maps that identify existing facilities and potential sites for future expansion within the preserve. Three canoe/kayak-specific stopovers currently exist within the preserve – all of which are located in St. Lucie County (See Map 4). FY 2011-2012, 1 year.

Performance Measures: 1. Consistent signage at canoe stopovers in St. Lucie and Martin counties.

The North Fork floodplain is comprised of a unique combination of temperate and subtropical species such as this rare butterfly orchid (Encyclia tampensis).

Part Three

Additional Plans

Chapter Six

Administrative Plans

The Southeast Florida Aquatic Preserves (SEFLAP) program has a staff of three full-time equivalent positions (FTE; two field and one administrative), and one full-time, temporary, Park Service Specialist position (OPS) to manage four aquatic preserves. The four preserves total approximately 48,327 acres in four highly-developed counties of southeast Florida: Indian River, St. Lucie, Martin, and Palm Beach. The management goals identified in this plan for the NFSLRAP must be balanced with the management goals of three additional preserves affiliated with the IRL and the Loxahatchee River. The SEFLAP program has developed a strategic work plan to include staff responsibility breakdown, vehicle and vessel replacement, and facility, staffing, and program needs, that is revised on an annual basis.

Successful implementation of the strategies identified in the management plan depends upon unpredictable funding and staffing factors over the next 10 years. For example, engaging the community and boosting the education and outreach program has been identified as an issue by local residents and the NFSLRAP Advisory Committee. Currently, less than 10% of staff time is spent on education and outreach for the preserve. A full-time education position will be necessary for staff to reach these education goals. The help of local residents and volunteers is another essential key to reaching the identified goals associated with the clean-up events, distribution of information, and citizen patrol. A volunteer database and distribution list has already been established and will be maintained to effectively document the amount of assistance the community provides in management of the preserve.

An example of the natural, meandering riverbends of the North Fork St. Lucie River.

Chapter Seven

Facilities Plans

Facilities - The Southeast Florida Aquatic Preserves field office is located at the Miller-Wild tract in Fort Pierce, a subparcel managed by Savannas Preserve State Park. Office components consist of one 1,456-square-foot modular building with five offices, which was built in 2003 and has a design life of 30 years, three portable sheds purchased in 2001, 2002, and 2006, and an open two-bay pole barn for boat storage built in 2004 that has a design life of 20 years. The office was not leveled properly when it was placed on the property in 2003. Due to this oversight, the sides of the office are settling and the building is separating down the ridge line. The office was relocated on-site in 2009 to remedy the situation but it is unlikely that the building will meet the expected design life of 30 years.

Future construction and maintenance needs include, but are not limited to:

1. repair and eventually replacement of the existing shingle roof on the office building;
2. regrade the dirt driveway to the compound;
3. complete the open air polebarn to include one enclosed bay;
4. repair and eventual replacement of the shingle roof on the pole barn;
5. maintain the septic tank;
6. repair and replace well pump;
7. repair and replace central air and heating system;
8. maintain plumbing;
9. replace carpeting;
10. repair of the stairs and entrance ramp to the office;
11. landscape (including stump grinding);
12. repair and eventual replacement of the three existing storage sheds;
13. hookup to St. Lucie County utilities once septic system fails;
14. paint exterior and interior office walls;
15. repair and replace water softener system; and
16. boat and vehicle replacement.

Upon the approach of a hurricane, all vessels and vehicles of the preserve will follow the procedures outlined in the Southeast Florida Aquatic Preserves Hurricane Plan which is updated annually.

Vehicles and Vessels - All major vehicles and vessels deemed necessary in the strategic plan have been acquired. As part of the program's strategic planning cycle, all vehicles and vessels in the program undergo a monthly inspection and maintenance by staff or an authorized vendor. The annual cost for fuel and maintenance is approximately $1,100 for the two vessels and $3,400 for the two vehicles, respectively. This is expected to increase with increasing cost of fuel and vessel and vehicle age.

Vessels and vessel functions:

1. **19' Carolina Skiff with 90 Hp Mercury Four Stroke Engine** - Acquired in 2001 for field work in shallow coastal waters within four Southeast Aquatic Preserves. The Carolina Skiff has a wide (6 foot) beam and a side console which makes it an excellent vessel for hauling field equipment to monitoring and enhancement sites.
2. **19' Twin Vee Bay Cat with 115 Hp Yamaha Four Stroke Engine** - Acquired in 2007 for field work in coastal waters in four Southeast Aquatic Preserves and near shore reef environments within St. Lucie Inlet Preserve State Park.

Vehicles and vehicle functions:

1. **GMC 3500 4x4 Dually Sierra** (with winch) - Acquired in 2000 for North Fork SLR Buffer Preserve land management projects and for towing boats. Since the management transfer of the North Fork SLR State Buffer Preserve to Savannas State Park in 2004, the GMC has primarily been used to tow boats and transfer building supplies for the IRL Spoil Island Project. The fuel efficiency of the GMC is poor and despite low mileage the vehicle is becoming unreliable and costly to maintain. Funds have been requested to replace the GMC during the 08-09 Fiscal Year with a more efficient four-wheel drive vehicle that can tow either boat, haul heavy building supplies, and serve as a second vehicle for travel.
2. **Chevy Blazer 4x4** - Acquired in 1998 for travel and towing boats to four Southeast Aquatic Preserves. With 117,000 miles, the Blazer is also becoming unreliable and costly to maintain. This is the primary vehicle used for long-distance travel to meetings, science symposia, and workshops. A replacement four-wheel drive vehicle will be needed in the near future to maintain efficient operation of Aquatic Preserve programs.
3. **Chevy Blazer 4x4** - 1998 model transferred from DEP's Southeast District Office to the Southeast Aquatic Preserves Field Office in 2007. This surplus vehicle has 103,000 miles, is without air conditioning, and is the primary vehicle used by the grant-funded Indian River Lagoon Shoreline Revegetation Coordinator. The vehicle is used to travel and tow a boat throughout the shoreline revegetation project boundary which extends from Brevard to Palm Beach Counties. Four new tires and a tow package were installed on the vehicle after the transfer in 2007.

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Appendix A

Legal Documents

A.1 / Aquatic Preserve Resolution

WHEREAS, the State of Florida, by virtue of its sovereignty, is the owner of the beds of all navigable waters, salt and fresh, lying within its territory, with certain minor exceptions, and is also the owner of certain other lands derived from various sources; and

WHEREAS, title to these sovereignty and certain other lands has been vested by the Florida Legislature in the State of Florida Board of Trustees of the Internal Improvement Trust Fund, to be held, protected and managed for the long-range benefit of the people of Florida; and

WHEREAS, the State of Florida Board of Trustees of the Internal Improvement Trust Fund, as a part of its overall management program for Florida's state-owned lands, does desire to insure the perpetual protection, preservation and public enjoyment of certain specific areas of exceptional quality and value by setting aside forever these certain areas as aquatic preserves or sanctuaries; and

WHEREAS, the ad hoc Florida Inter-Agency Advisory Committee on Submerged Land Management has selected through careful study and deliberation a number of specific areas of state—owned land having exceptional biological, aesthetic and scientific value, and has recommended to the State of Florida Board of Trustees of the Internal Improvement Trust Fund that these selected areas be officially recognized and established as the initial elements of a statewide system of aquatic preserves for Florida;

NOW, THEREFORE, BE IT RESOLVED by the State of Florida Board of Trustees of the Internal Improvement Trust Fund:

THAT it does hereby establish a statewide system of aquatic preserves as a means of protecting and preserving in perpetuity certain specially selected areas of state-owned land: and

THAT specifically described, individual areas of state-owned land may from time to time be established as aquatic preserves and included in the statewide system of aquatic preserves by separate resolution of the State of Florida Board of Trustees of the Internal Improvement Trust Fund; and

THAT the statewide system of aquatic preserves and all individual aquatic preserves established thereunder shall be administered and managed, either by the said State of Florida Board of Trustees of the Internal Improvement Trust Fund or its designee as may be specifically provided for in the establishing resolution for each individual aquatic preserve, in accordance with the following management policies and criteria:

(1) An aquatic preserve is intended to set aside an exceptional area of state-owned land and its associated waters for preservation essentially in their natural or existing condition by reasonable regulation of all human activity which might have an effect on the area.

(2) An aquatic preserve shall include only lands or water bottoms owned by the State of Florida, and such private lands or water bottoms as may be specifically authorized for inclusion by appropriate instrument from the owner. Any included lands or water bottoms to which a private ownership claim might subsequently be proved shall upon adjudication of private ownership be automatically excluded from the preserve, although such exclusion shall not preclude the State from attempting to negotiate an arrangement with the owner by which such lands or water bottoms might be again included within the preserve.

(3) No alteration of physical conditions within an aquatic preserve shall be permitted except: (a) minimum dredging and spoiling for authorized public navigation projects, or (b) other approved activity designed to enhance the quality or utility of the preserve itself. It is inherent in the concept of the aquatic preserve that, other than as contemplated above, there be: no dredging and filling to create land, no drilling of oil wells or excavation for shell or minerals, and no erection of structures on stilts or otherwise unless associated with authorized activity, within the confines of a preserve - to the extent these activities can be lawfully prevented.

(4) Specifically, there shall be no bulkhead lines set within an aquatic preserve. When the boundary of a preserve is intended to be the line of mean high water along a particular shoreline, any bulkhead line subsequently set for that shoreline will also be at the line of mean high water.

(5) All human activity within an aquatic preserve shall be subject to reasonable rules and regulations promulgated and enforced by the State of Florida Board of Trustees of the Internal Improvement Trust Fund and/or any other specifically designated managing agency Such rules and regulations shall not interfere unduly with lawful and traditional public uses of the area, such as fishing (both sport and commercial), hunting, boating, swimming and the like.

(6) Neither the establishment nor the management of an aquatic preserve shall infringe upon the lawful and traditional riparian rights o private property owners adjacent to a preserve. In furtherance of these rights, reasonable improvement for ingress and egress, mosquito control, shore protection and similar purposes may be permitted by the State of Florida Board of Trustees of the Internal Improvement Trust Fund and other jurisdictional agencies, after review and formal concurrence by any specifically designated managing agency for the preserve in question.

(7) Other uses of an aquatic preserve, or human activity within a preserve, although not originally contemplated, may be permitted by the State of Florida Board of Trustees of the Internal improvement Trust Fund and other jurisdictional agencies, but only after a formal finding of compatibility made by the said Trustees on the advice of any specifically designated managing agency for the preserve in question.

IN TESTIMONY WHEREOF, the Trustees for and on behalf of the State of Florida Board of Trustees of the Internal Improvement Trust Fund have hereunto subscribed their names and have caused the official seal of said State of Florida Board of Trustees of the Internal
Improvement Trust Fund to be hereunto affixed, in the City of Tallahassee, Florida, on this the 24th day of November A. D. 1969.

CLAUDE R. KIRK, JR, Governor
EARL FAIRCLOTH, Attorney General
BROWARD WILLIAMS, Treasurer
DOYLE CONNER, Commissioner of Agriculture
TOM ADAMS, Secretary of State
FRED O. DICKINSON, JR., Comptroller
FLOYD T. CHRISTIAN, Commissioner of Education

As and Constituting the State of Florida Board of Trustees of the Internal Improvement Trust Fund

A.2 / Florida Statutes (F.S.)

- ***Florida Statutes, Chapter 253: State Lands***
  www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=Ch0253/titl0253.htm
- ***Florida Statutes, Chapter 258: State Parks and Preserves***
  www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=Ch0258/ch0258.htm

  Part II (Aquatic Preserves):
  http://www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=Ch0258/part02.htm
- ***Florida Statutes, Chapter 370: Saltwater Fisheries***
  www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=Ch0370/titl0370.htm
- ***Florida Statutes, Chapter 372: Wildlife***
  www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=Ch0372/titl0372.htm
- ***Florida Statutes, Chapter 403: Environmental Control***
  (Statute authorizing FDEP to create Outstanding Florida Waters is at 403.061(27))
  www.leg.state.fl.us/Statutes/index.cfm?App_mode=Display_Statute&URL=Ch0403/ch0403.htm

A.3 / Florida Administrative Codes (F.A.C.)

- ***Florida Administrative Code, Chapter 18-20: Florida Aquatic Preserves***
  www.dep.state.fl.us/legal/Rules/shared/18-20.pdf
- ***Florida Administrative Code, Chapter 18-21: Sovereignty Submerged Lands Management***
  http://www.dep.state.fl.us/legal/Rules/shared/18-21.pdf
- ***Florida Administrative Code, Chapter 62-302: Surface Water Quality Standards***
  (Rule designating Outstanding Florida Waters is at 62-302.700)
  www.dep.state.fl.us/legal/Rules/shared/62-302/62-302.pdf

Appendix B

Resource Data

B.1 / Acronym List

Acronym	Definition	Acronym	Definition
AP	aquatic preserve	**MHW**	mean high water
BMAP	Basin Management Action Plan	**MOA**	memorandum of agreement
BMP	best management practices	**MOU**	memorandum of understanding
C&SF	Central and Southern Florida	**mph**	miles per hour
CAMA	Office of Coastal and Aquatic Managed Areas, in the Department of Environmental Protection	**MSX**	*Haplosporidium nelsoni*
CARL	Conservation and Recreation Lands	**NEP**	National Estuary Program
CCMP	Comprehensive Conservation and Management Plan	**NERR**	National Estuarine Research Reserve
CD	coastal development	**NFSLRAP**	North Fork St. Lucie River Aquatic Preserve
CERP	Comprehensive Everglades Restoration Plan	**NMFS**	National Marine Fisheries Service
CH3D	Curvilinear Hydrodynamics in Three Dimensions	**NOAA**	National Oceanic and Atmospheric Administration
CSO	Citizen Support Organization	**NPDES**	National Pollutant Discharge Elimination System
CZM	coastal zone management	**NR**	Natural Resource Management
DEP	Florida Department of Environmental Protection	**NSLWCD**	North St. Lucie Water Control District
DHR	Division of Historical Resources	**OFW**	Outstanding Florida Waters
DIDSON	Dual Frequency Identification Sonar	**OPS**	other personal services
DNR	Florida Department of Natural Resources (now DEP)	**OSDS**	on-site sewage disposal systems
DRI	Development of Regional Impact	**Ph.D.**	Doctor of Philosophy
DRP	Division of Recreation and Parks, in the Department of Environmental Protection	**PIR**	Project Implementation Report
DYNTRAN	Dynamic Transport	**ppt**	parts per thousand
ECOS	Estuarine, Coastal, and Ocean Science, Inc.	**PU**	public use and access
EFDC	Environmental Fluid Dynamics Computer Code	**PVC**	polyvinyl chloride
ESC	Environmental Studies Center	**RECOVER**	Research, Coordination, and Verification
ESA	Endangered Species Act	**SAV**	submerged aquatic vegetation
F.A.C.	Florida Administrative Code	**S.D.**	standard deviation
FAU	Florida Atlantic University	**SEFLAP**	Southeast Florida Aquatic Preserves
F.A.W.	Florida Administrative Weekly	**SFWMD**	South Florida Water Management District
FCREPA	Florida Committee on Rare and Endangered Plants and Animals	**SJRWMD**	St. Johns River Water Management District
FCT	Florida Communities Trust	**SLC**	St. Lucie County
FDACS	Florida Department of Agriculture and Consumer Services	**SLCMCD**	St. Lucie County Mosquito Control District
FIT	Florida Institute of Technology	**SLE**	St. Lucie Estuary
FNAI	Florida Natural Area Inventory	**SLR**	St. Lucie River
FOS	Florida Oceanographic Society	**SSC**	species of special concern
FPL	Florida Power and Light	**STA**	stormwater treatment area
F.S.	Florida Statutes	**SWAMP**	Surface Water Ambient Monitoring Program
FTE	full-time equivalent	**SWIM**	Surface Water Improvement and Management Plan
FWC	Florida Fish and Wildlife Conservation Commission	**TCEEC**	Treasure Coast Environmental Education Council
FWS	U.S. Fish & Wildlife Service	**TCRPC**	Treasure Coast Regional Planning Council
FY	fiscal year	**TMDL**	total maximum daily load
GMC	General Motors Corporation	**UF**	University of Florida
GIS	geographic information system	**U.S.**	United States
GPS	global positioning system	**USACE**	U.S. Army Corps of Engineers
GTM	Guana Tolomato Matanzas	**USEPA**	United States Environmental Protection Agency
HBOI	Harbor Branch Oceanographic Institute	**USGS**	U.S. Geological Survey
HSPF	Hydrological Simulation Program Fortran	**WaSh**	Watershed Water Quality
IFAS	Institute of Food and Agriculture Science	**WMD**	water management district
IRSC	Indian River State College	**WPA**	water preserve area
IRL	Indian River Lagoon	**WPP**	watershed protection plan
IRL-S	Indian River Lagoon-South	**WQ**	water quality
LiDAR	light detection and ranging		

Acceler8: Florida's commitment to provide $1.5 billion to accelerate the design and construction of a suite of restoration projects selected for the immediate benefits they can provide to the Everglades and the South Florida Ecosystem.

acre-feet: The volume of water necessary to cover one acre of surface area to a depth of one foot.

aquaculture: The cultivation or nurturing of aquatic organisms.

basin/sub-basin: The entire tract of land drained by a river and its tributaries; smaller portion of a larger tract of land drained by a river and its tributaries.

benthic: Of, related to, or occurring at the bottom of a body of water.

berm: A mound of earth usually engineered by humans, especially the bank of a canal.

bromeliads: Any member of the pineapple family of plants, usually having stiff, leathery leaves and spikes of bright flowers (many live on other plants and are commonly referred to as air plants).

brooding: Production by or as if by incubation.

build-out: Indicates that all land parcels are built upon with either housing or other uses.

candidate species: Those petitioned species that are actively being considered for listing as endangered or threatened under the ESA, as well as those species for which NMFS has initiated an ESA status review that it has announced in the *Federal Register*. Neither "candidate species" nor "species of concern" carries any procedural or substantive protections under the ESA.

circumtropical: Existing around, about, or surrounding a tropical area or climate.

codified: The process of collecting and restating the law of a jurisdiction in certain areas, usually by subject, forming a legal case.

commercial, industrial, and other revenue generating/income related docks: Docking facilities for an activity which produces income, through rental or any other means, or which serves as an accessory facility to other rental, commercial, or industrial operations. It shall include, but not be limited to docking for: marinas, restaurants, hotels, motels, commercial fishing, shipping, boat or ship construction, repair, and sales.

Comprehensive Everglades Restoration Plan (CERP): A comprehensive plan for the water resources of central and southern Florida authorized in the Water Resources Development Act of 2000. The overarching objectives of this Comprehensive Everglades Restoration Plan are the restoration, preservation, and protection of the south Florida ecosystem while providing for the other water-related needs of the region.

conjunction: To join together; combination, association, or overlap.

Conservation and Recreation Lands (CARL): Florida created this land acquisition program in 1979 to acquire lands to conserve and protect unique natural areas, endangered species, unusual geologic features, wetlands, and significant archaeological and historical sites. CARL projects were funded by the CARL Trust Fund and Preservation 2000. The Florida Forever program is CARL's successor.

conservation easement: A legal agreement between a landowner and a government agency or nonprofit organization to protect the natural resources of a property permanently or for some designated period of time. The property still belongs to the landowner, but restrictions are placed both on the current landowner and subsequent landowners.

consolidated substrate: A compacted mass of sediment, typically stratified.

conveyance: The act of moving something from one location to another.

crosswalk: Conversion of one natural area classification (e.g.Florida Land Use Cover and Forms Classification System) to another (e.g. Florida Natural Areas Inventory), the layering of maps to align geological and natural features.

cultch: Material, typically oyster shells, deposited on oyster grounds to furnish points of attachment for spat.

cumulative: Increased by successive additions.

development of regional impact (DRI): Any development which, because of its character, magnitude, or location, would have a substantial effect upon the health, safety, or welfare of citizens of more than one county. DRIs must undergo regional and state review in addition to the local development review process.

disseminate: To scatter widely or disperse.

dredge spoil: Material or soil taken out of an area mechanically and stored in a pile or ridge, or graded evenly.

emergent: Growing in water with the majority of the plant extending above the water surface.

endangered species: The ESA defines the term "endangered species" as any species which is in danger of extinction throughout all or a significant portion of its range.

endemic: Native to, characteristic of, or restricted to a locality or region.

ephemeral: Temporary.

epiphyte: A plant that usually lives on other plants without damaging them.

equilibrium: A state of balance between opposing forces.

estuarine: Consisting of an estuary environment, which is a semi-enclosed coastal water body with a free connection to the open sea and within which seawater is measurably diluted with freshwater.

Florida Forever (FF): The 10-year, $3 billion program established by the Florida Legislature to conserve environmentally sensitive land, restore waterways, and preserve important cultural and historical resources. Florida Forever replaced Preservation 2000.

gasification: Conversion into gas, specifically the conversion of residual waste sludge into natural gas.

geology: The structure of a specific region of the earth's crust.

geomorphology: The study of form, nature, and evolution of the earth's surface.

greater everglades ecosystem: An area consisting of the lands and waters within the boundary of the South Florida Water Management District, including the Everglades, the Florida Keys, and the contiguous nearshore coastal waters of South Florida.

ground-truthing: To verify locations on a map by actually visiting the site.

heterogeneity: The quality or state of being heterogeneous (With dissimilar elements or parts).

homogeneity: The quality or state of being homogeneous (Uniform throughout in structure).

hydrologic: Dealing with the properties, distribution, and circulation of water.

hydrology: The science and study of the properties, distribution and circulation of water on and below the earth's surface and in the atmosphere.

hydrologic regime: Flow variations, usually represented by the monthly average flow graphics (calculated for a certain number of years).

hydroperiod: The cyclical changes in the amount or stage of water in an aqueous habitat.

hypoxic: Where oxygen is deficient in a water body (<2 mg/L).

impaired waterbody: A river, lake, or coastal water that, because of pollution levels, is not meeting water quality standards for its designated use, such as fishing, swimming, shellfish harvesting, or as a source of drinking water.

Lake Okeechobee estuary recovery: Plan to restore the ecological health of Lake Okeechobee and the St. Lucie and Caloosahatchee Estuaries.

limnetic (fresh): Water with less than 0.5 parts per thousand (ppt) salinity.

loading: The total amount of material entering a system from all sources.

mandate: An obligation handed down by an inter-governmental agency.

mesohaline: Between 5 and 18 parts per thousand salt concentration.

minimum flow and level: The established limits at which further withdrawals of water would be significantly harmful to the water resources or ecology of an area.

mitigation: An action or series of actions that offset the adverse environmental impact of a permitted activity.

muck: Fine grained sediments that contain a significant amount of clay and silt and about 10 percent organic matter.

nekton: Actively swimming animals in a body of water.

northern everglades: Ecosystem within the SFWMD boundary encompassing the Lake Okeechobee, Caloosahatchee River, and St. Lucie River basins. Key features include Kissimmee area lakes and rivers, Lake Okeechobee, and the Caloosahatchee and St. Lucie River estuaries.

oligohaline: Between 0.5 and 5 parts per thousand salt concentration.

ooze: A soft deposit (mud, slime, shells) on the bottom of a body of water.

pelagic: Relating to, living, or occurring in the open sea.

peripheral: Organisms on or near the edge of their geographical ranges.

physiogeographic: Describing the characteristics of a site's physical geography in terms of elevation, slope, or orientation.

piezoelectric: Relating to, or functioning by, the electricity or electric polarity of pressure.

planktonic: Drifting aquatic plants (phytoplankton) and animals (zooplankton).

polishing cell: An area where final treatment is achieved before releasing contents, usually water, to a waterway or wetland area.

polyhaline: Between 18 and 30 parts per thousand salt concentration.

Preservation 2000: A 10-year program, initiated by the State of Florida in 1990, that raised $300 million per year for a total of $3 billion for environmental land acquisition.

private residential multi-slip dock: A docking facility used for private recreation or leisure purposes for multi-unit residential dwellings, which shall include but is not limited to condominiums, townhouses, subdivisions, and other such dwellings or residential areas and which is designated to moor three or more boats. Yacht clubs associated with residential developments, where utilization of the docking facility requires some real property interest in the residential area, shall also be included.

private residential single-family dock: A dock used for private, recreational, or leisure purposes for single family residence, cottage, or other such single dwelling unit and which is designed to moor no more than two boats. This also includes docks, with mooring of no more than a total of four boats, located on property lines between two upland single-family residences, where the dock is shared for use by upland, single-family residences.

prototype: The first full-scale, functional form of a new design or equipment.

regime: A regular pattern of occurrence, action, or conditions (as of seasonal rainfall).

regional planning councils: Florida planning and public policy agencies that work with public and private leadership on regional issues.

residence time: The duration of persistence of a mass or substance in a medium or place.

riparian: Related to, living, or occurring on the bank of a natural watercourse.

ruderal/disturbed: Referring to plants living on wasteland in built-up areas, with sediments not occurring in the natural states.

saline: Consisting of or containing salt.

Save Our Rivers: This 1981 Florida program created the Water Management Lands Trust Fund. This trust fund enables the water management districts to acquire lands necessary for water management, water supply, and the conservation and protection of water resources. Save Our Rivers projects can be jointly funded through the Water Management Lands Trust Fund and Preservation 2000/Florida Forever.

sedimentation: The action or process of forming or depositing sediments.

sessile benthic organism: Any organism anchored to the benthic environment (bottom).

shapefile: Computerized maps and images depicting different natural features created with Geographic Information Systems (GIS).

sheet flow: The flow of water across a given surface area such as a field, parking lot, or road during a rain event without a formal conveyance system (pipe, swale, etc).

sovereignty of lands: Supreme and independent power or authority in government as possessed or claimed by a state or community over lands or submerged lands.

spat: An oyster or similar bivalve mollusk in the juvenile stage, especially after it settles to the bottom and starts to develop a shell.

spawning aggregation: A group of individuals of a species living in close proximity during mating or reproductive cycles.

species of special concern: Those species about which NOAA's National Marine Fisheries Service (NMFS) has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act.

stakeholder: Individual or organization who stand to gain or lose from the success or failure of a system or program.

standard deviation (S.D.): A measure of the variation in a sample, calculated as the square root of the variance.

submerged: Occurring below the surface of the water; completely underwater.

substrate: The soils and sediments that comprise the ground.

telemetry: The use of an electrical apparatus for measuring a quantity and transmitting the result electronically to a distant station.

threatened: The term "threatened species" is defined as any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

toe of slope: In surveying, the lower edge of an abrupt change in elevation, typically where the ground levels out.

topography: The surface features of a place or region.

total maximum daily load (TMDL): A scientific determination of the maximum amount of a given pollutant that surface water can absorb and still meet the water quality standards that protect human health and aquatic life.

transverse: Acting, lying, or being across. Made at right angles to the long axis of a body.

triploid: Having three times the haploid number of chromosomes.

turbid/turbidity: Water clouded by suspended sediment or organic matter.

unconsolidated substrate: Loose, un-compacted and un-stratified sediment.

vestige: A trace, mark, or visible sign left by something vanished or lost. Smallest quantity or trace.

water column: The area of a body of water from the surface to the substrate.

Water Resources Development Act: The federal authorizing legislation for U.S. Army Corps of Engineers' water resource projects.

watershed: The geographic area through which water flows across the land and drains into a common body of water, whether a stream, river, lake, or ocean, including tributaries (wetlands, streams, canals, ditches, etc.) as well as stormwater runoff from the land.

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B.4.1 / Native Species Within and Adjacent to the North Fork St. Lucie River Aquatic Preserve

Common Name	Species Name	Status			References
		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
Kingdom Fungi (fungi)					
Division Mycophycophyta (lichens)					
Reindeer moss	*Cladonia* sp.				DEP, 2003; DEP, 2007
Kingdom Plantae (plants)					
Division Pterophyta (ferns)					
Boston fern	*Nephrolepis exaltata*				DNR, 1984; DEP, 2003; DEP, 2007
Chain fern	*Woodwardia virginica*				DNR, 1984
Cinnamon fern	*Osmunda cinnamomea*		CE		DNR, 1984; Coile & Garland, 2003; DEP, 2003; DEP, 2007
Golden polypody	*Phlebodium aureum*				DNR, 1984; DEP, 2003; DEP, 2007
Hand fern	*Ophioglossum palmatum*		E		DNR, 1984; Coile & Garland, 2003; DEP, 2003; DEP, 2007
Marsh fern	*Thelypteris palustris*				DNR, 1984; DEP, 2003; DEP, 2007
Pineland braken fern	*Pteridium aquilinum*				DEP, 2003; DEP, 2007
Resurrection fern	*Polypodium polypodioides*				DNR, 1984; DEP, 2003; DEP, 2007
Royal fern	*Osmunda regalis*		CE		DNR, 1984; Coile & Garland, 2003 ; DEP, 2003; DEP, 2007
Shoestring fern	*Vittaria lineata*				DNR, 1984; DEP, 2003; DEP, 2007
Strap fern	*Campyloneurum phyllitidis*				DNR, 1984
Swamp fern	*Blechnum serrulatum*				DNR, 1984; DEP, 2003; DEP, 2007
Water fern	*Salvinia rotundifolia*				DNR, 1984; DEP, 2003
Water horn fern	*Ceratopteris thalictroides*				DEP, 2007
Whisk fern	*Psilotum nudum*				DNR, 1984; DEP, 2003; DEP, 2007
Wood fern	*Thelypteris interrupta*				DNR, 1984
Division Pteridophyta (ferns)					
Giant leather fern	*Acrostichum danaeifolium*				DNR, 1984; DEP, 2003; DEP, 2007
Division Pinophyta (cone-bearing plants)					
Sand pine	*Pinus clausa*				DEP, 2003; DEP, 2007
South Florida slash pine	*Pinus elliotti var. densa*				DEP, 2003; DEP, 2007
Division Magnoliophyta (flowering plants)					
Class Liliopsida (grass-like flowering plants)					
Adam's needle	*Yucca filamentosa*				DEP, 2003; DEP, 2007
Air pine	*Tillandsia fasciculata*		E		Teas, 1971; DNR, 1984; Coile & Garland, 2003; DEP, 2003; DEP, 2007
Arrow arum	*Peltandra virginica*				DNR, 1984
Arrowhead	*Sagittaria* sp.				DEP, 2003; DEP, 2007
Ball moss	*Tillandsia recurvata*				DNR, 1984; DEP, 2003; DEP, 2007
Butterfly orchid	*Encyclia tampensis*		CE		Teas, 1971; DNR, 1984; Coile & Garland, 2003; DEP, 2003; DEP, 2007
Cabbage (Sabal) palm	*Sabal palmetto*				DNR, 1984; DEP, 2003; DEP, 2007
Catbrier	*Smilax laurifolia*				DNR, 1984; DEP, 2003; DEP, 2007
Cattail	*Typha latifolia*				DEP, 2003; DEP, 2007

Legend: CE-Commercially Exploited; SSC-Species of Special Concern; T-Threatened; E-Endangered, ud-undetermined

Common Name	Species Name	Status			References
		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
Cordgrass	*Spartina bakeri*				DEP, 2003; DEP, 2007
Dayflower	*Commelina erecta*				DEP, 2003; DEP, 2007
Durban crowfoot grass	*Dactyloctenium aegyptium*				DEP, 2003; DEP, 2007
Giant air pine	*Tillandsia utriculata*		E		Teas, 1971; DNR, 1984; Coile & Garland, 2003; DEP, 2003; DEP, 2007
Greenbrier	*Smilax auriculata*				DEP, 2003; DEP, 2007
Ground orchid	*Habenaria* sp.				DEP, 2003; DEP, 2007
Leatherleaf airplant	*Tillandsia variabilis*		T		Coile & Garland, 2003; DEP, 2003; DEP, 2007
Manatee River airplant	*Tillandsia simulata*				DEP, 2003; DEP, 2007
Needle-leaf airplant	*Tillandsia setacea*				DNR, 1984; DEP, 2007
Northern needleleaf	*Tillandsia balbisiana*		T		DNR, 1984; Coile & Garland, 2003; DEP, 2003; DEP, 2007
Panic grass	*Panicum joorii*				DNR, 1984
Pine lily	*Lilium catesbaei*		T		Coile & Garland, 2003; DEP, 2003; DEP, 2007
Pipewort	*Eriocaulon decangulare*				DEP, 2003; DEP, 2007
Redroot	*Lachnanthes caroliniana*				DEP, 2003; DEP, 2007
Rush	*Juncus* sp.				Robbins, 1996; DEP, 2003; DEP, 2007
Saw greenbrier	*Smilax bona-nox*				DNR, 1984; DEP, 2003; DEP, 2007
Saw palmetto	*Serenoa repens*				DNR, 1984; DEP, 2003; DEP, 2007
Sedge	*Cyperus* sp.				DEP, 2003; DEP, 2007
Shoal grass	*Halodule wrightii*				URS Greiner Woodward Clyde, 1999
Small's airplant	*Tillandsia smalliana*				DEP, 2003; DEP, 2007
Spanish moss	*Tillandsia usneoides*				DNR, 1984; DEP, 2003; DEP, 2007
Spike moss	*Selaginella arenicola*				DEP, 2003; DEP, 2007
Spoonflower	*Peltandra sagittifolia*				DEP, 2003; DEP, 2007
Star rush	*Rhynchospora latifolia*				DEP, 2003; DEP, 2007
Swamp grass	*Carex* sp.				DEP, 2003; DEP, 2007
Swamp lily	*Crinum americanum*				DNR, 1984; DEP, 2003; DEP, 2007
Twisted airplant	*Tillandsia flexuosa*		T		Coile & Garland, 2003; DEP, 2003; DEP, 2007
Twisted wild-pine	*Tillandsia paucifolia*				DEP, 2003; DEP, 2007
Whitetop	*Rhynchospora colorata*				DEP, 2003; DEP, 2007
Widgeon grass	*Ruppia maritima*				URS Greiner Woodward Clyde, 1999
Wiregrass (Threeawn)	*Aristida beyrichiana*				DEP, 2003; DEP, 2007
Yellow blue-eyed grass	*Sisyrinchium exile*				DEP, 2003; DEP, 2007
Yellow-eyed grass	*Xyris* sp.				DEP, 2003; DEP, 2007
Class Magnoliopsida (woody flowering plants)					
American beautyberry	*Callicarpa americana*				DNR, 1984; DEP, 2003; DEP, 2007
American white water lily	*Nymphaea odorata*				DEP, unpublished data
Argeratum	*Conoclinium coelestinum*				DEP, 2003; DEP, 2007
Barbara's button	*Marshallia tenuifolia*				DEP, 2003; DEP, 2007
Bastard indigo	*Amorpha fruiticosa*				DNR, 1984
Black mangrove	*Avicennia germinans*				DEP, 2003; DEP, 2007
Blackroot	*Pterocaulon virgatum*				DEP, 2003; DEP, 2007
Blazing star	*Liatris barberi*				DEP, 2003; DEP, 2007
Buttonbush	*Cephalanthus occidentalis*				DNR, 1984; DEP, 2003; DEP, 2007
Calusa grape	*Vitis shuttleworthii*				DNR, 1984
Camphorweed	*Pluchea rosea*				DEP, 2003; DEP, 2007
Climbing aster	*Aster caroliniensis*				DEP, 2003; DEP, 2007
Climbing hempweed	*Mikania scandens*				DEP, 2003; DEP, 2007
Coastal plain willow	*Salix caroliniana*				DNR, 1984; DEP, 2003; DEP, 2007
Coin vine	*Dalbergia ecastophyllum*				DEP, 2003; DEP, 2007
Coral bean	*Erythrina herbacea*				DNR, 1984

Legend: CE-Commercially Exploited; SSC-Species of Special Concern; T-Threatened; E-Endangered, ud-undetermined

Common Name	Species Name	Status			References
		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
Dahoon holly	*Ilex cassine*				DNR, 1984; DEP, 2003; DEP, 2007
Deer-tongue	*Carphephorous paniculatus*				DEP, 2003; DEP, 2007
Dog fennel	*Eupatorium* sp.				DEP, 2003; DEP, 2007
Drumheads	*Polygala cruciata*				DEP, 2003; DEP, 2007
Elderberry	*Sambucus simpsonii*				DNR, 1984
Erect scrub spurge	*Euphorbia polyphylla*				DEP, 2003; DEP, 2007
False nettle	*Boehmeria cylindrica*				DEP, 2003; DEP, 2007
Florida bluebell	*Campanula floridana*				DEP, 2003; DEP, 2007
Fragrant eryngium	*Eryngium aromaticum*				DEP, 2003; DEP, 2007
Galactia	*Galactia regularis*				DEP, 2003; DEP, 2007
Goldenaster	*Pityopsis graminifolia*				DEP, 2003; DEP, 2007
Gopher apple	*Licania michauxii*				DEP, 2003; DEP, 2007
Gumbo limbo	*Bursera simaruba*				DNR, 1984; DEP, 2003; DEP, 2007
Ironweed	*Vernonia* sp.				DEP, 2003; DEP, 2007
Knotweed	*Polygonum* sp.				DEP, 2003; DEP, 2007
Large-flowered conradina	*Conradina grandiflora*		T		Coile & Garland, 2003; DEP, 2003; DEP, 2007
Large-flowered sabatia	*Sabatia grandiflora*				DEP, 2003; DEP, 2007
Laurel oak	*Quercus laurifolia*				DNR, 1984; DEP, 2003; DEP, 2007
Live oak	*Quercus virginiana*				DEP, 2003; DEP, 2007
Lizard's tail	*Saururus cernuus*				DNR, 1984
Loblolly bay	*Gordonia lisianthus*				DEP, 2003; DEP, 2007
Love vine	*Cassytha filiformis*				DEP, 2003; DEP, 2007
Mangrove rubber vine	*Rhabdadenia biflora*				DEP, 2003; DEP, 2007
Marlberry	*Ardisia escallonioides*				DEP, 2003; DEP, 2007
Marsh pennywort	*Hydrocotyle umbellata*				DEP, 2003; DEP, 2007
Meadow beauty	*Rhexia nashii*				DEP, 2003; DEP, 2007
Mexican clover	*Richardia brasiliensis*				DEP, 2003; DEP, 2007
Moonflower	*Ipomoea alba*				DEP, 2003; DEP, 2007
Muscadine grape	*Vitis rotundifolia*				DNR, 1984; DEP, 2003; DEP, 2007
Myrsine	*Myrsine guianensis*				DNR, 1984; DEP, 2003; DEP, 2007
Myrtle oak	*Quercus myrtifolia*				DEP, 2003; DEP, 2007
Nodding pinweed	*Lechea cernua*		T		Coile & Garland, 2003; DEP, 2003
Partridge pea	*Cassia fasciculata*				DEP, 2003; DEP, 2007
Pennyroyal	*Piloblephis rigida*				DEP, 2003; DEP, 2007
Peppergrass	*Lepidium virginicum*				DEP, 2003; DEP, 2007
Persimmon	*Diospyros virginiana*				DNR, 1984
Pine barren goldenrod	*Solidago fistulosa*				DEP, 2003; DEP, 2007
Pink sundew	*Drosera capillaris*				DEP, 2003; DEP, 2007
Poison ivy	*Toxicodendron radicans*				DNR, 1984; DEP, 2003; DEP, 2007
Pond apple	*Annona glabra*				DNR, 1984; DEP, 2003; DEP, 2007
Pop ash	*Fraxinus caroliniana*				DNR, 1984; DEP, 2003; DEP, 2007
Prickly-pear cactus	*Opuntia* sp.				DEP, 2003; DEP, 2007
Primrose willow	*Ludwigia peruviana*				DNR, 1984
Red mangrove	*Rhizophora mangle*				DEP, 2003; DEP, 2007
Red maple	*Acer rubrum*				DNR, 1984; DEP, 2003; DEP, 2007
Red mulberry	*Morus rubra*				DNR, 1984
Rosegentian	*Sabatia* sp.				DEP, 2003; DEP, 2007
Saltbush	*Baccharis angustifolia*				DEP, 2003; DEP, 2007
Saltbush (Sea myrtle)	*Baccharis halimifolia*				DEP, 2003; DEP, 2007
Sand live oak	*Quercus geminata*				DEP, 2003; DEP, 2007
Sawgrass	*Cladium jamaicensis*				DNR, 1984; DEP, 2003; DEP, 2007
Scrub hickory	*Carya floridana*				DEP, 2003; DEP, 2007
Sensitive briar	*Schrankia microphylla*				DEP, 2003; DEP, 2007
Shiny blueberry	*Vaccinium myrsinites*				DEP, 2003; DEP, 2007

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		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
Shiny sumac	*Rhus copallina*				DEP, 2003; DEP, 2007
Shiny-leaved wild coffee	*Psychotria nervosa*				DEP, 2003; DEP, 2007
Showy partridge pea	*Cassia chamaecrista*				DEP, 2003; DEP, 2007
Smatweed	*Polygonum sp.*				DEP, 2003
Soft-leaved wild coffee	*Psychotria sulzneri*				DNR, 1984; DEP, 2003; DEP, 2007
Southern fox grape	*Vitis munsoniana*				DEP, 2003; DEP, 2007
Southern guara	*Gaura angustifolia*				DEP, 2003; DEP, 2007
Spanish needle	*Bidens alba*				DEP, 2003; DEP, 2007
St. Andrews cross	*Hypericum hypericoides*				DEP, 2003; DEP, 2007
St. Johns wort	*Hypericum reductum*				DEP, 2003; DEP, 2007
Staggerbush	*Lyonia fruticosa*				DEP, 2003; DEP, 2007
Stiff cornel dogwood	*Cornus foemina*				DNR, 1984
Strangler fig	*Ficus aurea*				DNR, 1984; DEP, 2003; DEP, 2007
Swamp bay	*Persea palustris*				DEP, 2007
Swamp milkweed	*Asclepias incarnata*				DEP, 2003; DEP, 2007
Sweet bay	*Magnolia virginiana*				DNR, 1984; DEP, 2003
Sweetgum	*Liquidambar styraciflua*				DEP, 2003; DEP, 2007
Tall milkwort	*Polygala cymosa*				DEP, 2003; DEP, 2007
Tallow-wood (Hog plum)	*Ximenia americana*				DEP, 2003; DEP, 2007
Tarflower	*Befaria racemosa*				DEP, 2003; DEP, 2007
Tickseed	*Coreopsis leavenworthii*				DEP, 2003; DEP, 2007
Tiny polygala (Tiny milkwort)	*Polygala smallii*		E		Coile & Garland, 2003; DEP, 2003; DEP, 2007
Trailing morning glory	*Stylisma patens*				DEP, 2003; DEP, 2007
Twistleaf goldenrod	*Solidago tortifolia*				DEP, 2003; DEP, 2007
Verbena	*Glandularia tampensis*		E		Coile & Garland, 2003; DEP, 2003; DEP, 2007
Virginia creeper	*Parthenocissus quinquefolia*				DEP, 2003; DEP, 2007
Water hemlock	*Cicuta mexicana*				DEP, 2003; DEP, 2007
Water hickory	*Carya aquatica*				DNR, 1984; DEP, 2003; DEP, 2007
Water hyssop	*Bacopa monnieri*				DNR, 1984
Water oak	*Quercus nigra*				DNR, 1984
Water pimpernel	*Samolus parviflorus*				DEP, 2003; DEP, 2007
Wax myrtle (Southern bayberry)	*Myrica cerifera*				DNR, 1984; DEP, 2003; DEP, 2007
White mangrove	*Laguncularia racemosa*				DEP, 2007
White stopper	*Eugenia axillaris*				DEP, 2003; DEP, 2007
White vine	*Sarcostemma clausa*				DEP, 2003; DEP, 2007
Wild bachelor's button	*Polygala nana*				DEP, 2003; DEP, 2007
Wild coffee	*Psychotria undata*				DNR, 1984
Wild lime	*Zanthoxylum fagara*				DEP, 2003; DEP, 2007
Wire plant	*Stipulicida setacea*				DEP, 2003; DEP, 2007
Yellow bachelor's button	*Polygala rugelii*				DEP, 2003; DEP, 2007
Yellow water lily (Spatterdock)	*Nuphar lutea*				DEP, unpublished data
Kingdom Animalia (animals)					
Phylum Cnidaria					
Class Scyphozoa (jellyfishes)					
Moon jellyfish	*Aurelia aurita*				Gunter & Hall, 1963
Phylum Ctenophora (comb jellies)					
Comb jelly	*Mnemiopsis mccradyi*				Gunter & Hall, 1963
Phylum Annelida (segmented worms)					
Neried polychaete worm	*Nereidae*				Beal et al., 2006
Oligochaete worm	*Oligochaeta* sp.				Beal et al., 2006
Polychaete worm	*Polychaeta* sp.				Beal et al., 2006

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		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
Phylum Arthropoda (insects, crustaceans)					
Subphylum Crustacea (shrimp and crabs)					
Blue crab	*Callinectes sapidus*				Gunter & Hall, 1963; Beal et al., 2006
Brown shrimp	*Farfantepenaeus aztecus*				Gunter & Hall, 1963; Beal et al., 2006
Cinnamon river shrimp	*Macrobrachium acanthurus*				Gunter & Hall, 1963
Crayfish	*Procambridae* (multiple spp.)				Beal et al., 2006
Florida grass shrimp	*Palaemon floridanus*				Beal et al., 2006
Grass shrimp	*Palaemonetes cf. pugio*				Beal et al., 2006
Grass shrimp	*Palaemonetes* sp.				Gunter & Hall, 1963; Teas, 1971; Beal et al., 2006
Great land crab	*Cardisoma guanhumi*				DEP, unpublished data
Long-arm prawn	*Macrobrachium* sp.				Beal et al., 2006
Mangrove crab	*Sesarma* sp.				Beal et al., 2006
Mud crab	*Xanthidae*				Beal et al., 2006
Ornate crab	*Callinectes ornatus*				Gunter & Hall, 1963
Pink shrimp	*Farfantepenaeus duorarum*				Gunter & Hall, 1963
Squareback marsh crab	*Armases cinereum*				Beal et al., 2006
Swimming crab	*Callinectes bocourti*				Beal et al., 2006
Thinstripe hermit crab	*Clibanarius vitattus*				Gunter & Hall, 1963
Class Gastropoda (snails)					
Common marsh snail	*Melampus bidentatus*				Beal et al., 2006
Common nassa	*Nassarius vibex*				Gunter & Hall, 1963
Nerite snail	*Neritidae*				Beal et al., 2006
Snail	*Gastropoda* spp.				Beal et al., 2006
Class Bivalvia (clams, mussels, oysters)					
Eastern oyster	*Crassostrea virginica*				URS Greiner Woodward Clyde, 1999
False muscle	*Congeria leucophaeta*				Gunter & Hall, 1963; Teas, 1971
Florida marsh clam	*Pseudocyena floridiana*				Teas, 1971
Rangia clam	*Rangia cuneata*				Gunter & Hall, 1963
Quahog clam	*Venus sp.*				Teas, 1971
Subphylum Vertebrata (vertebrates)					
Class Chondrichthyes (cartilaginous fishes)					
Southern stingray	*Dasyatis sabina*				Gunter & Hall, 1963; Robbins, 1996; DEP, 2003; DEP, 2007
Superclass Osteichthyes (bony fishes)					
American eel	*Anguilla rostrata*				DEP, 2003; Gilmore, 2005; DEP, 2007
Anchovy, juvenile	*Engraulidae,* juvenile				Springer, 1960; DEP, 2003; DEP, 2007
Atlantic bumper	*Chloroscombrus chrysurus*				DEP, 2003; DEP, 2007
Atlantic croaker	*Micropogonias undulatus*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Atlantic cutlassfish	*Trichiurus lepturus*				DEP, 2003; DEP, 2007
Atlantic menhaden	*Brevoortia tyrannus*				Springer, 1960; DEP, 2003; DEP, 2007
Atlantic midshipman	*Porichthys porosissimus*				DEP, 2003; DEP, 2007
Atlantic moonfish	*Vomer setapinnis*				DEP, 2003; DEP, 2007
Atlantic needlefish	*Strongylura marina*				DEP, 2003; DEP, 2007
Atlantic spadefish	*Chaetodipterus faber*				DEP, 2003; DEP, 2007
Atlantic thread herring	*Opisthonema oglinum*				DEP, 2003; DEP, 2007
Ballyhoo	*Hemiramphus brasiliensis*				DEP, 2003; DEP, 2007
Bay anchovy	*Anchoa mitchilli*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Bay whiff	*Citharichthys spilopterus*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; Beal et al., 2006; DEP, 2007
Bigeye stargazer	*Dactyloscopus crossotus*				DEP, 2003; DEP, 2007

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		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
Bighead searobin	*Prionotus tribulus*				DEP, 2003; DEP, 2007
Bigmouth sleeper	*Gobiomorus dormitor*	T			Ashton, 1992; DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Black crappie	*Pomoxis nigromaculatus*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Black drum	*Pogonias cromis*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Black margate	*Anisotremus surinamensis*				DEP, 2003; DEP, 2007
Blueback herring	*Alosa aestivalis*				Springer, 1960; DEP, 2003; DEP, 2007
Bluefin killifish	*Lucania goodei*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Bluefish	*Pomatomus saltatrix*				DEP, 2003; DEP, 2007
Bluegill	*Lepomis macrochirus*				Gunter & Hall, 1963; DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Blue runner	*Caranx crysos*				DEP, 2003; DEP, 2007
Bluespotted cornetfish	*Fistularia tabacaria*				DEP, 2003; DEP, 2007
Bluespotted sunfish	*Enneacanthus gloriosus*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Bluestriped grunt	*Haemulon sciurus*				DEP, 2003; DEP, 2007
Bonefish	*Albula vulpes*				DEP, 2003; DEP, 2007
Bowfin (Mudfish)	*Amia calva*				DEP, 2003; Gilmore, 2005; DEP, 2007
Brook silverside	*Labidesthes sicculus*				DEP, 2003; DEP, 2007
Brown bullhead	*Ameiurus nebulosus*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Chain pipefish	*Syngnathus louisianae*				DEP, 2003; DEP, 2007
Channel catfish	*Ictalurus punctatus*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Checkered puffer	*Sphoeroides testudineus*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Clown goby	*Microgobius gulosus*				DEP, 2003; Beal et al., 2006; DEP, 2007
Code goby	*Gobiosoma robustum*				DEP, 2003; DEP, 2007
Common pompano	*Trachinotus carolinus*				DEP, 2003; DEP, 2007
Common snook	*Centropomus undecimalis*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Crested goby	*Lophogobius cyprinoides*				DEP, 2003; DEP, 2007
Crevalle jack	*Caranx hippos*				Springer, 1960; DEP, 2003; DEP, 2007
Cuban anchovy	*Anchoa cubana*				DEP, 2003; DEP, 2007
Darter goby	*Gobionellus boleosoma*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Dollar sunfish	*Lepomis marginatus*				DEP, 2003; DEP, 2007
Dusky anchovy	*Anchoa lyolepis*				DEP, 2003; DEP, 2007
Dusky pipefish	*Syngnathus floridae*				DEP, 2003; DEP, 2007
Eastern mosquitofish	*Gambusia holbrooki*				Beal et al., 2006; DEP, 2007
Emerald goby	*Gobionellus smaragdus*				DEP, 2003; DEP, 2007
Emerald sleeper	*Erotelis smaragdus*				DEP, 2003; DEP, 2007
Fat sleeper	*Dormitator maculates*				DEP, 2003; Beal et al., 2006; DEP, 2007
Fat snook	*Centropomus parallelus*				DEP, 2003; DEP, 2007
Flagfish	*Jordanella floridae*				DEP, 2003; DEP, 2007
French grunt	*Haemulon flavolineatum*				DEP, 2003; DEP, 2007
Frillfin goby (Molly miller)	*Bathygobius soporator*				DEP, 2003; DEP, 2007
Fringed flounder	*Etropus crossotus*				DEP, 2003; DEP, 2007
Gafftopsail catfish	*Bagre marinus*				DEP, 2003; DEP, 2007
Gar	*Lepisosteus* sp.				DEP, 2003; DEP, 2007
Gizzard shad	*Dorosoma cepedianum*				DEP, 2003; DEP, 2007

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		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
Golden shiner	*Notemigonus crysoleucas*				DEP, 2003; DEP, 2007
Goliath grouper	*Epinephelus itajara*				DEP, 2003; DEP, 2007
Gray snapper	*Lutjanus griseus*				DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Gray triggerfish	*Balistes capriscus*				DEP, 2003; DEP, 2007
Great barracuda	*Sphyraena barracuda*				Springer, 1960; DEP, 2003; DEP, 2007
Green goby	*Microgobius thalassinus*				DEP, 2003; DEP, 2007
Grunt	*Haemulon* sp.				DEP, 2003; DEP, 2007
Gulf flounder	*Paralichthys albigutta*				DEP, 2003; DEP, 2007
Gulf pipefish	*Syngnathus scovelli*				DEP, 2003; DEP, 2007
Gulf whiff	*Citharichthys macrops*				DEP, 2003; DEP, 2007
Hairy blenny	*Labrisomus nuchipinnis*				DEP, 2003; DEP, 2007
Hardhead catfish	*Arius felis*				Springer, 1960; DEP, 2003; DEP, 2007
Herring, juvenile	*Clupeidae,* juvenile				DEP, 2003; DEP, 2007
Highfin blenny	*Lupinoblennius nicholsi*				DEP, 2003; DEP, 2007
Hogchoker	*Trinectes maculates*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; Beal et al., 2006; DEP, 2007
Horse-eye jack	*Caranx latus*				DEP, 2003; DEP, 2007
Houndfish	*Tylosurus* sp.				DEP, 2003; DEP, 2007
Inland silverside	*Menidia beryllina*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Inshore lizardfish	*Synodus foetens*				DEP, 2003; DEP, 2007
Irish pompano	*Diapterus auratus*				Springer, 1960; DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Jawfish	*Opisthognathus* sp.				DEP, 2003; DEP, 2007
Ladyfish	*Elops saurus*				Springer, 1960; DEP, 2003; Gilmore, 2005; DEP, 2007
Lane snapper	*Lutjanus synagris*				DEP, 2003; DEP, 2007
Largemouth bass	*Micropterus salmoides*				DEP, 2003; Gilmore, 2005; DEP, 2007
Least killifish	*Heterandria formosa*				Gunter & Hall, 1963; Teas, 1971; DEP, 2003; Beal et al., 2006; DEP, 2007
Leatherjacket	*Oligoplites saurus*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Lined sole	*Achirus lineatus*				Gunter & Hall, 1963; DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Lookdown	*Selene vomer*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Lyre goby	*Evorthodus lyricus*				DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Mahogany snapper	*Lutjanus mahogoni*				DEP, 2003; DEP, 2007
Mangrove rivulus	*Rivulus marmoratus*	SCC	SSC	SSC	Ashton, 1992; Beal et al., 2006
Marsh killifish	*Fundulus confluentus*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Moray eel, larval	*Muraenidea, leptocephalus*				DEP, 2003; DEP, 2007
Mosquitofish	*Gambusia affinis*				Gunter & Hall, 1963; Teas, 1971; DEP, 2003
Mutton snapper	*Lutjanus analis*				DEP, 2003; DEP, 2007
Naked goby	*Gobiosoma bosci*				DEP, 2003; Beal et al., 2006; DEP, 2007
Nassau grouper	*Epinephelus striatus*				DEP, 2003; DEP, 2007
Needlefishes	*Strongylura* sp.				Gunter & Hall, 1963; DEP, 2003
Northern kingfish	*Menticirrhus saxatilis*				DEP, 2003; DEP, 2007
Northern puffer	*Sphoeroides maculatus*				DEP, 2003; DEP, 2007
Northern seahorse	*Hippocampus hudsonius*				DEP, 2003; DEP, 2007
Northern sennet	*Sphyraena borealis*				DEP, 2003; DEP, 2007
Opossum pipefish	*Microphis brachyurus lineatus*	T	SSC	SSC	Ashton, 1992; DEP, 2003; DEP, 2007

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Oyster toadfish	*Opsanus tau*				DEP, 2003; DEP, 2007
Parrotfish	*Scarus* sp.				DEP, 2003; DEP, 2007
Parrotfish	*Sparisoma* sp.				DEP, 2003; DEP, 2007
Permit	*Trachinotus falcatus*				DEP, 2003; DEP, 2007
Pigfish	*Orthopristis chrysopterus*				DEP, 2003; DEP, 2007
Pinfish	*Lagodon rhomboides*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Planehead filefish	*Monacanthus hispidus*				DEP, 2003; DEP, 2007
Plumed scorpionfish	*Scorpaena grandicornis*				DEP, 2003; DEP, 2007
Rainwater killifish	*Lucania parva*				DEP, 2003; DEP, 2007
Red drum (Redfish)	*Sciaenops ocellatus*				Gunter & Hall, 1963; DEP, 2003; Beal et al., 2006; DEP, 2007
Redear sunfish	*Lepomis microlophus*				DEP, 2003; Gilmore, 2005; DEP, 2007
Red grouper	*Epinephelus morio*				DEP, 2003; DEP, 2007
River goby	*Awaous banana*	T			Ashton, 1992; DEP, 2003; DEP, 2007
Rock seabass	*Centropristis philadelphica*				DEP, 2003; DEP, 2007
Rough silverside	*Membras martinica*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Sailfin molly	*Poecilia latipinna*				Springer, 1960; Teas, 1971; DEP, 2003; Beal et al., 2006; DEP, 2007
Sailor's choice	*Haemulon parra*				DEP, 2003; DEP, 2007
Sand perch	*Diplectrum formosum*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Sand stargazer	*Gillellus* sp.				DEP, 2003; DEP, 2007
Sargassumfish	*Histrio histrio*				DEP, 2003; DEP, 2007
Scaled sardine	*Harengula jagauna*				DEP, 2003; DEP, 2007
Schoolmaster	*Lutjanus apodus*				DEP, 2003; DEP, 2007
Scorpionfish	*Scorpaena* sp.				DEP, 2003; DEP, 2007
Seabass, juvenile	*Serranidae,* juvenile				DEP, 2003; DEP, 2007
Sea catfish	*Galeichthys felis*				Springer, 1960; Gunter & Hall, 1963
Seahorse	*Hippocampus* sp.				DEP, 2003; DEP, 2007
Searobin	*Prionotus* sp.				DEP, 2003; DEP, 2007
Seminole killifish	*Fundulus seminolis*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Sergeant major	*Abudefduf saxatilis*				DEP, 2003; DEP, 2007
Sharptail goby	*Gobionellus hastatus*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Sheepshead	*Archosargus probatocephalus*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; Gilmore, 2005; DEP, 2007
Sheepshead minnow	*Cyprinodon variegatus*				DEP, 2003; DEP, 2007
Silver jenny	*Eucinostomus gula*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; Beal et al., 2006; DEP, 2007
Silver perch	*Bairdiella chrysura*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Silver porgy	*Diplodus argenteus*				DEP, 2003; DEP, 2007
Silver seatrout	*Cynoscion nothus*				DEP, 2003; DEP, 2007
Silverside	*Menidia* sp.				Springer, 1960; Beal et al., 2006
Skilletfish	*Gobiesox strumosus*				DEP, 2003; DEP, 2007
Slashcheek goby	*Gobionellus pseudofasciatus*	T			Ashton, 1992; DEP, 2003; DEP, 2007
Sleeper	*Eleotris* sp.				DEP, 2003; DEP, 2007
Slim goby	*Gobionellus gracillimus*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Slippery dick	*Halichoeres bivittatus*				DEP, 2003; DEP, 2007
Small-scaled goby	*Gobionellus oceanicus*				DEP, 2003; DEP, 2007
Smooth puffer	*Lagocephalus laevigatus*				DEP, 2003; DEP, 2007

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Smooth trunkfish	*Lactophrys triqueter*				DEP, 2003; DEP, 2007
Southern flounder	*Paralichthys lethostigma*				DEP, 2003; DEP, 2007
Southern kingfish	*Menticirrhus americanus*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Southern puffer	*Sphoeroides nephelus*				DEP, 2003; DEP, 2007
Southern sennet	*Sphyraena picudilla*				DEP, 2003; DEP, 2007
Spanish mackeral	*Scomberomorus maculatus*				DEP, 2003; DEP, 2007
Spanish sardine	*Sardinella anchovia*				DEP, 2003; DEP, 2007
Spinycheek sleeper	*Eleotris pisonis*				Beal et al., 2006
Spot	*Leiostomus xanthurus*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Spotfin mojarra	*Eucinostomus argenteus*				Springer, 1960; DEP, 2003; DEP, 2007
Spotted gar	*Lepisosteus platyrhincus*				Gunter & Hall, 1963; Teas, 1971; DEP, 2003; Gilmore, 2005; DEP, 2007
Spotted pinfish	*Diplodus holbrooki*				DEP, 2003; DEP, 2007
Spotted scorpionfish	*Scorpaena plumieri*				DEP, 2003; DEP, 2007
Spotted seatrout	*Cynoscion nebulosus*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Spotted sunfish	*Lepomis punctatus*				DEP, 2003; DEP, 2007
Star drum	*Stellifer lanceolatus*				DEP, 2003; DEP, 2007
Striped anchovy	*Anchoa hepsetus*				DEP, 2003; DEP, 2007
Striped burrfish	*Chilomycterus schoepfi*				DEP, 2003; DEP, 2007
Striped mojarra	*Eugerres plumieri*				Springer, 1960; DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Striped mullet	*Mugil cephalus*				Springer, 1960; Gunter & Hall, 1963; Teas, 1971; DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Swordspine snook	*Centropomus ensiferus*				Beal et al., 2006
Taillight shiner	*Notropis maculatus*				DEP, 2003; DEP, 2007
Tarpon	*Magalops atlanticus*				Teas, 1971DEP, 2003; DEP, 2007
Tarpon snook	*Centropomus pectinatus*				DEP, 2003; Gilmore, 2005; DEP, 2007
Threadfin	*Polydactylus octonemus*				DEP, 2003; DEP, 2007
Threadfin shad	*Dorosoma petenense*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Tidewater mojarra	*Eucinostomus harengulus*				Gilmore, 2005; Beal et al., 2006
Tonguefish	*Symphurus plagiusa*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Triggerfish, juvenile	*Balistidae,* juvenile				DEP, 2003; DEP, 2007
Tripletail	*Lobotes surinamensis*				DEP, 2003; DEP, 2007
Trunkfish	*Lactophrys trigonus*				DEP, 2003; DEP, 2007
Violet goby	*Gobioides broussonnetti*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Weakfish	*Cynoscion regalis*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
White catfish	*Ictalurus catus*				Springer, 1960; Gunter & Hall, 1963; DEP, 2003; DEP, 2007
White grunt	*Haemulon plumieri*				DEP, 2003; DEP, 2007
White mullet	*Mugil curema*				Gunter & Hall, 1963; DEP, 2003; Gilmore, 2005; Beal et al., 2006; DEP, 2007
Worm eel	*Myrophis punctatus*				DEP, 2003; DEP, 2007
Yellow bullhead	*Ictalurus natalis*				DEP, 2003; DEP, 2007
Yellowfin menhaden	*Brevoortia smithi*				Gunter & Hall, 1963; DEP, 2003; DEP, 2007
Yellowfin mojarra	*Gerres cinereus*				DEP, 2003; DEP, 2007
Yellow goatfish	*Pseudupeneus maculatus*				DEP, 2003; DEP, 2007
Yellow jack	*Caranx bartholomaei*				DEP, 2003; DEP, 2007

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		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
Class Amphibia (frogs, toads,salamanders)					
Barking treefrog	*Hyla gratiosa*				DEP, 2003; DEP, 2007
Dwarf salamander	*Eurycea quadridigitata*				DNR, 1984
Eastern narrow-mouthed toad	*Gastrophryne carolinensis*				DNR, 1984
Eastern spadefoot toad	*Scaphiopus holbrooki*				DEP, 2003; DEP, 2007
Florida cricket frog	*Acris gryllus*				DNR, 1984
Greater siren	*Siren lacertina*				DNR, 1984; Beal et al., 2006
Green treefrog	*Hyla cinerea*				DNR, 1984; DEP, 2003; DEP, 2007
Little grass frog	*Limnaoedus ocularis*				DNR, 1984
Narrow-striped dwarf siren	*Pseudobranchus axanthus*				DNR, 1984
Oak toad	*Bufo quercicus*				DNR, 1984; DEP, 2003; DEP, 2007
Peninsula newt	*Notophthalmus viridescens*				DNR, 1984
Pig frog	*Rana grylio*				DNR, 1984
Siren	*Siren* sp.				DEP, 2003; DEP, 2007
Southern leopard frog	*Rana utricularia*				DNR, 1984; DEP, 2003; DEP, 2007
Southern toad	*Bufo terrestris*				DNR, 1984
Squirrel treefrog	*Hyla squirella*				DNR, 1984
Two-toed amphiuma	*Amphiuma means*				DNR, 1984
Class Reptilia (reptiles)					
American alligator	*Alligator mississippiensis*		SSC	T	DNR, 1984; DEP, 2003; Beal et al., 2006; DEP, 2007
Coastal dunes crowned snake	*Tantilla relicta pamlica*				DEP, 2003; DEP, 2007
Common musk turtle	*Sternotherus odoratus*				DNR, 1984
Corn snake	*Elaphe guttata guttata*				DEP, 2003; DEP, 2007
Dusky pygmy rattlesnake	*Sistrurus miliarius*				DNR, 1984
Eastern coachwhip snake	*Masticophis flagellum flagellum*				DEP, 2003; DEP, 2007
Eastern coral snake	*Micrurus fulvius*				DNR, 1984; DEP, 2003; DEP, 2007
Eastern diamondback rattlesnake	*Crotalus adamanteus*				DEP, 2003; DEP, 2007
Eastern garter snake	*Thamnophis sirtalis*				DNR, 1984; DEP, 2003; DEP, 2007
Eastern indigo snake	*Drymarchon corais couperi*	SSC	T	T	DNR, 1984; Ashton, 1992; DEP, 2003; DEP, 2007
Eastern ribbon snake	*Thamnophis sauritus*				DNR, 1984
Florida box turtle	*Terrapene carolina bauri*				DNR, 1984; DEP, 2003; DEP, 2007
Florida brown snake	*Storeria dekayi victa*	T	T		DNR, 1984; Ashton, 1992
Florida cottonmouth	*Agkistrodon piscivorus*				DNR, 1984; DEP, 2003; DEP, 2007
Florida pine snake	*Pituophis melanoleucus mugitus*	ud	SSC		Ashton, 1992; DEP, 2003; DEP, 2007
Florida red-bellied turtle	*Chrysemys nelsoni*				DNR, 1984
Florida scrub lizard	*Sceloporus woodi*	T			Ashton, 1992; DEP, 2003; DEP, 2007
Florida softshell	*Trionyx ferox*				DNR, 1984; DEP, 2003; Beal et al., 2006; DEP, 2007
Florida water snake	*Nerodia fasciata*				DNR, 1984
Gopher tortoise	*Gopherus polyphemus*	T	SSC		Ashton, 1992; DEP, 2003; DEP, 2007
Green anole	*Anolis carolinensis*				DNR, 1984; DEP, 2003; DEP, 2007
Ground skink	*Sciencella lateralis*				DNR, 1984
King snake	*Lompropeltis* sp.				DNR, 1984
Peninsula mole skink	*Eumeces egregious onocrepis*				DEP, 2003; DEP, 2007
Rat snake	*Elaphe* sp.				DNR, 1984
Rough green snake	*Opheodrys aestivus*				DNR, 1984; DEP, 2003; DEP, 2007

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Six-lined racerunner	*Cnemidophorus sexlineatus*				DNR, 1984
Snapping turtle	*Chelydra serpentine*				DNR, 1984; Beal et al., 2006
Southeastern five-lined skink	*Eumeces inexpectatus*				DNR, 1984
Southern black racer	*Coluber constrictor*				DNR, 1984; DEP, 2003; DEP, 2007
Southern ring-necked snake	*Diadophis punctatus*				DNR, 1984
Striped mud turtle	*Kinosternon baurii*				DNR, 1984; DEP, 2003; DEP, 2007
Yellow rat snake	*Elaphe obsoleta quadrivittata*				DEP, 2003; DEP, 2007
Class Aves (birds)					
American coot	*Fulica americana*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
American goldfinch	*Carduelis tristis*				Teas, 1971; DEP, 2003; DEP, 2007
American kestrel	*Falco sparverius*		T		Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
American redstart	*Setophaga ruticilla*	R			Ashton, 1992; DEP, 2003; DEP, 2007
American robin	*Turdus migratorius*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
American widgeon	*Anas americana*				DEP, 2003; DEP, 2007
Anhinga	*Anhinga anhinga*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Bald eagle	*Haliaeetus leucocephalus*	T	T	T	Teas, 1971; DNR, 1984; Ashton, 1992; DEP, 2003; DEP, 2007
Barn swallow	*Hirundo rustica*				DNR, 1984
Barred owl	*Strix varia*				DNR, 1984; Teas, 1971; DEP, 2003; DEP, 2007
Belted kingfisher	*Ceryle alcyon*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Black and white warbler	*Mniotilta varia*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Black-bellied plover	*Pluvialis squatarola*				Teas, 1971; DEP, 2003; DEP, 2007
Black-crowned nght heron	*Nycticorax nycticorax*	SSC			Ashton, 1992; DEP, 2003; DEP, 2007
Black-necked stilt	*Himantopus mexicanus*				Teas, 1971; DEP, 2003; DEP, 2007
Black skimmer	*Rynchops niger*	SSC			Ashton, 1992; DEP, 2003; DEP, 2007
Black-throated blue warbler	*Dendroica caerulescens*				DEP, 2003; DEP, 2007
Black vulture	*Coragyps atratus*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Blue-gray gnatcatcher	*Polioptila caerulea*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Blue jay	*Cyanocitta cristata*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Blue-winged teal	*Anas discors*				DEP, 2003; DEP, 2007
Boat-tailed grackle	*Quiscalus major*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Bobolink	*Dolichonyx oryzivorus*				Teas, 1971; DEP, 2003; DEP, 2007
Bonaparte's gull	*Lanus philadelphia*				DEP, 2003; DEP, 2007
Broad-winged hawk	*Buteo platypterus*				DNR, 1984; DEP, 2003; DEP, 2007
Brown-headed cowbird	*Molothrus ater*				DEP, 2003; DEP, 2007
Brown pelican	*Pelecanus occidentalis*	T	SSC		Teas, 1971; Ashton, 1992; DEP, 2003; DEP, 2007
Brown thrasher	*Toxostoma rufum*				DEP, 2003; DEP, 2007
Bufflehead	*Bucephala albeola*				DEP, 2003; DEP, 2007
Carolina wren	*Thryothorus ludovicianus*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Caspian tern	*Sterna caspia*	SSC			Ashton, 1992; DEP, 2003; DEP, 2007

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		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
Cedar waxwing	*Bombycilla cedrorum*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Chipping sparrow	*Spizella passerina*				DEP, 2003; DEP, 2007
Chuck-will's widow	*Caprimulgus carolinensis*				Teas, 1971; DEP, 2003; DEP, 2007
Clapper rail	*Rallus longirostris*				DEP, 2003; DEP, 2007
Common bobwhite	*Colinus virginianus*				Teas, 1971; DEP, 2003; DEP, 2007
Common crow	*Corvus brachyrhynchos*				DNR, 1984; DEP, 2003; DEP, 2007
Common gallinule	*Gallinula chloropus*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Common grackle	*Quiscalus quiscula*				Teas, 1971; DEP, 2003; DEP, 2007
Common loon	*Gavia immer*				Teas, 1971; DEP, 2003; DEP, 2007
Common snipe	*Gallinago gallinago*				DEP, 2003; DEP, 2007
Common yellowthroat	*Geothlypis trichas*				DNR, 1984; DEP, 2003; DEP, 2007
Cooper's hawk	*Accipiter cooperii*	SSC			Ashton, 1992; DEP, 2003; DEP, 2007
Double-crested cormorant	*Phalacrocorax auritus*				Teas, 1971; DEP, 2003; DEP, 2007
Downy woodpecker	*Picoides pubescens*				DEP, 2003; DEP, 2007
Duck	*Anatidae*				DEP, 2007
Dunlin	*Calidris alpina*				DEP, 2003; DEP, 2007
Eastern bluebird	*Sialia sialis*				Teas, 1971; DEP, 2003; DEP, 2007
Eastern meadowlark	*Sturnella magna*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Eastern phoebe	*Sayornis phoebe*				Teas, 1971; DEP, 2003; DEP, 2007
Eastern towhee	*Pipilo erythrophthalmus*				DEP, 2003; DEP, 2007
Fish crow	*Corvus ossifragus*				Teas, 1971; DEP, 2003; DEP, 2007
Flycatcher	*Empidonax* sp.				DEP, 2003; DEP, 2007
Forster's tern	*Sterna forsteria*				DEP, 2003; DEP, 2007
Gadwall	*Anas strepera*				DEP, 2003; DEP, 2007
Gray catbird	*Dumetella carolinensis*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Gray kingbird	*Tyrannus dominicensis*				Teas, 1971
Great black-back gull	*Larus marinus*				DEP, 2003; DEP, 2007
Great blue heron	*Ardea herodias*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Great crested flycatcher	*Myiarchus crinitus*				Teas, 1971; DEP, 2003; DEP, 2007
Great egret	*Ardea alba*	SSC			Teas, 1971; DNR, 1984; Ashton, 1992; DEP, 2003; DEP, 2007
Great horned owl	*Bubo virginianus*				Teas, 1971; DEP, 2003; DEP, 2007
Green heron	*Butorides virescens*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Green-winged teal	*Anas crecca*				DEP, 2003; DEP, 2007
Ground dove	*Columbina passerina*				Teas, 1971; DEP, 2003; DEP, 2007
Hairy woodpecker	*Picoides villosus*	SSC			Ashton, 1992; DEP, 2003; DEP, 2007
Hermit thrush	*Catharus ustulatus*				DEP, 2003; DEP, 2007
Herring gull	*Larus argentatus*				DEP, 2003; DEP, 2007
Hooded merganser	*Lophodytes cucullatus*				DEP, 2003; DEP, 2007
House wren	*Troglodytes aedon*				DEP, 2003; DEP, 2007
Killdeer	*Charadrius vociferus*				Teas, 1971; DEP, 2003; DEP, 2007
Laughing gull	*Larus atricilla*				DEP, 2003; DEP, 2007
Least bittern	*Botaurus lentiginosus*	SSC			Ashton, 1992; DEP, 2003; DEP, 2007
Least sandpiper	*Calidris minutilla*				DEP, 2003; DEP, 2007
Lesser scaup	*Aythya affinis*				Teas, 1971; DEP, 2003; DEP, 2007
Lesser yellowlegs	*Tringa flavipes*				DEP, 2003; DEP, 2007
Limpkin	*Aramus guarauna*	SSC	SSC		Ashton, 1992; DEP, 2003
Little blue heron	*Egretta caerulea*	SSC	SSC		Teas, 1971; DNR, 1984; Ashton, 1992; DEP, 2003; DEP, 2007
Loggerhead shrike	*Lanius ludovicianus*				Teas, 1971; DEP, 2003; DEP, 2007

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		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
Louisianna waterthrush	*Seiurus motacilla*	R			Teas, 1971; Ashton, 1992; DEP, 2003; DEP, 2007
Magnificent frigatebird	*Fregata magnificens*	T			Ashton, 1992; DEP, 2003; DEP, 2007
Mallard	*Anas platyrhynchos*				Teas, 1971; DEP, 2003; DEP, 2007
Marsh wren	*Cistothorus palustris*	SSC			Ashton, 1992; DEP, 2003; DEP, 2007
Merlin	*Falco columbarius*	ud			Ashton, 1992; DEP, 2003; DEP, 2007
Mottled duck	*Anas fulvigula*				DEP, 2003; DEP, 2007
Mourning dove	*Zenaida macroura*				Teas, 1971; DEP, 2003; DEP, 2007
Northern cardinal	*Cardinalis cardinalis*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Northern flicker	*Colaptes auratus*				Teas, 1971; DEP, 2003; DEP, 2007
Northern harrier (Marsh hawk)	*Circus cyaneus*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Northern mockingbird	*Mimus polyglottos*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Northern parula	*Parula americana*				DEP, 2003; DEP, 2007
Northern shoveler	*Anas clypeata*				DEP, 2003; DEP, 2007
Northern waterthrush	*Seiurus noveboracensis*				DEP, 2003; DEP, 2007
Orange-crowned warbler	*Vermivora celata*				DEP, 2003; DEP, 2007
Osprey	*Pandion haliaetus*	T	SSC		Teas, 1971; DNR, 1984; Ashton, 1992; DEP, 2003; DEP, 2007
Ovenbird	*Seiurus aurocapillus*				DEP, 2003; DEP, 2007
Painted bunting	*Passerina ciris*	ud			Ashton, 1992; DEP, 2003; DEP, 2007
Palm warbler	*Dendroica palmarum*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Pied-billed grebe	*Podilymbus podiceps*				Teas, 1971; DEP, 2003; DEP, 2007
Pileated woodpecker	*Dryocopus pileatus*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Pine warbler	*Dendroica pinus*				Teas, 1971; DEP, 2003; DEP, 2007
Piping plover	*Charadrius melodus*	E		T	Ashton, 1992; DEP, 2003; DEP, 2007
Prarie warbler	*Dendroica discolor*	ud			Ashton, 1992; DEP, 2003; DEP, 2007
Purple gallinule	*Porphyrio martinica*				Teas, 1971; DEP, 2003; DEP, 2007
Red-bellied woodpecker	*Melanerpes carolinus*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Red-breasted merganser	*Mergus serrator*				DEP, 2003; DEP, 2007
Red-headed woodpecker	*Melanerpes erthrocephalus*				DEP, 2003; DEP, 2007
Red-shouldered hawk	*Buteo lineatus*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Red-tailed hawk	*Buteo jamaicensis*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Red-winged blackbird	*Agelaius phoeniceus*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Ring-billed gull	*Larus delawarensis*				DEP, 2003; DEP, 2007
Ring-necked duck	*Aythya collaris*				DEP, 2003; DEP, 2007
Royal tern	*Sterna maxima*	SSC			Teas, 1971; Ashton, 1992; DEP, 2003; DEP, 2007
Ruby-crowned kinglet	*Regulus calendula*				DEP, 2003; DEP, 2007
Ruby-throated hummingbird	*Archilochus colubris*				DEP, 2003; DEP, 2007
Ruddy turnstone	*Arenaria interpres*				DEP, 2003; DEP, 2007
Sanderling	*Calidris alba*				DEP, 2003; DEP, 2007
Sandhill crane	*Grus canadensis*	T	T	E	Teas, 1971; Ashton, 1992; DEP, 2003; DEP, 2007
Sandwich tern	*Sterna sandvicensis*	SSC			Ashton, 1992; DEP, 2003; DEP, 2007
Savannah sparrow	*Passerculus sandwichensis*				DEP, 2003; DEP, 2007
Screech owl	*Otus asio*				DNR, 1984; DEP, 2003; DEP, 2007

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Semipalmated plover	*Charadrius semipalmatus*				DEP, 2003; DEP, 2007
Semipalmated sandpiper	*Calidris pusilla*				DEP, 2003; DEP, 2007
Sharp-shinned hawk	*Accipiter striatus*				DEP, 2003; DEP, 2007
Short-eared owl	*Asio flammeus*				DNR, 1984
Snowy egret	*Egretta thula*	SSC	SSC		Teas, 1971; DNR, 1984; Ashton, 1992; DEP, 2003; DEP, 2007
Solitary vireo	*Vireo solitarius*				DEP, 2003; DEP, 2007
Song sparrow	*Melospiza melodia*				Teas, 1971; DEP, 2003; DEP, 2007
Southeastern kestrel	*Falco sparverius paulus*	T	T		DNR, 1984; Ashton, 1992
Spotted sandpiper	*Actitis macularia*				Teas, 1971; DEP, 2003; DEP, 2007
Swallow-tailed kite	*Elanoides forficatus*	T			Ashton, 1992; DEP, 2003; DEP, 2007
Swamp sparrow	*Melospiza georgiana*				Teas, 1971; DEP, 2003; DEP, 2007
Towhee	*Pipilo sp.*				Teas, 1971
Tree swallow	*Tachycineta bicolor*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Tricolor heron	*Egretta tricolor*	SSC	SSC		Teas, 1971; DNR, 1984; Ashton, 1992; DEP, 2003; DEP, 2007
Tufted titmouse	*Parus bicolor*				DEP, 2003; DEP, 2007
Turkey vulture	*Cathartes aura*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Warbler	*Parulidae* spp.				DEP, 2007
Western sandpiper	*Calidris mauri*				DEP, 2003; DEP, 2007
Whip-poor-will	*Caprimulgus pelagica*				DEP, 2003; DEP, 2007
White-eyed vireo	*Vireo griseus*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
White ibis	*Eudocimus albus*	SSC	SSC		Teas, 1971; DNR, 1984; Ashton, 1992; DEP, 2003; DEP, 2007
Wild turkey	*Meleagris gallopavo*				DEP, 2003; DEP, 2007
Willet	*Catoptrophorus semipalmatis*				DEP, 2003; DEP, 2007
Wilson's plover	*Charadrius wilsonia*	SSC			Ashton, 1992; DEP, 2003; DEP, 2007
Wood duck	*Aix sponsa*				Teas, 1971; DEP, 2003; DEP, 2007
Wood stork	*Mycteria americana*	E	E	E	Teas, 1971; Ashton, 1992; DEP, 2003; DEP, 2007
Woodcock	*Scolopax sp.*				Teas, 1971
Yellow-bellied sapsucker	*Sphyrapicus varius*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Yellow-billed cuckoo	*Coccyzus americanus*			Can-didate	Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Yellow-crowned night heron	*Nyctanassa violacea*	SSC			Ashton, 1992; DEP, 2003; DEP, 2007
Yellow-rumped warbler	*Dendroica coronata*				Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Yellow-throated warbler	*Dendroica dominca*				Teas, 1971; DEP, 2003; DEP, 2007
Yellow warbler	*Dendroica petechia*				DEP, 2003; DEP, 2007
Class Mammalia (mammals)					
Atlantic bottlenose dolphin	*Tursiops truncatus*				DEP, unpublished data
Bobcat	*Lynx rufus*				DNR, 1984; DEP, 2003; DEP, 2007
Common gray fox	*Urocyon cinereoargenteus*				DNR, 1984; DEP, 2003; DEP, 2007
Common opossum	*Didelphis marsupialis*				DNR, 1984
Cottontail rabbit	*Sylvilagus floridanus*				DNR, 1984
Eastern gray squirrel	*Sciurus carolinensis*				DNR, 1984; DEP, 2003; DEP, 2007
Eastern mole	*Scalopus aquaticus*				DNR, 1984
Eastern spotted skunk	*Spilogale putorius*				DEP, 2003; DEP, 2007
Eastern yellow bat	*Lasiurus intermedius*				Gioeli, 2007
Evening bat	*Nycticeius humeralis*				Gioeli, 2007

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Least shrew	*Cryptotis parva*				DNR, 1984; DEP, 2003; DEP, 2007
Marsh rabbit	*Sylvilagus palustris*				DNR, 1984; DEP, 2003; DEP, 2007
Mexican free-tailed bat	*Tadarida brasiliensis*				Gioeli, 2007
Nine-banded armadillo	*Dasypus novemcinctus*				DNR, 1984; DEP, 2003; DEP, 2007
Pocket gopher	*Geomys pinetis*				DEP, 2003; DEP, 2007
Racoon	*Procyon lotor*				DNR, 1984; DEP, 2003; DEP, 2007
Rice rat	*Oryzomys palustris*				DNR, 1984
River otter	*Lutra canadensis*				DNR, 1984; DEP, 2003; DEP, 2007
Sherman's fox squirrel	*Sciurus niger shermani*	T	SSC		Ashton, 1992; DEP, 2003; DEP, 2007
Southeastern shrew	*Sorex longerostris*				DEP, 2003; DEP, 2007
Striped skunk	*Mephitis mephitis*				DNR, 1984
Virginia opossum	*Didelphis virginiana*				DEP, 2003; DEP, 2007
West Indian manatee	*Trichechus manatus*	E	E	E	Teas, 1971; Ashton, 1992; DEP, 2003; DEP, 2007
White-tailed deer	*Odocoileus virginianus*				DNR, 1984; DEP, 2003; DEP, 2007
Kingdom Protista (phytoplankton)					
Phylum Dinoflagellata (dinoflagellates)					
	Ceratium furca				Millie et al., 2004
	Gonyaulax spinifera				Millie et al., 2004
	Gymnodinium sanguineum				Millie et al., 2004
	Gymnodinium spp.				Millie et al., 2004
	Gymnodinium varians				Millie et al., 2004
	Gyrodinium spp.				Millie et al., 2004
	Heterocapsa rotundata				Millie et al., 2004
	Karlodinium micrum				Millie et al., 2004
	Katodinium rotundata				Millie et al., 2004
	Prorocentrum minimum				Millie et al., 2004
	Scrippsiella subsalsa				Millie et al., 2004
Phylum Bacillariophyta (diatoms)					
	Asterionellopsis gracilis				Millie et al., 2004
	Chaetoceros danicus				Millie et al., 2004
	Cyclotella spp.				Millie et al., 2004
	Ditylum brightwellii				Millie et al., 2004
	Leptocylindrus minimus				Millie et al., 2004
	Odontella mobiliensis				Millie et al., 2004
	Rhizosolenia delicatula				Millie et al., 2004
	Rhizosolenia pungens				Millie et al., 2004
	Skeletonema costatum				Millie et al., 2004
	Synedra sp.				Millie et al., 2004
	Thalassiosiera spp.				Millie et al., 2004
Phylum Chrysophyta (golden algae)					
	Chromulina sp.				Millie et al., 2004
	Chrysochromulina parva				Millie et al., 2004
	Dinobryon spp.				Millie et al., 2004
	Metramonas simplex				Millie et al., 2004
	Ochromonas nana				Millie et al., 2004
	Ochromonas ovalis				Millie et al., 2004
	Pseudopedinella pyriforme				Millie et al., 2004
Phylum Cryptophyta (cryptomonads)					
	Cryptomonas erosa				Millie et al., 2004
	Hemiselmis spp.				Millie et al., 2004
	Katablepharis ovalis				Millie et al., 2004
	Rhodomonas lens				Millie et al., 2004

Legend: CE-Commercially Exploited; SSC-Species of Special Concern; T-Threatened; E-Endangered, ud-undetermined

Common Name	Species Name	Status			References
		FCREPA	State FWC/ FDACS	Federal NOAA/ FWS	
	Rhodomonas minuta				Millie et al., 2004
	Rhodomonas sp.				Millie et al., 2004
Phylum Cyanophyta (cyanobacteria)					
	Oscillatoria spp.				Millie et al., 2004
	Synechococcus spp.				Millie et al., 2004
	Synechocystis spp.				Millie et al., 2004
Phylum Chlorophyta (green algae)					
	Chlamydomonas coccoides				Millie et al., 2004
	Chlamydomonas quadrilobata				Millie et al., 2004
	Dunaliella primolecta				Millie et al., 2004
	Micromonas pusilla				Millie et al., 2004
	Pyraminonas spp.				Millie et al., 2004
Phylum Choanozoa					
	Choanoflagellate spp.				Millie et al., 2004
Phylum Euglenophyta (euglenoids)					
	Eutreptiella marina				Millie et al., 2004

Legend: CE-Commercially Exploited; SSC-Species of Special Concern; T-Threatened; E-Endangered, ud-undetermined

B.4.2 / Non-native Species List

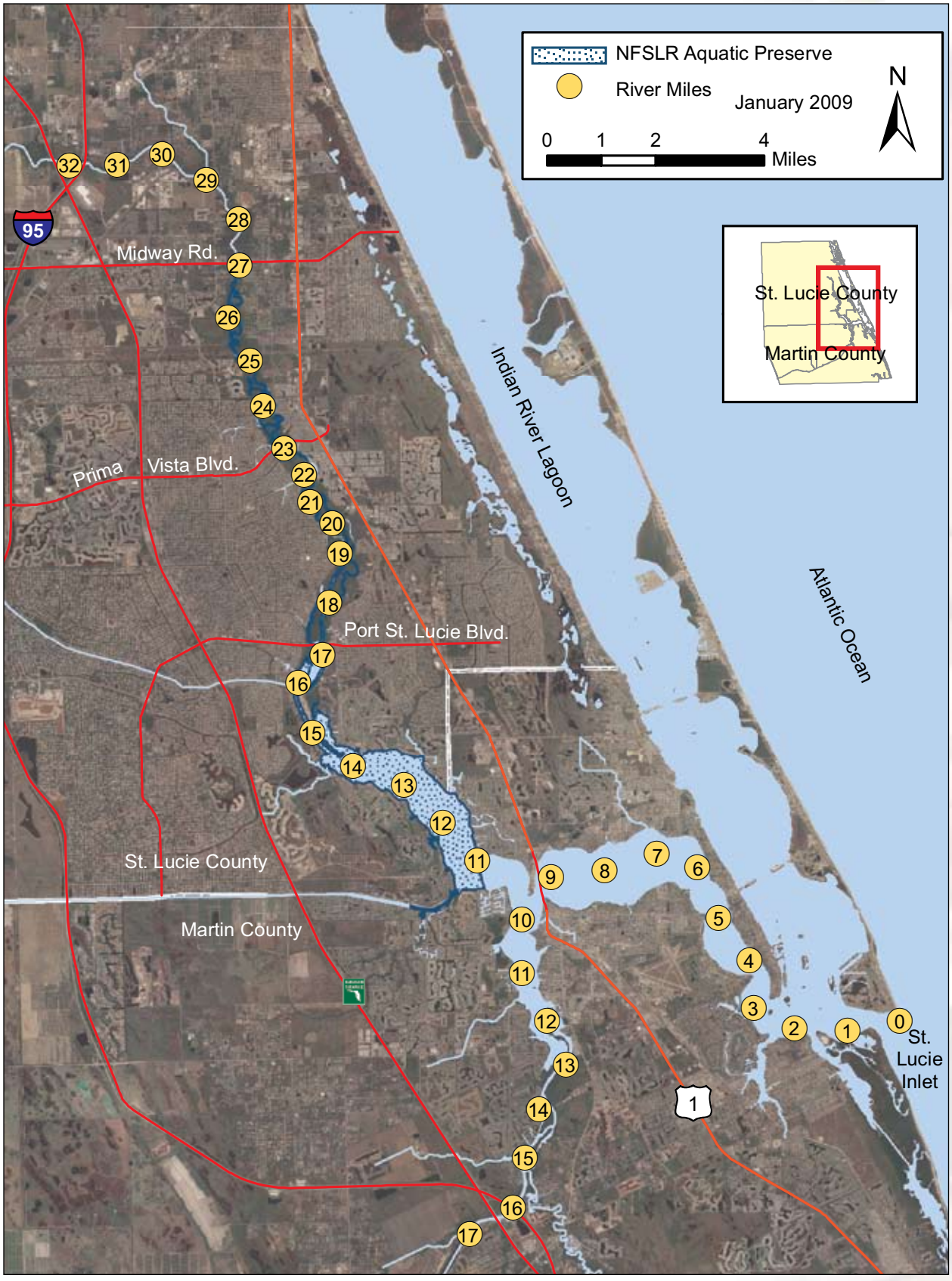
Common Name	Species Name	State Status	Federal Status	References
Kingdom Plantae (plants)				
Division Pteridophyta				
Old world climbing fern	*Lygodium microphyllum*			DEP, 2003; DEP, 2007
Division Magnoliophyta (flowering plants)				
Class Liliopsida (grass-like flowering plants)				
Air potato	*Dioscorea bulbifera*			DNR, 1984; DEP, 2003; DEP, 2007
Arrowhead vine	*Syngonium podophyllum*			DEP, 2003; DEP, 2007
Asparagus fern	*Asparagus denssiflorus*			DEP, 2003; DEP, 2007
Cogon grass	*Imperata cylindrica*			DEP, 2003; DEP, 2007
Dwarf papyrus	*Cyperus prolifer*			DEP, 2003; DEP, 2007
Green wandering jew	*Tradescantia fluminensis*			DEP, 2003; DEP, 2007
Guinea grass	*Panicum maximum*			DEP, 2003; DEP, 2007
Oyster plant	*Tradescantia spathacea*			DEP, 2003; DEP, 2007
Torpedo grass	*Panicum repens*			DEP, 2003; DEP, 2007
Water lettuce	*Pistia stratiotes*			DEP, unpublished data
Wild taro	*Colocasia esculenta*			DNR, 1984; DEP, 2003; DEP, 2007
Class Magnoliopsida (woody flowering plants)				
Australian Pine	*Casuarina glauca*			Teas, 1971
Balsam apple	*Momardica balsamina*			DEP, 2003; DEP, 2007
Bischofia	*Bischofia javanica*			DEP, 2003; DEP, 2007
Brazilian pepper	*Schinus terebinthifolius*			Teas, 1971; DNR, 1984; DEP, 2003; DEP, 2007
Caesar weed	*Urena lobata*			DNR, 1984; DEP, 2003; DEP, 2007
Carrotwood	*Cupaniopsis anacardioides*			DEP, 2003; DEP, 2007
Castor bean	*Ricinus communis*			DEP, 2007
Chandelier plant	*Kalanchoe delaqoensis*			DEP, 2003; DEP, 2007
Coral ardisia	*Ardisia crenata*			DEP, 2003; DEP, 2007
Coral vine	*Antigonon leptopus*			DEP, 2003; DEP, 2007
Earleaf acacia	*Acacia auriculiformis*			DEP, 2003; DEP, 2007

Legend: CE-Commercially Exploited; SSC-Species of Special Concern; T-Threatened; E-Endangered, ud-undetermined

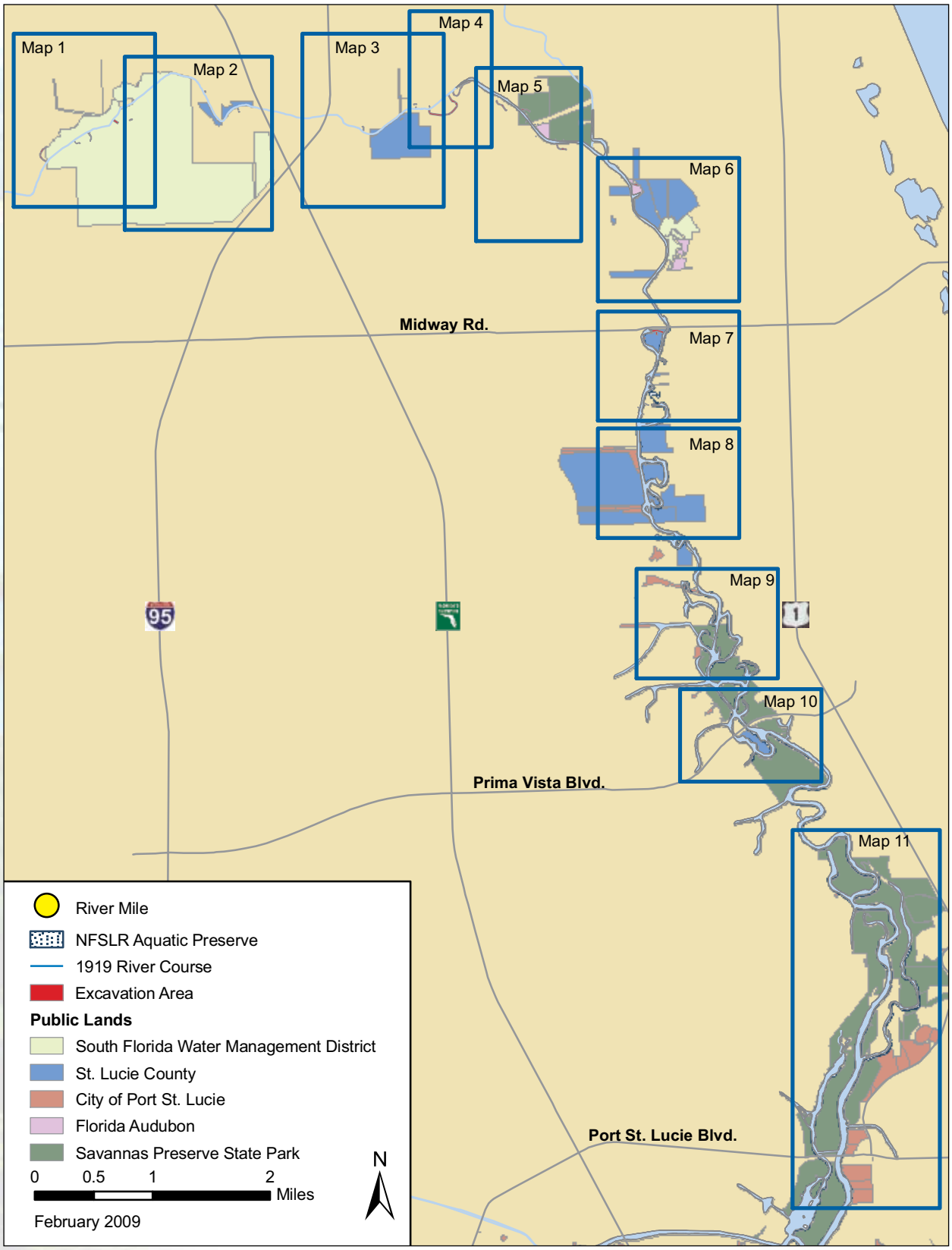
Common Name	Species Name	State Status	Federal Status	References
Ear pod tree	*Enterolobium cyclocarpum*			DEP, 2003; DEP, 2007
Guava	*Psidium guajava*			DNR, 1984; DEP, 2003; DEP, 2007
Java plum	*Syzygium cumini*			DEP, 2003; DEP, 2007
Lantana	*Lantana camara*			DEP, 2003; DEP, 2007
Melaleuca	*Melaleuca quinquenervia*			DEP, 2003; DEP, 2007
Mexican petunia	*Ruellia brittoniana*			DEP, 2003; DEP, 2007
Philodendron	*Philodendron* sp.			DEP, 2003; DEP, 2007
Rosary pea	*Abrus precatorius*			DEP, 2003; DEP, 2007
Schefflera	*Schefflera actinophylla*			DEP, 2003; DEP, 2007
Sesbania	*Sesbania* sp.			DEP, 2007
Shoebutton ardesia	*Ardisia elliptica*			DEP, 2003; DEP, 2007
Strawberry guava	*Psidium cattleianum*			DEP, 2003; DEP, 2007
Surinam cherry	*Eugenia uniflora*			DEP, 2003; DEP, 2007
Tropical almond	*Terminalia cattapa*			DEP, 2003; DEP, 2007
Tropical soda apple	*Solanum viarum*			DEP, 2003; DEP, 2007
Twinleaf nightshade	*Solanum diphyllum*			DEP, 2007
Vitex	*Vitex trifolia*			DEP, 2003; DEP, 2007
Wedilia	*Wedelia trilobata*			DEP, 2003; DEP, 2007
Women's tongue	*Albizzia lebbeck*			DEP, 2003; DEP, 2007
Kingdom Animalia (animals)				
Subphylum Vertebrata (vertebrates)				
Superclass Osteichthyes (bony fishes)				
Blue tilapia	*Oreochromis* hybrid			Gilmore, 2005
Grass carp	*Ctenopharyngodon idella*			DEP, unpublished data
Mayan cichlid	*Cichlasoma urophthalmus*			Beal et al., 2006
Plecostomus	*Plecostomus* sp.			Gilmore, 2005
Sailfin catfish	*Pterygoplichthys disjunctivus*			DEP, unpublished data
Class Amphibia (frogs, toads,salamanders)				
Cuban treefrog	*Osteopilus septentrionalis*			DEP, 2003; DEP, 2007
Greenhouse frog	*Eleutherodactylus planirostris*			DNR, 1984
Class Reptilia (reptiles)				
Basilisk lizard	*Basiliscus basiliscus*			DEP, unpublished data
Brown anole	*Anolis sagrei sagrei*			DEP, 2003; DEP, 2007
Green iguana	*Iguana iguana*			DEP, 2003; DEP, 2007
Class Aves (birds)				
African cattle egret	*Bubulcus ibis*			DNR, 1984; DEP, 2003; DEP, 2007
European starling	*Sturnus vulgaris*			DEP, 2003; DEP, 2007
House sparrow	*Passer domesticus*			Teas, 1971; DEP, 2003; DEP, 2007
Class Mammalia (mammals)				
Feral hog	*Sus scrofa*			DNR, 1984; DEP, 2003; DEP, 2007

Legend: CE-Commercially Exploited; SSC-Species of Special Concern; T-Threatened; E-Endangered, ud-undetermined

B.5.1 / St. Lucie River Miles

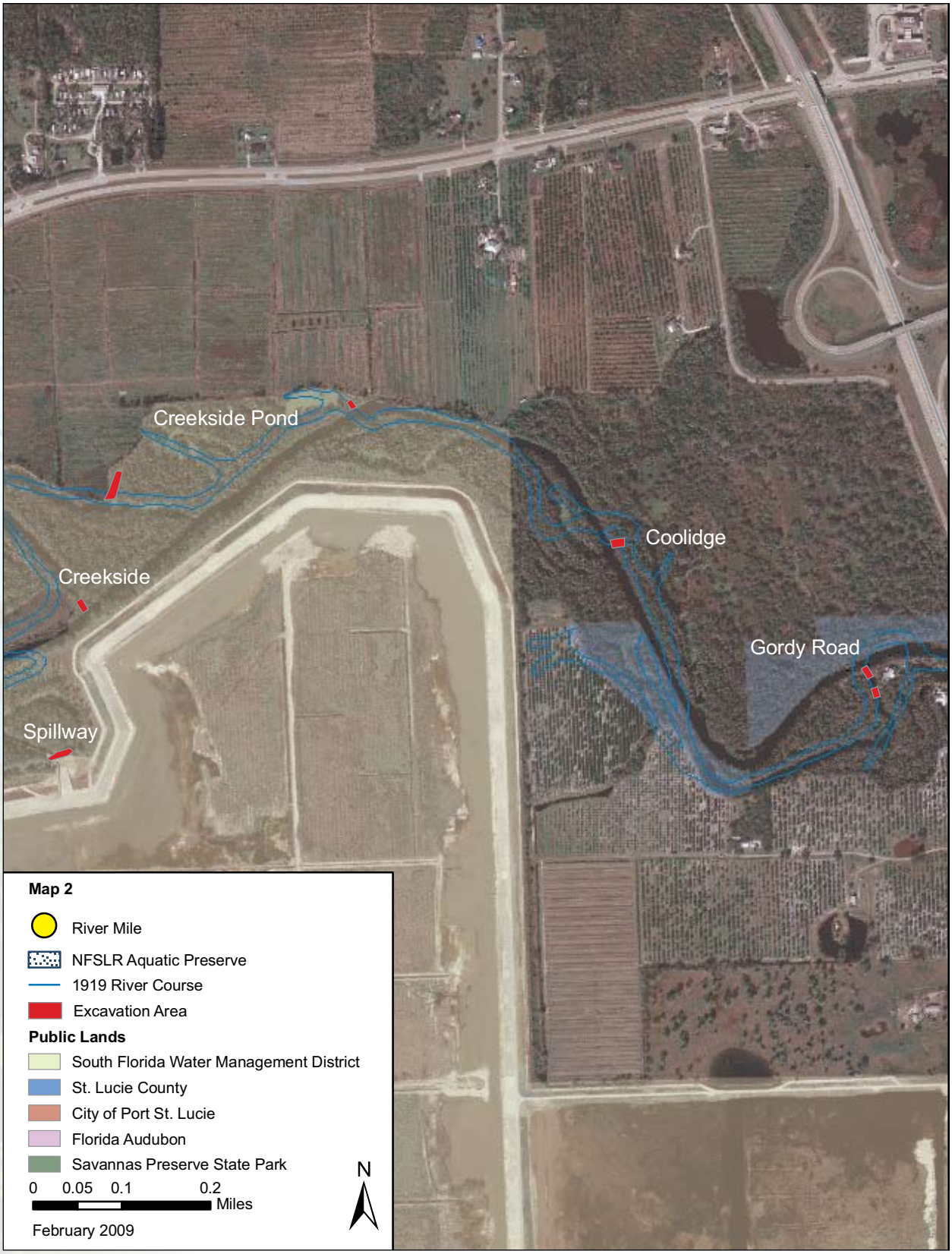


B.5.2 / North Fork St. Lucie River and Ten Mile Creek Hydrologic Restoration Sites.
Sites identified along the North Fork St. Lucie River and its headwaters, Ten Mile Creek, that require hydrologic restoration to improve water quality within the preserve.



Hydrologic restoration project area overview map.

Hydrologic restoration project map 1.

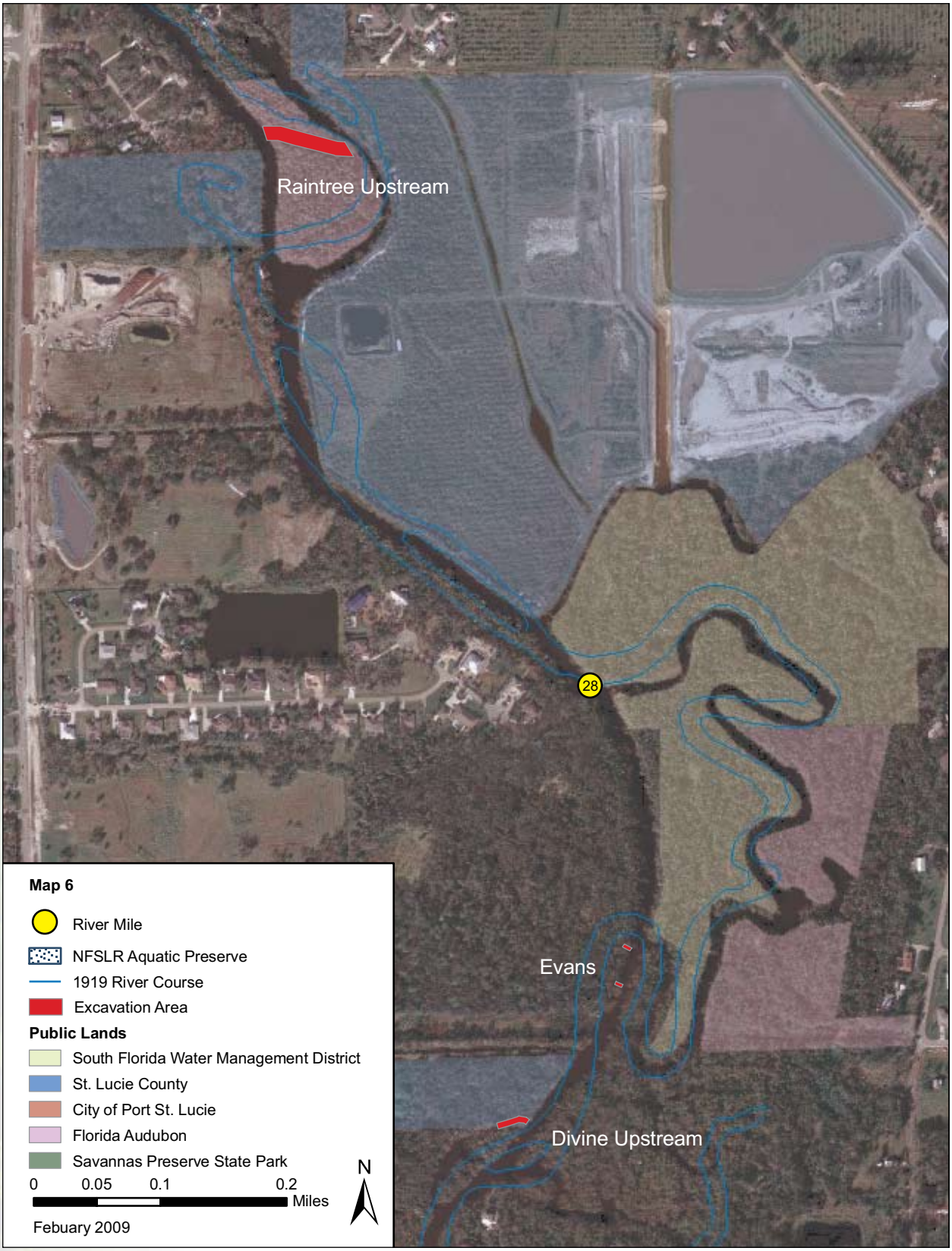


Hydrologic restoration project map 2.

Hydrologic restoration project map 3.

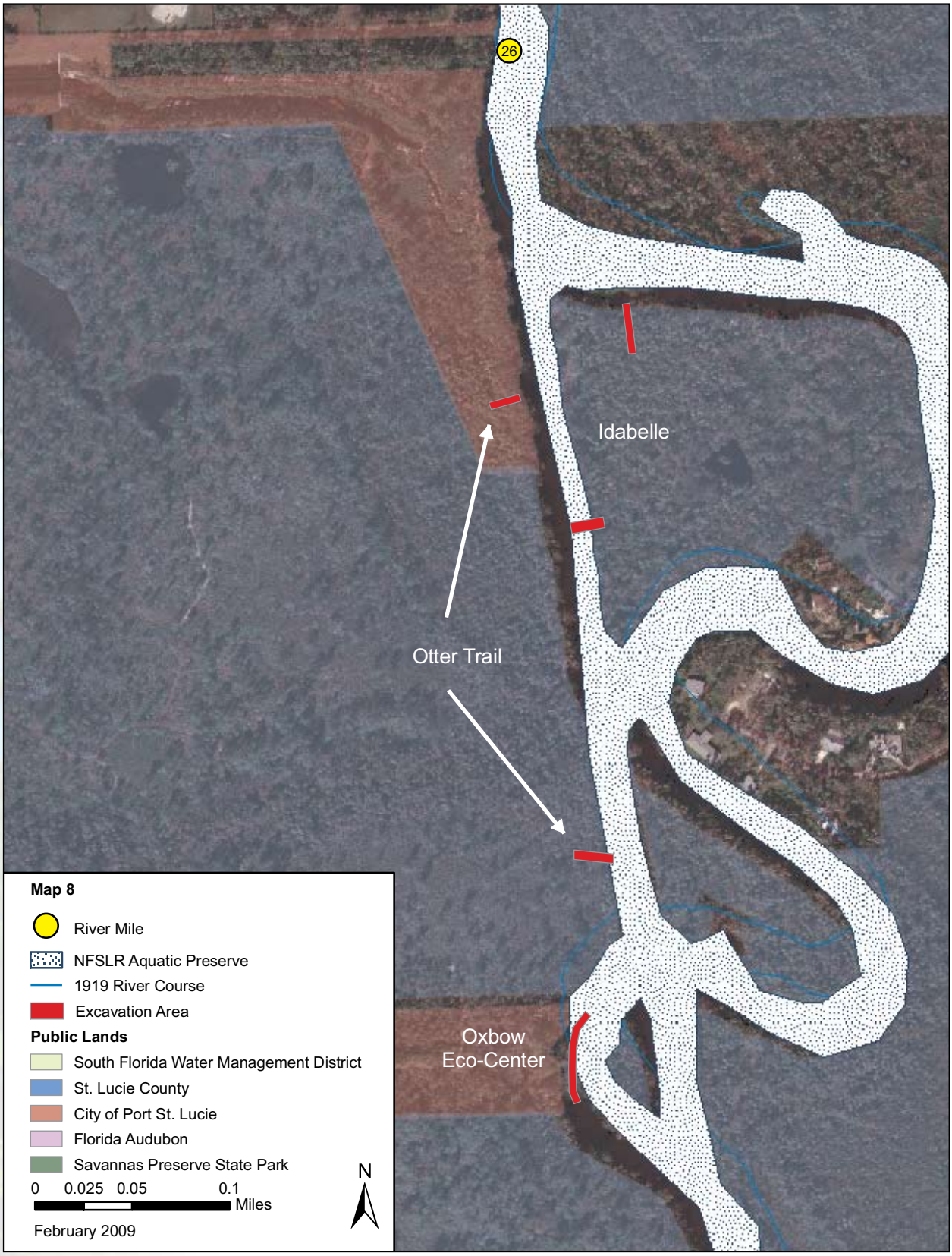
Hydrologic restoration project map 4.

Hydrologic restoration project map 5.

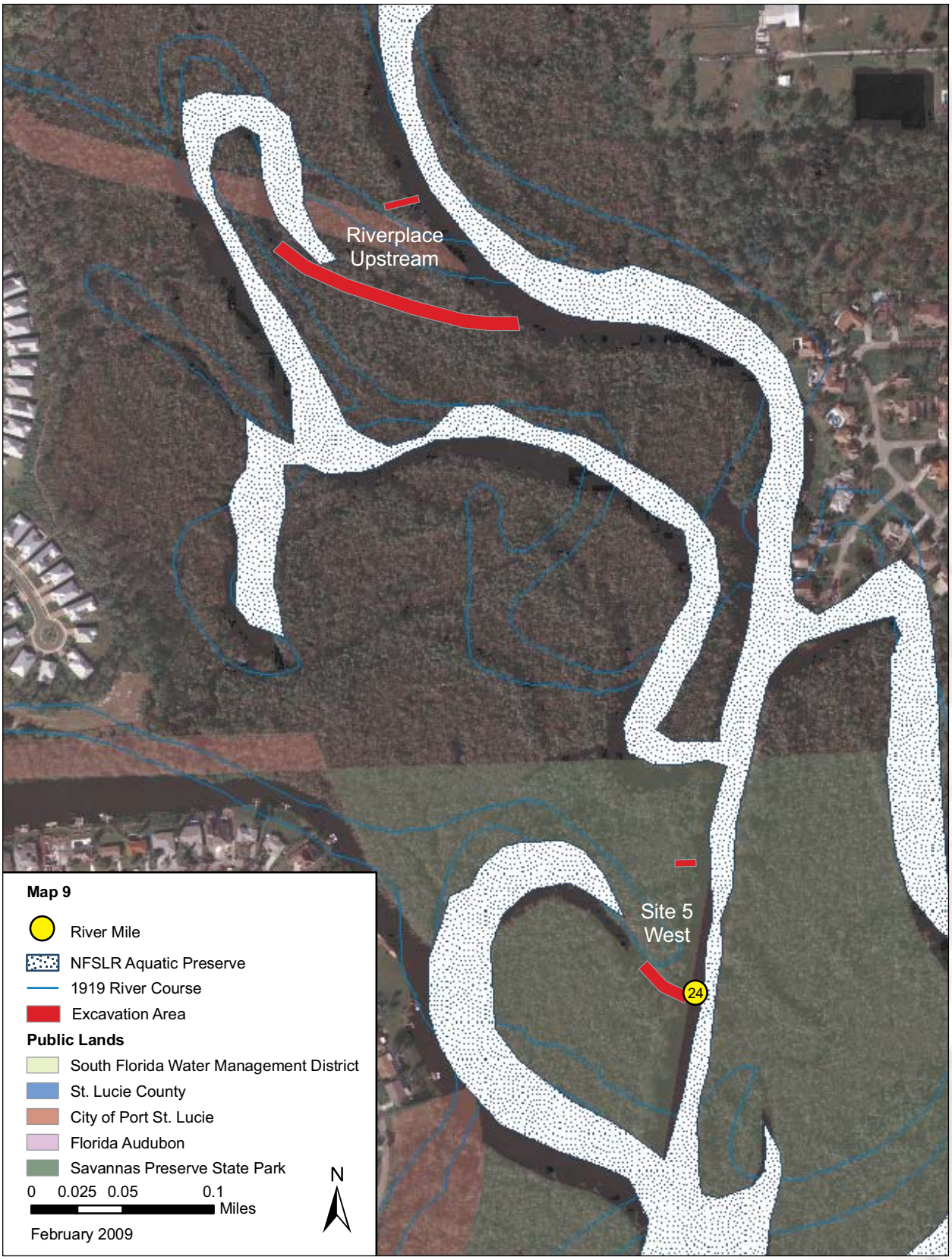


Hydrologic restoration project map 6.

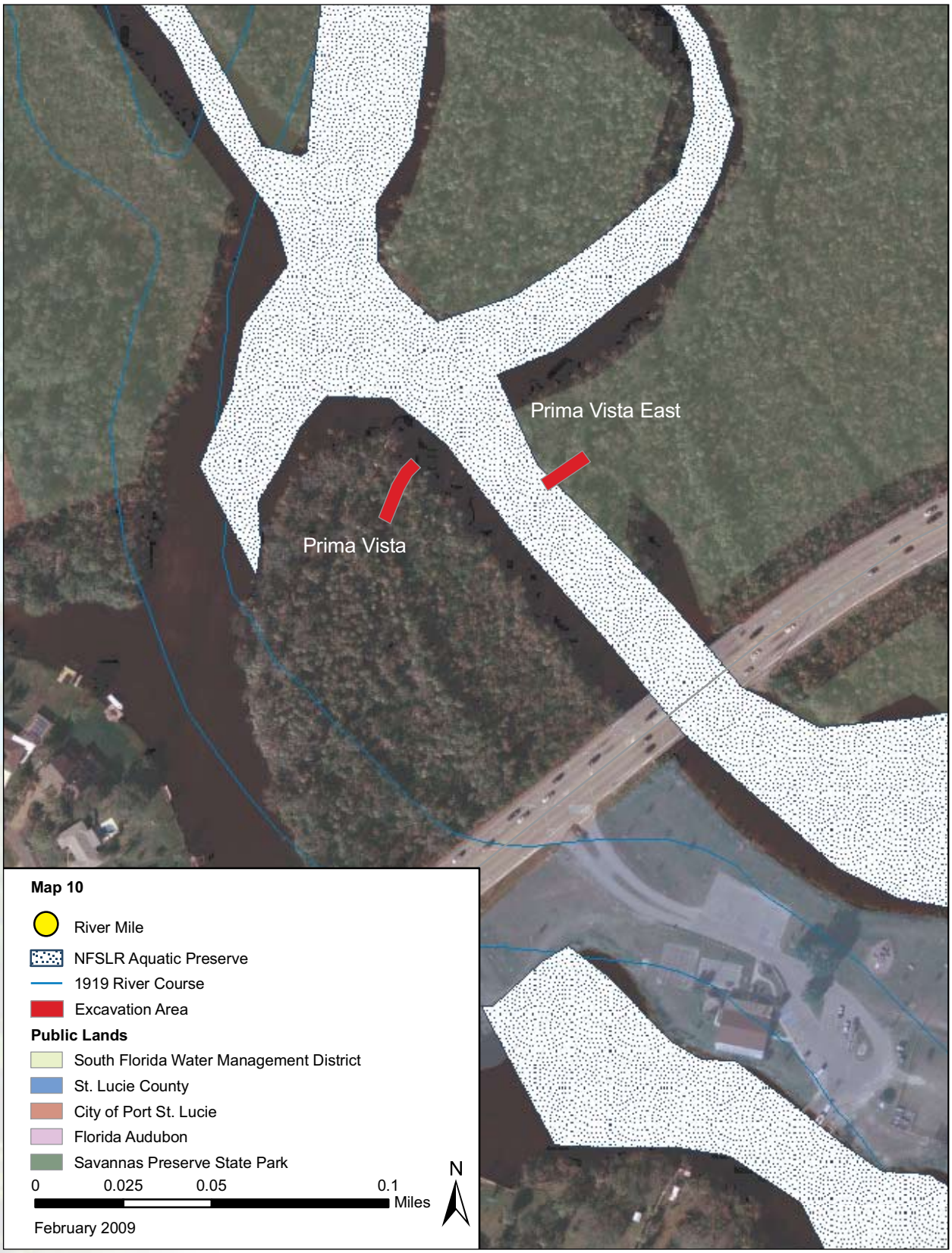
Hydrologic restoration project map 7.



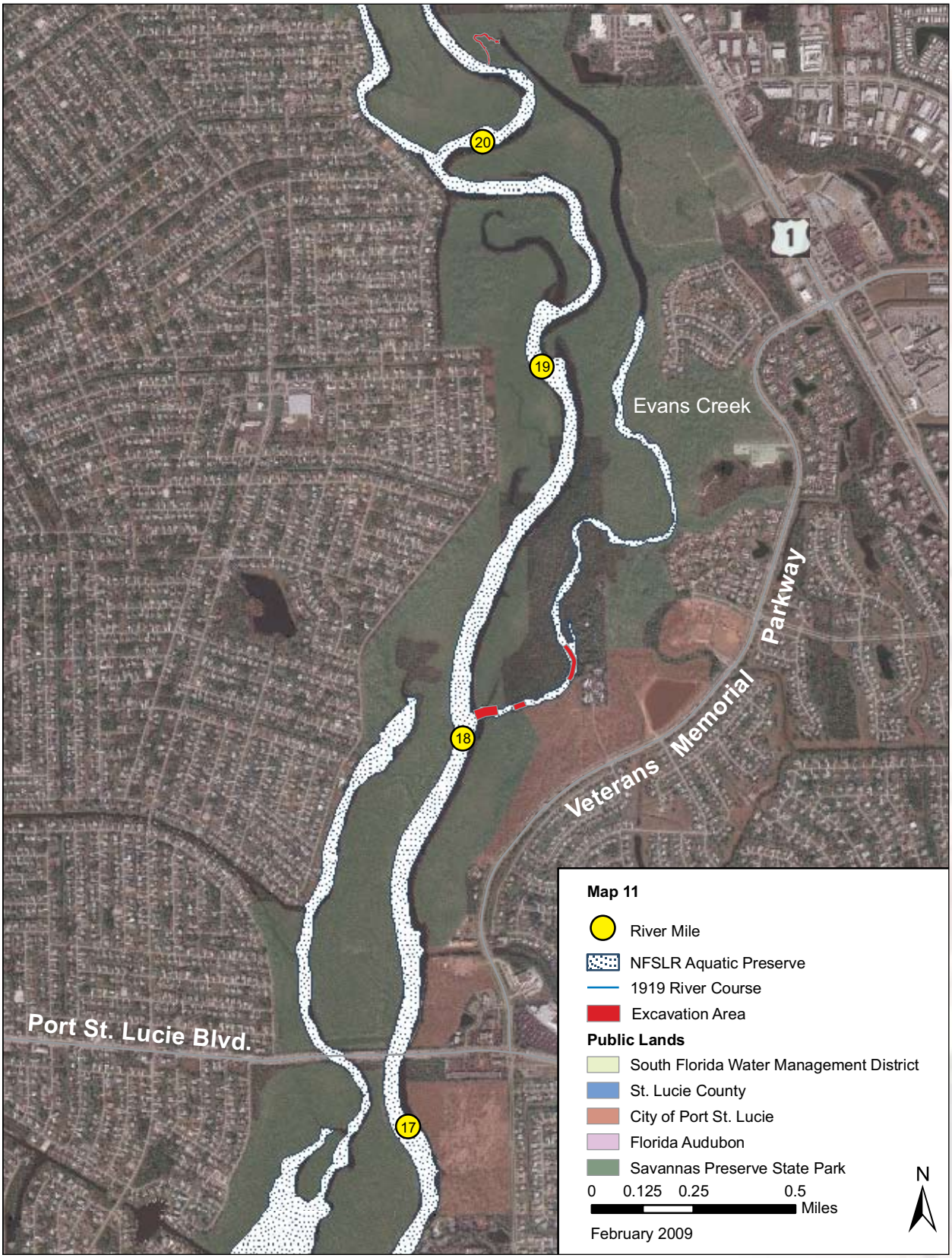
Hydrologic restoration project map 8.



Hydrologic restoration project map 9.



Hydrologic restoration project map 10.



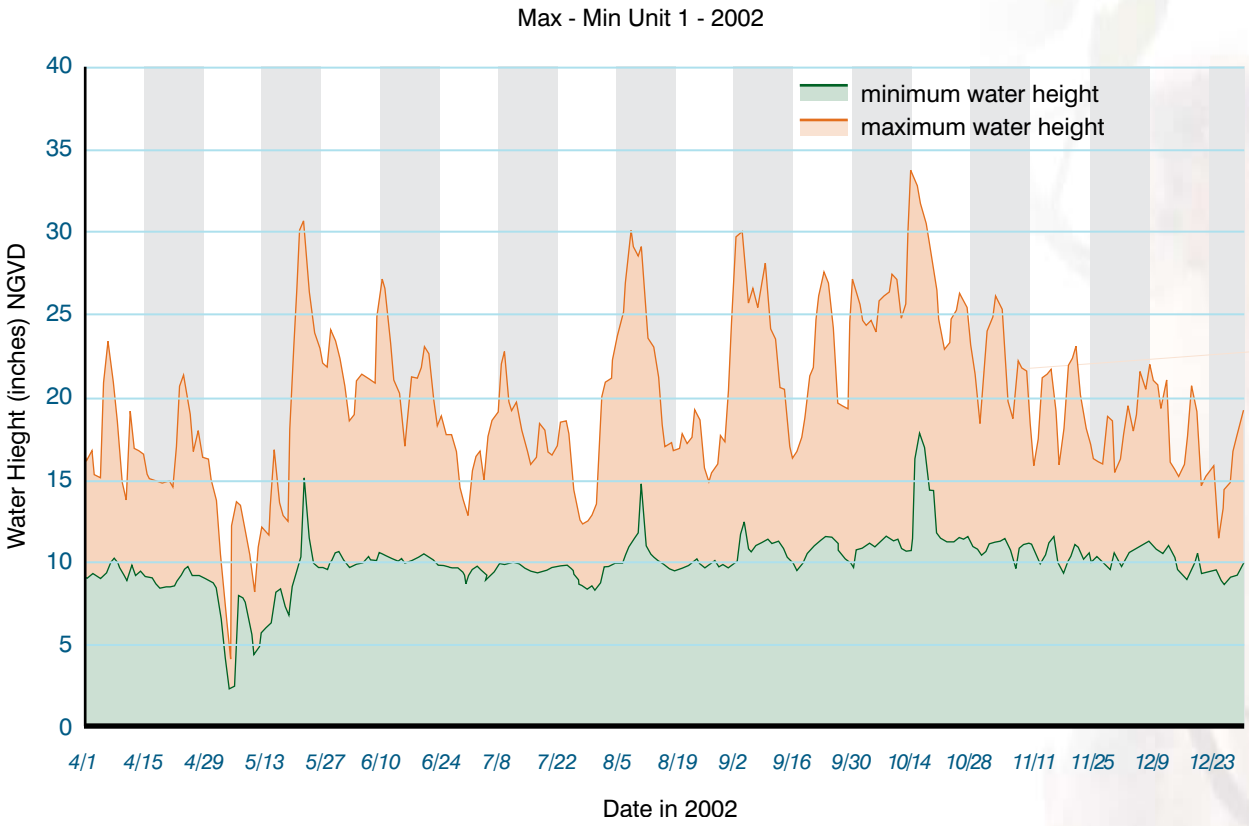
Hydrologic restoration project map 11.

The following table provides the restoration type, ownership, and cost estimate for each of the North Fork St. Lucie River and Ten Mile Creek Hydrologic Restoration Project sites identified in the above map series.

Site Name	Restoration Type	Ownership	Cost Estimate (K)
Creekside West	Oxbow	Public/Private	300
Gentile	Oxbow	Public	300
Spillway	Oxbow	Public	100
Creekside	Oxbow	Public	100
Creekside Pond	Pond Connection	Public	75
Coolidge	Oxbow	Private	250
NE Reservoir System	Oxbow	Public/Private	450
Gordy	Oxbow	Public/Private	150
Jenkins	Oxbow	Public/Private	150
Ralls	Oxbow	Public	150
Brown	Oxbow	Private	150
Shelby West	Oxbow	Private	400
Shelby East	Oxbow	Private	350
Scout Camp	Oxbow	Private	275
Scout Camp South	Pond Connection	Public	40
Miller	Oxbow	Public	225
Railroad West	Oxbow	Public	100
Railroad East	Oxbow and Floodplain	Public/Private	300
Cargill	Oxbow	Private	250
River Oaks	Oxbow	Private	500
Raintree Upstream	Oxbow	Public	150
Evans	Pond Connection	Private	40
Devine	Oxbow	Private	75
Midway	Oxbow and Pond Reconnection	Public	450
Broken Bench	Floodplain	unknown	60
Haupt Upstream	Oxbow	Private	40
Roberts Upstream	Oxbow	Private	250
Charleston Oaks	Floodplain	Private	125
Otter Trail	Floodplain	Public	450
Idabelle	Floodplain	Public	150
Oxbow Eco-Center	Oxbow	Public	125
River Place Upstream	Oxbow	Private	575
Site 5 West	Oxbow and Floodplain	Public	75
Prima Vista East	Floodplain	Public	75
Prima Vista	Floodplain	Public	75
Evans Creek	Oxbow	Public/Private	60

B.5.3 / Tidal Fluctuation in Reconnected Floodplain

Data showing the water levels in a artificially isolated floodplain after the hydrologic connection was restored in 2002.



Piezoelectric tidal stage dataloggers can be used to monitor changes in residence time and volume of water on the reconnected marsh surface.

Poster presentation from the National Conference on Coastal and Estuarine Habitat Restoration in New Orleans (Beal et. al. 2006).

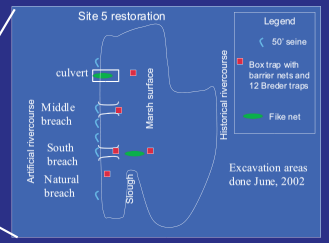
Biological response to hydrologic restoration of oligohaline floodplain communities and oxbows along North Fork St. Lucie River, St. Lucie County, FL.

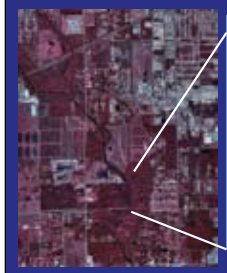
Beal, J.L.[1], S.S. Hitt[2], L.W. Herren[3], G. Kaufmann[3], and R. Hauck[3].

1 FL Fish and Wildlife Conservation Commission, Ft. Pierce, FL
2 Ecological Associates, Jensen Beach, FL
3 FL Dept. of Environmental Protection, Ft. Pierce, FL

Abstract
Two pilot studies (berm breaching to create tidal creeks and to reconnect an oxbow) were conducted to measure feasibility, cost and environmental benefit of hydrologic restoration along the North Fork St. Lucie River. Biological responses included changes in fish and decapod community structure and movement of species into the wetlands.

Introduction
The St. Lucie River is a main tributary into the southern portion of the Indian River Lagoon, an Estuary of National Significance containing a highly diverse biological community. A significant portion of the floodplain of the river's North Fork is completely or partially isolated from the river's main branch because of dredging conducted during the 1920s-1940s. Certain natural communities (e.g., floodplain swamp and forest, blackwater river oxbows) from the original water course are no longer fully connected to the river, therefore a significant portion of the river's natural filtration of water-borne nutrients is not utilized. Also, utilization of these habitats by aquatic organisms has been limited. Dredge spoil occupies 8.9 miles (16.2%) of the river's 55 miles of main branch riverfront, existing as berms 2-18' high and 10-30' wide. These spoil berms constricting natural flow were breached during two pilot studies using a variety of methods. The responses of the biological communities (fish and decapod utilization) were studied pre-and post-restoration.



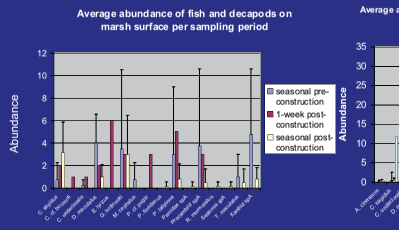


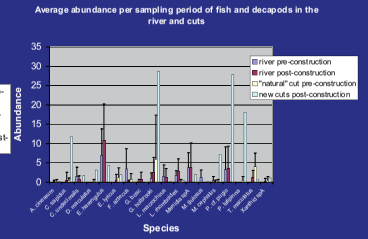
Materials and Methods
The study sites along the North Fork are known as Site 5 (an island created during river dredging) and the Strazulla oxbow (isolated from the river on its north end during river dredging)(see graphics above). Site 5 was breached in June, 2002 to allow water to sheet flow across the marsh surface and to increase utilization by aquatic organisms. At Site 5, fish and decapod sampling was conducted as one-week sampling events at the highest tides of spring (April-May) and fall (October-November). Events included box trap, Breder trap, and fike net sets (24 hours of continuous collecting) and physicals data collection. Seining was conducted along the river edge (50' bag seine with ¼" mesh) and into the newly-created cuts known as middle and south breaches. Four pre-restoration sampling events were conducted and 7 post (including one event in summer 2002, one week after excavation). Specimens captured were identified to the lowest taxon possible and measured (SL for fishes, TL for shrimps, carapace width for crabs). Pair-wise comparisons of dataset means were conducted using t-test or ANOVA (for normally distributed data) or Mann-Whitney Rank Sum Test (SigmaStat). Strazulla oxbow's north end was reconnected to allow water to flow along the historical rivercourse. No pre-construction sampling occurred in the oxbow due to muck deposits greater than 7 feet. Three sampling events were conducted post-restoration using a fike net with barrier nets strung across the entire newly-opened oxbow mouth and seine and Breder traps. All impacted areas for both pilot studies were secured with native plantings and monitored using photopoints.

Results: Site 5
During the course of the study, 1492 fish and decapods were collected (1045 fish, 447 decapods) representing 40 taxa (28 fishes, 12 decapods). See taxa in boxes below. CPUE rates per gear type are as follows: seine 16.6 +/- 34.5 (max.=187), boxtrap 7.53 +/- 8.4 (max.=42), Breder trap 0.2 +/- 0.8 (max.=8), fike net 16.2 +/- 29.1 (max.=94). Most statistical analyses (e.g., number of species or individuals captured on the marsh surface pre- and post-restoration, length of dominant taxa on marsh surface pre and post, data comparing the two new breaches constructed) were non-significant. Significant differences were found for DO on the marsh surface (pooled data) before (mean=3.8ppm) and after (mean=5.9ppm) restoration (p=0.004) and for *Gambusia holbrooki* lengths in the mid breach (mean=22.3mm) versus south breach (mean=19.3mm)(p=<0.001). Fish and decapod community structure changed as a result of restoration (see figures below). On the marsh surface, restoration resulted in the loss of *Mugil cephalus* and the appearance of 5 taxa (highlighted in **bold** below). In the river and cuts, restoration resulted in the loss of *Scianops ocellata* and the appearance of 15 taxa (underlined below). Graphics below summarize dominant taxa.

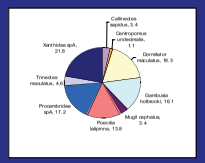
Fishes: *Achirus lineatus*, *Centropomus ensiferus*, *Centropomus undecimalis*, *Cichlidae spA*, *Cichlasoma urophthalmus*, *Citharichthys spilopterus*, *Diapterus auratus*, *Dormitator maculatus*, *Eleotris pisonis*, *Eucinostomus harengulus*, *Eucinostomus gula*, *Eugerres plumieri*, ***Evorthodus lyricus***, *Gambusia holbrooki*, *Gobiosoma bosc*, *Heterandria formosa*, *Lagodon rhomboides*, *Lepomis macrochirus*, *Lutjanus griseus*, *Menidia sp.*, *Microgobius gulosus*, *Mugil cephalus*, *Mugil curema*, ***Percidae spA***, *Poecilia latipinna*, *Rivulus marmoratus*, *Sciaenops ocellata*, *Trinectes maculatus*.

Decapods: *Callinectes sapidus*, ***Callinectes bocourti***, *Armases cinereum*, *Sesarma* sp. A, ***Palaemonetes cf. pugio***, ***Palaemon floridanus***, *Farfantepenaeus aztecus*, *Procambridae* sp. A, *Procambridae* sp. B, *Xanthidae* sp. A, *Palaemonidae* sp. B, *Palaemonidae* sp. C.

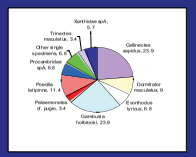




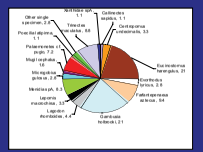
Evorthodus lyricus



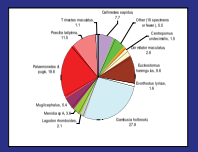
Relative abundance of fish and decapods on the marsh surface pre-restoration



Relative abundance of fish and decapods on the marsh surface post-restoration



Relative abundance of fish and decapods in the river and cut pre-restoration



Relative abundance of fish and decapods in the river and cuts post-restoration

Results: Strazulla oxbow
During the course of the study, 36 fish and decapods were captured, representing 10 taxa (*Gambusia holbrooki*, *Eleotris pisonis*, *Centropomus undecimalis*, *Eucinostomus harengulus*, *Mugil cephalus*, *Lagodon rhomboides*, *Lepomis macrochirus*, *Gobiomorus dormitor*, *Callinectes sapidus*, *Macrobrachium sp.*). Other animals were also captured including reptiles (*Apalone ferox*, *Chelydra serpentine*, *Alligator mississipiensis*) and an amphibian (*Siren lacertina*).

Strazulla Oxbow before

Strazulla Oxbow after

Discussion
This study assessed the feasibility and benefit of improving hydrologic connectivity of floodplain wetlands and oxbows isolated due to dredging along the North Fork St. Lucie River. Restoration of a similarly-impacted system in the region (Kissimmee River) serves as a model for this effort (Dahm et al., 1995) and the challenges associated with excavation and monitoring. The habitat type (forested floodplain wetlands), substrate (fines, muck), and water depth (<12") pose problems for most conventional sampling gear types and therefore few specimens were collected. For this study, the benefits of restoration included:

-increased DO levels within newly reconnected wetlands and oxbows

-formation of streams, braids, undercuts, Small Woody Debris (SWD), Large Woody Debris (LWD) allowing increased habitat complexity

-increased hydroperiod of floodplain wetlands and habitat utilization by aquatic organisms

-utilization of new cuts, rehydrated wetlands, and the oxbow by commercially and recreationally important species (e.g., snooks, blue crabs, brown shrimp, mullets, mojarras) and rare species (bigmouth sleeper, mangrove rivulus)

-the five components of restoration of fish habitat: depth and area improvement for various life stages, water quality, seasonal current patterns, refugia, and food availability (Trexler, 1995).

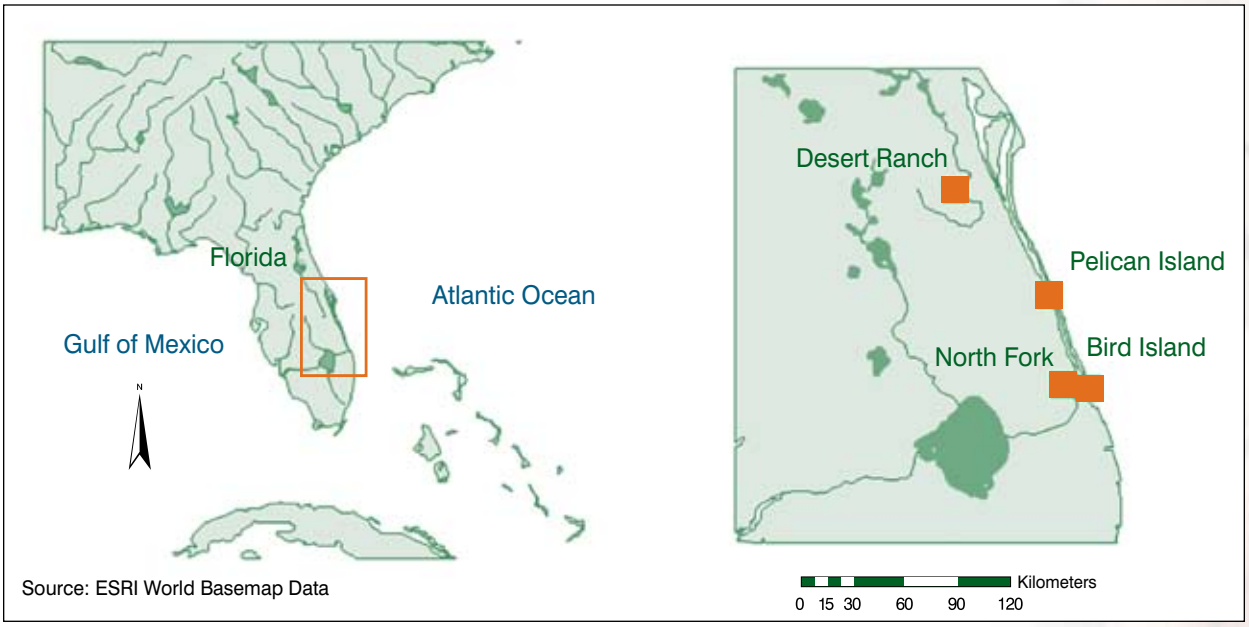
Restoration of the North Fork St. Lucie River through hydrologic reconnection of oligohaline floodplain wetlands and isolated oxbows is beneficial (aquatic animal utilization, water quality improvements, nutrient cycling) and feasible (roughly $60,000 per cut and $90,000 per oxbow endpoint). Numerous sites along the North Fork have been identified for similar restoration efforts (PBSJ, 2003) and will be funded through the Indian River Lagoon South Feasibility Study.

Literature cited
Dahm, C.N., K.W. Cummins, H.M. Valett, and R.L. Coleman. 1995. An ecosystem view of the restoration of the Kissimmee River. Restoration Ecology 3(3): 225-238.

Trexler, J.C. 1995. Restoration of the Kissimmee River: a conceptual model of past and present fish communities and its consequences for evaluating restoration success. Restoration Ecology 3(3): 195-210.

Post, Buckley, Shue, and Jernigan. 2003. Final report to FDEP: feasibility Study for the reconnection of wetlands and oxbows along the NFSLR. 30pp.

	Desert Ranch			North Fork			Bird Island			Pelican Island		
	2004	2005	2006	2004	2005	2006	2004	2005	2006	2004	2005	2006
Number of Nests	254	176	249	86	68	132	87	74	147	78	29	0
Nest Density (#Nests/m2)	0.15	0.10	0.19	0.08	0.06	0.08	0.01	0.01	0.02	0.01	<0.01	N/A
% Failures	25	77	9	31	60	5	48	89	2	42	100	N/A
Number of Fledglings	376	77	645	118	44	335	83	14	340	72	0	N/A
Mean Nestling Success	1.48	0.44	2.59	1.37	0.65	2.54	0.95	0.19	2.31	0.92	0.00	N/A
Median Nestling Success	2	0	3	1	0	3	1	0	2	1	0	N/A
Mean Nestling Success (Excluding Failures)	1.98	1.88	2.73	2.00	1.63	2.68	1.84	1.75	2.36	1.60	N/A	N/A
Median Nestling Success (Excluding Failures)	2	2	3	2	2	3	2	2	2	2	N/A	N/A



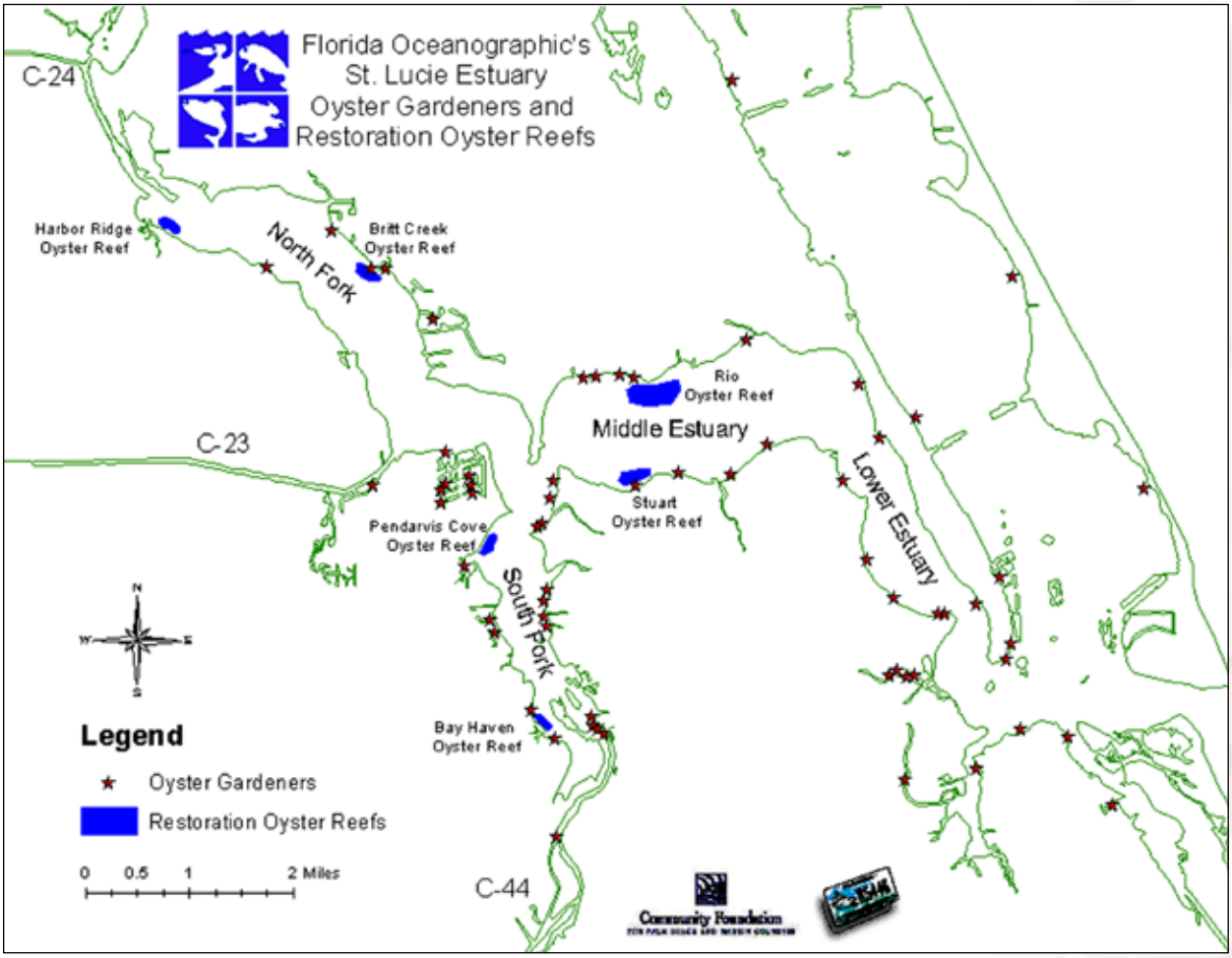
Summary of wood stork reproductive success data collected at four Florida breeding bird colonies for the 2004, 2005, and 2006 breeding seasons from Griffin et al. accepted into Acta Zoologica in 2008.

Parameter	FDEP	SFWMD	SLC DOH	FOS	MRC	U.S. GS
DO	X	X		X	X	
Salinity	X	X	X	X	X	X
Specific Conductivity	X	X				X
Temperature	X	X	X	X	X	X
pH	X	X		X	X	
Sample Depth	X					
Secchi Disk (Clarity)	X	X		X	X	
Alkalinity	X					
Ammonia (NH_3)	X					
BOD-5 day	X					
Calcium	X					
Chloride	X					
Total Coliform					X	
Color	X	X				
Fecal Coliform	X		X		X	
Fluoride	X					
Magnesium	X					
Nitrite-Nitrate (NO_2-NO_3)	X	X				
Orthophoshate-filtered	X					
Phaeophytin-a	X	X				
Potassium	X					
Sodium	X					
Sulfate	X					
Total Dissolved Solids (TDS)	X					
Total Kjeldahl Nitrogen (TKN)	X	X				
Total Organic Carbon (TOC)	X					
Total Phosphorus (TP)	X	X				
Total Suspended Solids (TSS)	X	X				
Turbidty	X	X				
Nitrogen Oxides (NO_X)		X				
Orthophosphate (PO_4)		X				
Total Orthophosphate (TPO_4)		X				
Chlorophyll-a	X	X				
Chlorophyll-b		X				
Chlorophyll-c		X				
Volatile Suspended Solids (VSS)		X				
Ammonium (NH_4)		X				
Enterococcus			X			
Carotene		X				
Arsenic	X	X				
Cadium	X					
Copper	X	X				
Lead	X					
Silver	X					
Chromium	X	X				
Iron	X					
Zinc	X					
Nickel	X					

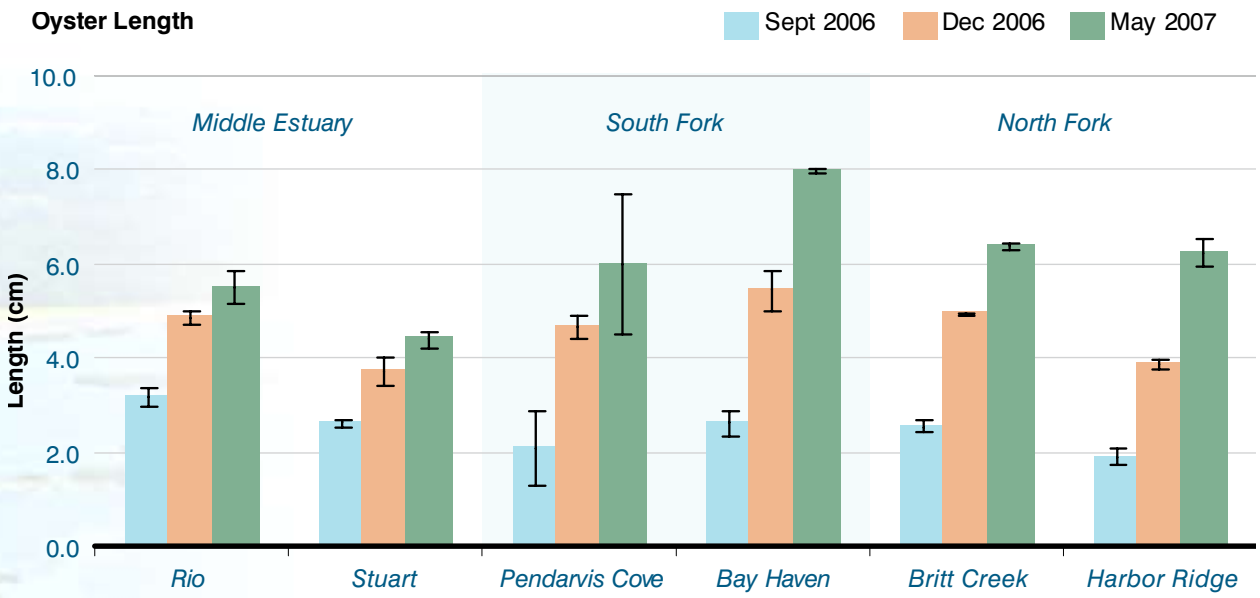
Water Quality Parameters Monitored in the North Fork St. Lucie River by Florida Department of Environmental Protection (DEP), South Florida Water Management District (SFWMD), St. Lucie County Department of Health (SLC DOH), Florida Oceanographic Society (FOS), Marine Resources Council (MRC), and United States Geological Survey (USGS).

B.5.7 | Oyster Reef Monitoring Data

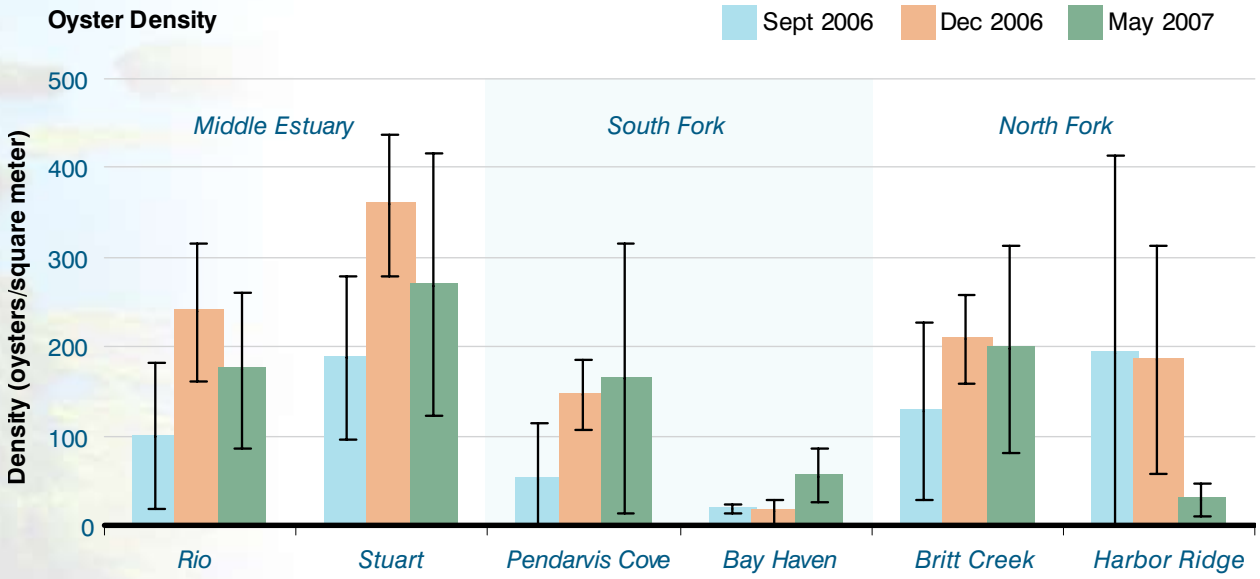
Two entities, Florida Oceanographic Society and Florida Fish and Wildlife Conservation Commission, collect oyster reef monitoring data within the preserve. The following data provide a comarative synopsis of oyster density, size, and recruitment abilities within the North Fork St. Lucie River.



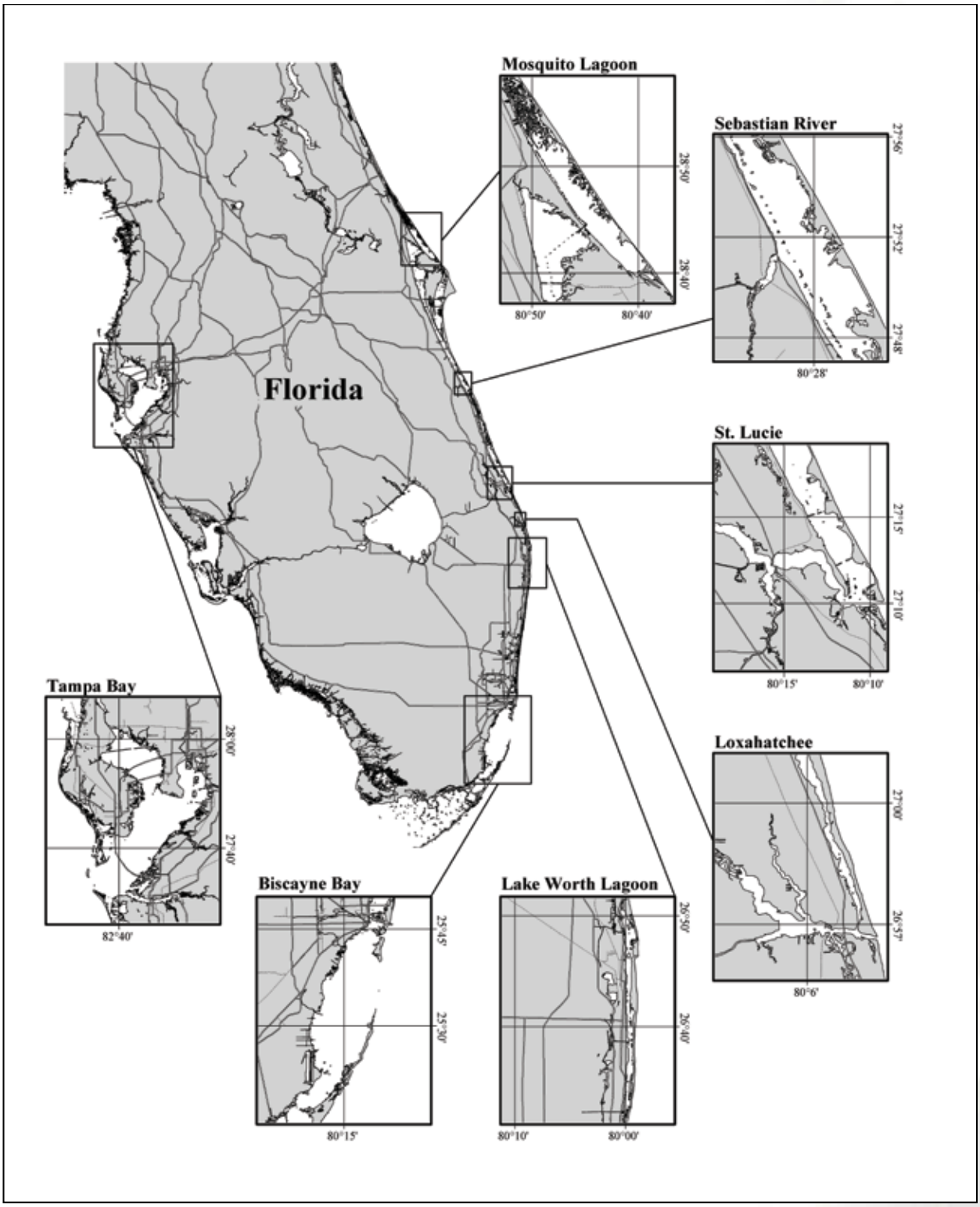
St. Lucie River Oyster Gardner Volunteer Location Map.



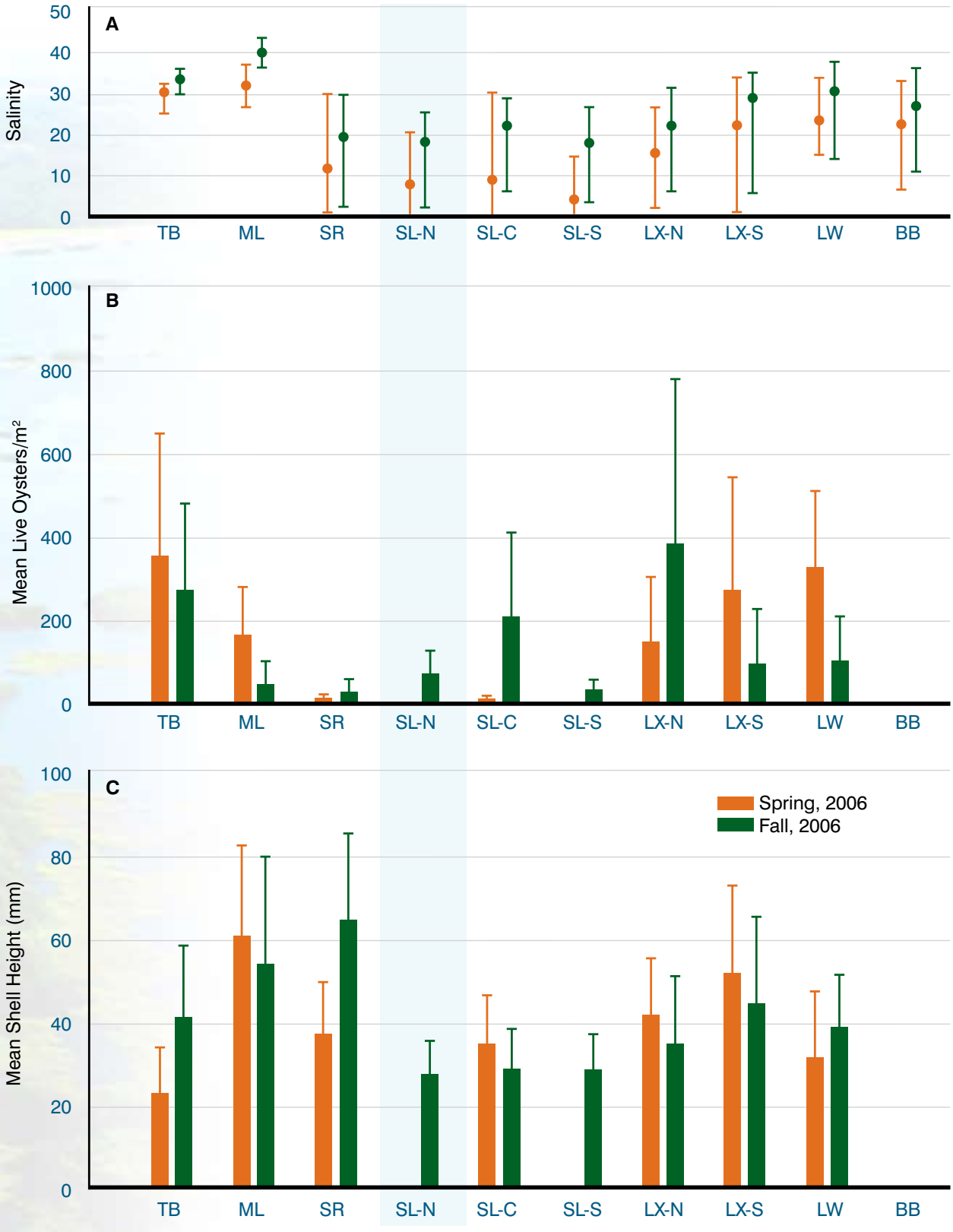
Comparison of oyster density in the St. Lucie River from September 2006 to May 2007 (data provided by Florida Oceanographic Society).



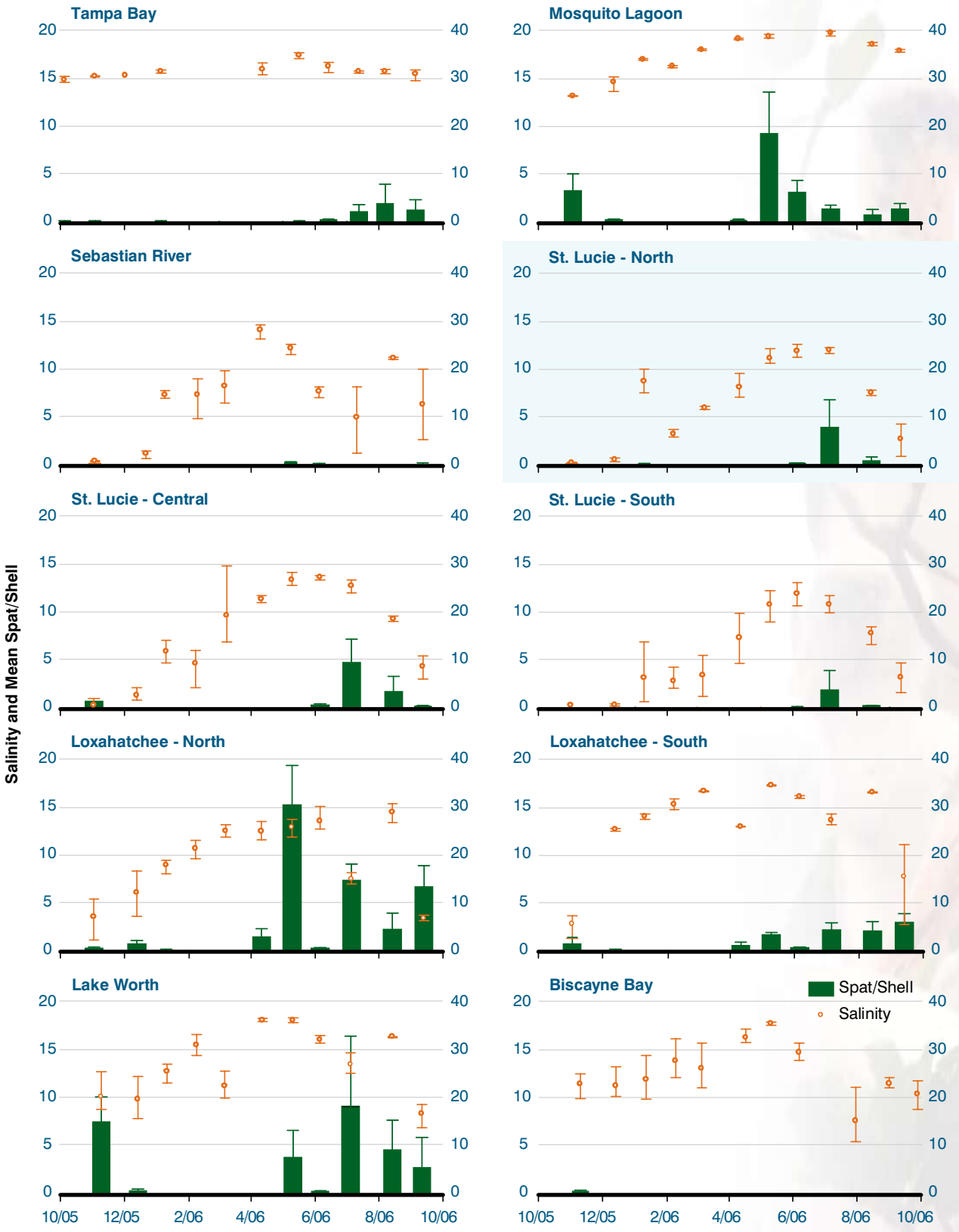
Comparison of oyster length in the St. Lucie River from September 2006 to May 2007 (data provided by Florida Oceanographic Society).



Florida Fish and Wildlife Conservation Commission oyster reef monitoring sites throughout Florida (reproduced from Florida Fish and Wildlife Conservation Commission [FWC], 2006).



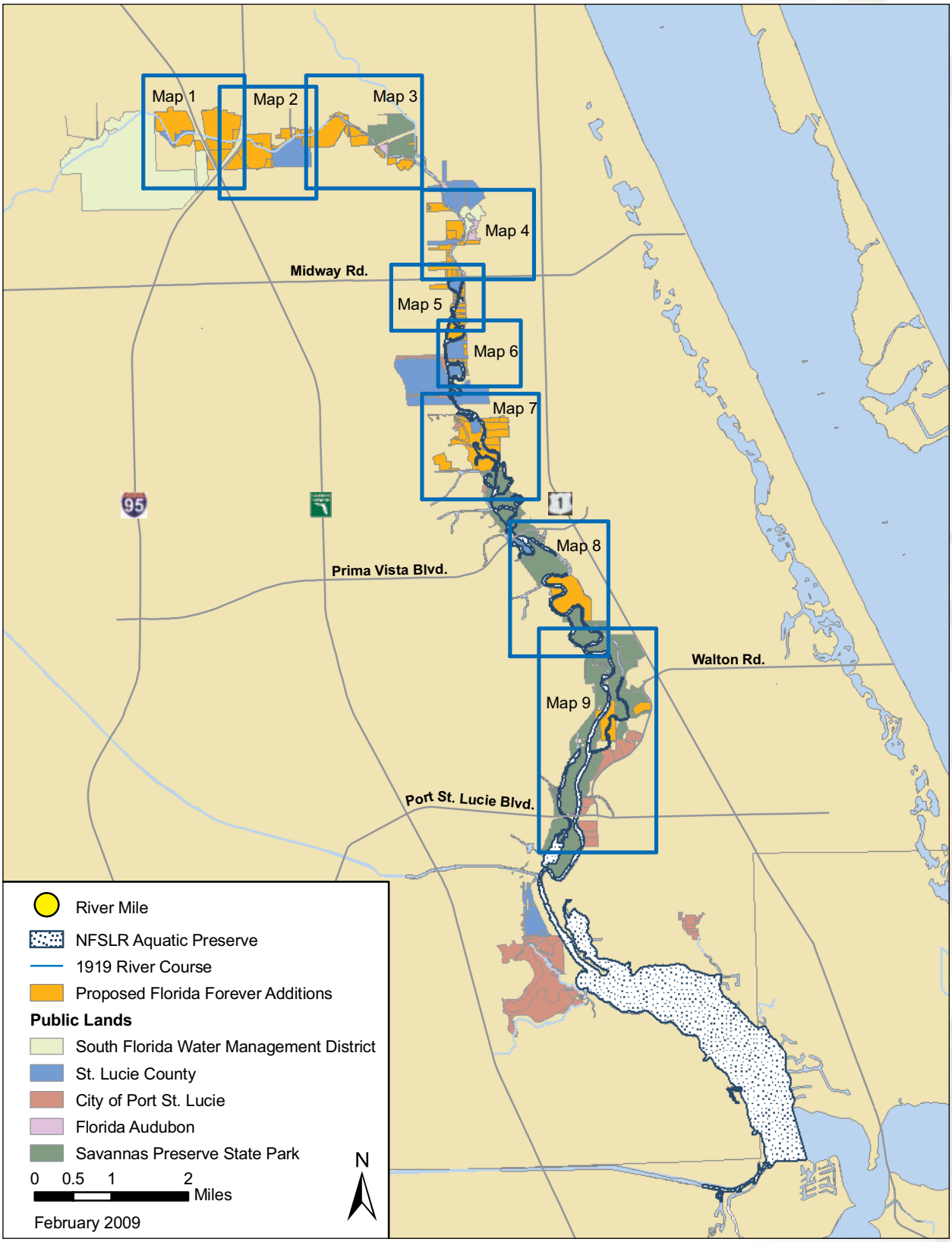
A) Mean, maximum, and minimum salinities recorded at each study site during the six months prior to each survey. B) Mean number of live oysters present at each study site during the spring 2006 and fall 2006 surveys. C) Mean shell height (mm) of oysters present at each study site during the spring 2006 and fall 2006 surveys. (TB = Tampa Bay, ML= Mosquito Lagoon, SR = Sebastian River, SL-N = St. Lucie-North, SL-C = St. Lucie-Central, SL-S = St. Lucie-South, LX-N = Loxahatchee-North, LX-S = Loxahatchee-South, LW = Lake Worth Lagoon, BB = Biscayne Bay) (Reproduced from Florida Fish and Wildlife Conservation Commission [FWC], 2007a).



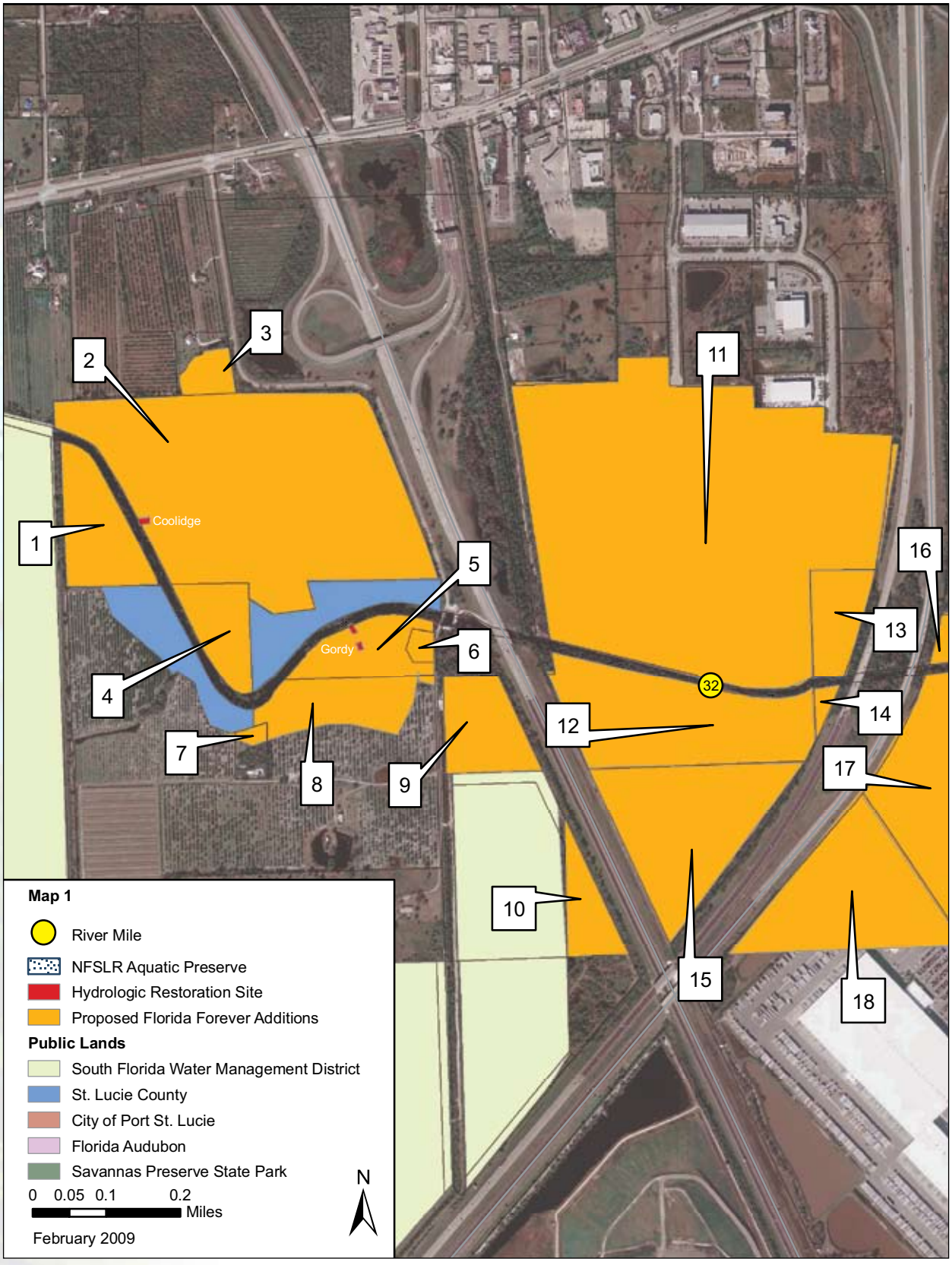
Mean (± S.D.) number of oyster recruits collected per shell each month and the mean, maximum, and minimum salinities recorded each month from October 2005 to October 2006 (reproduced from FWC, 2006).

Shoreline stabilization is a necessary component of hydrologic restoration projects because of the need to breach large spoil berms in order to restore flow to artificially isolated oxbows and floodplains. The images above show a successful shoreline stabilization project at a floodplain reconnection site located one mile north of Prima Vista Boulevard.

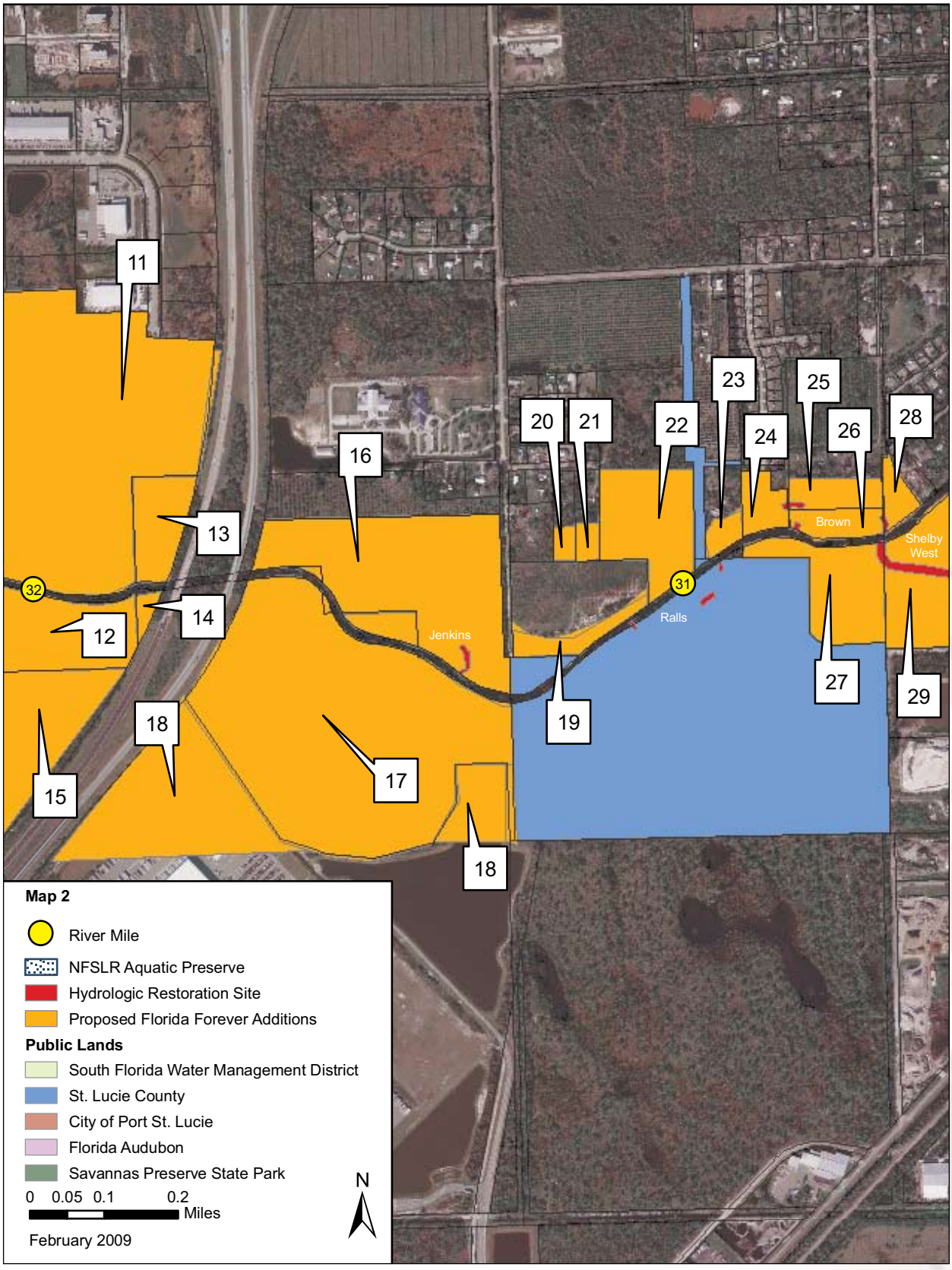
Private parcels located along the North Fork St. Lucie River and its headwaters (Ten Mile Creek) that, if acquired, would benefit the preserve.



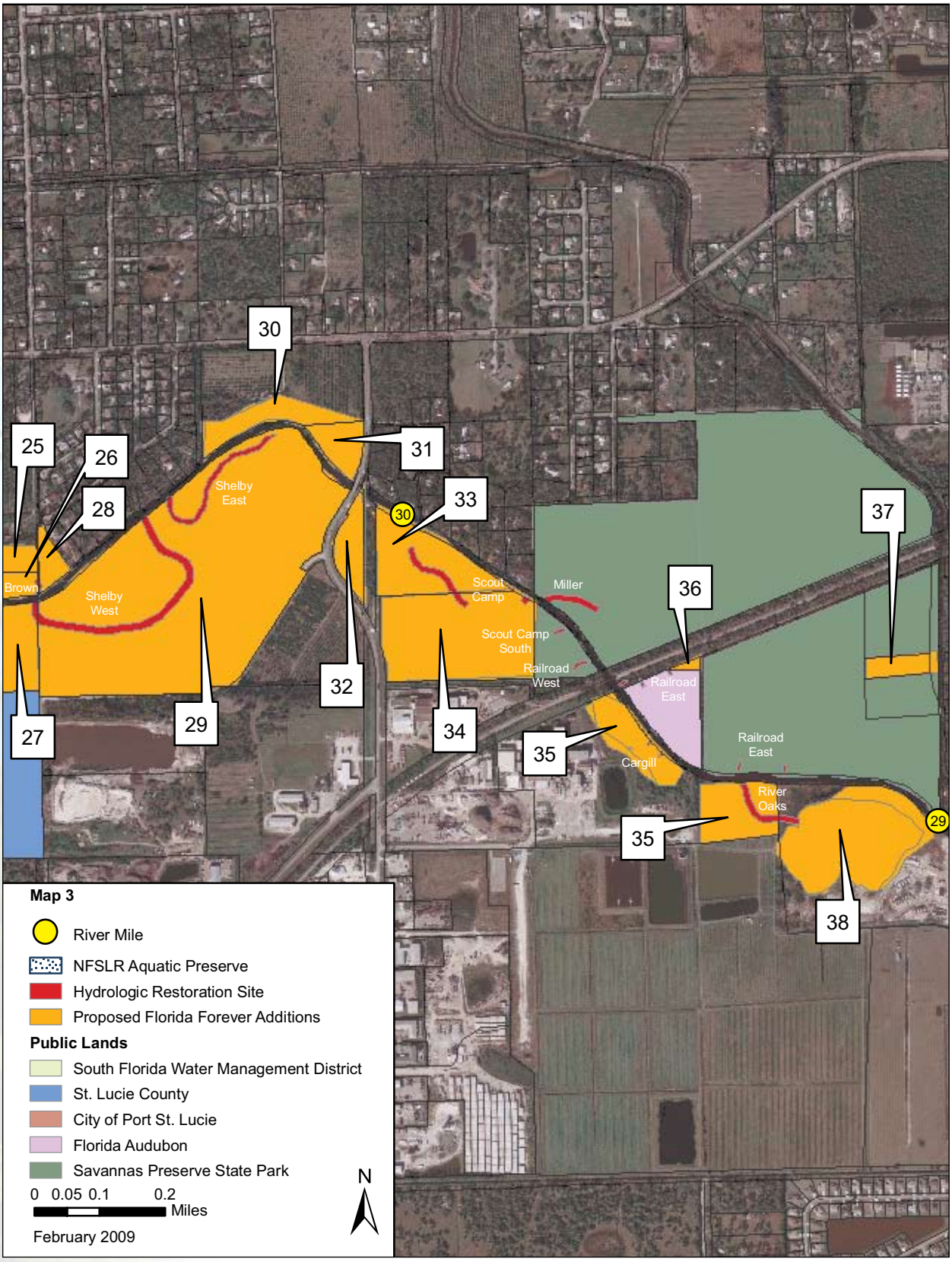
Land acquisition overview map.



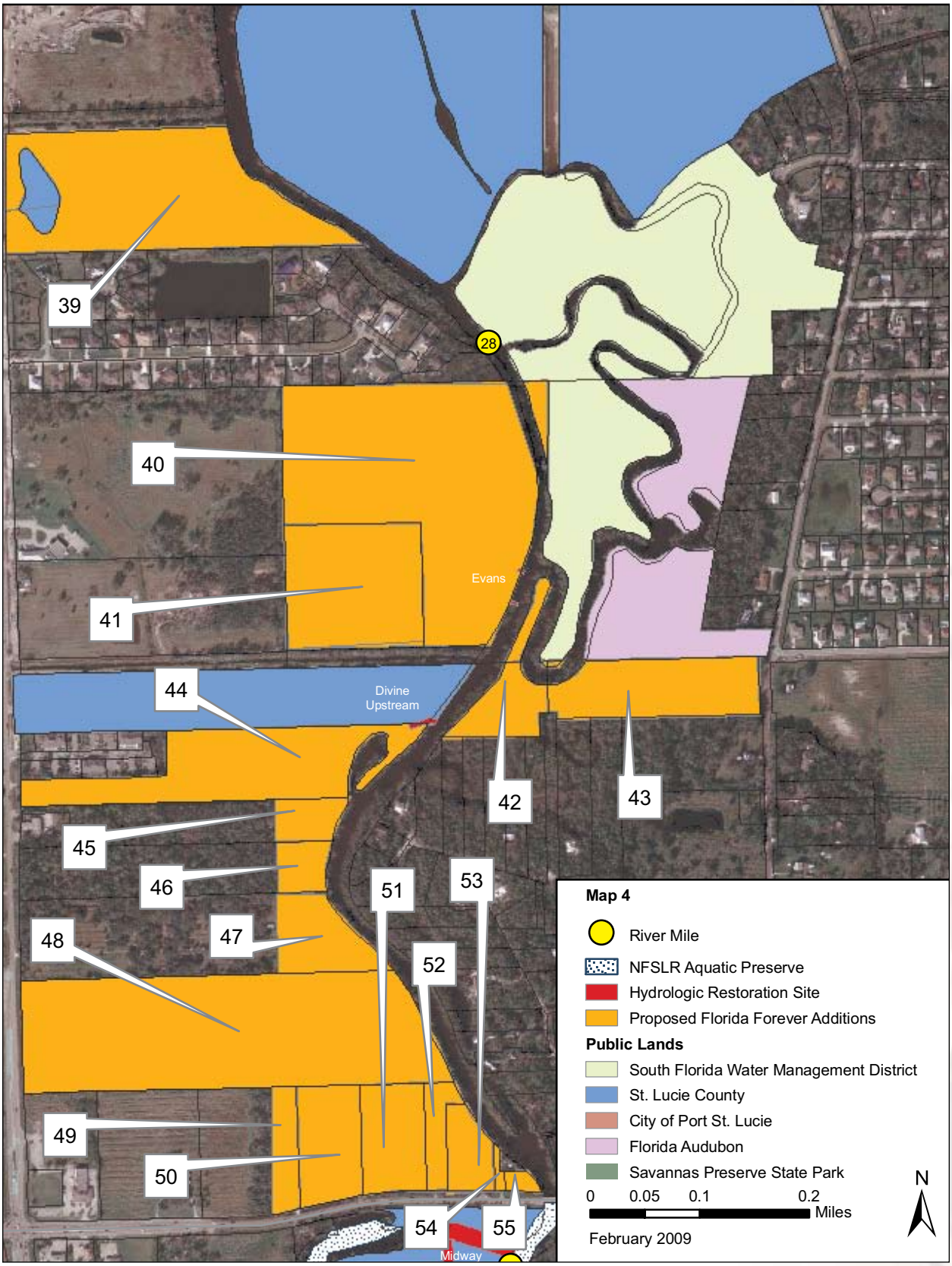
Land acquisition map 1.



Land acquisition map 2.

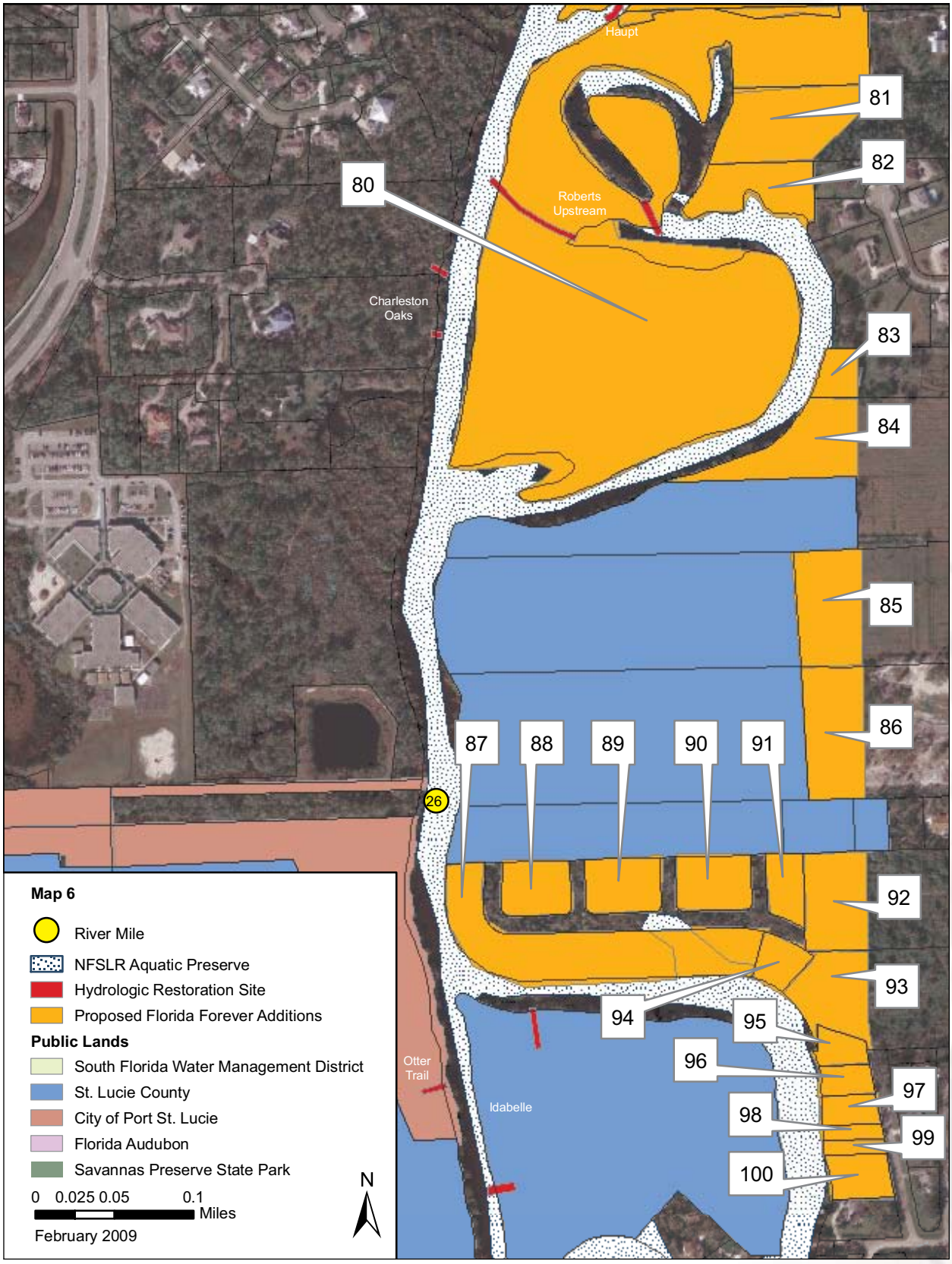


Land acquisition map 3.

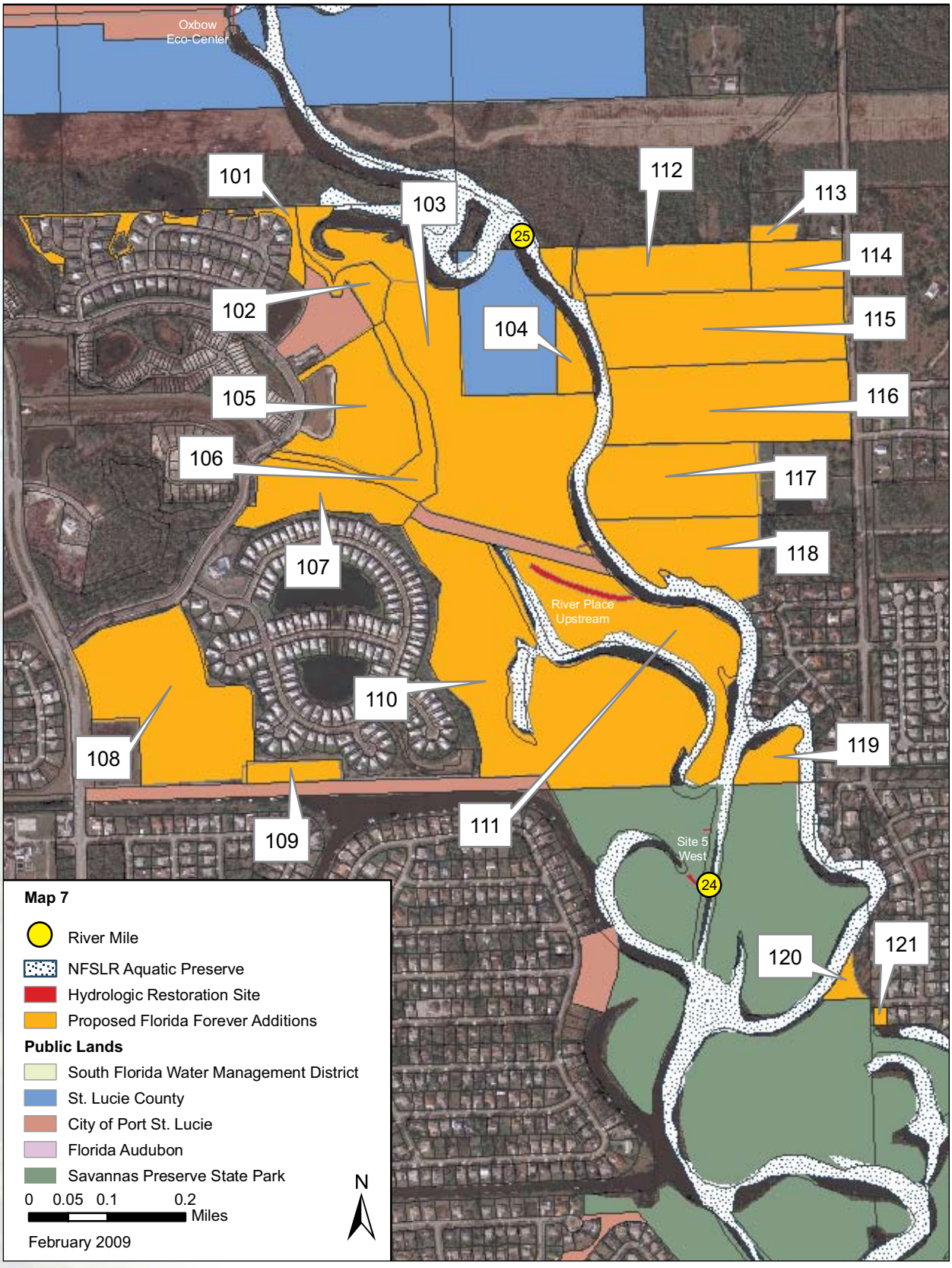


Land acquisition map 4.

Land acquisition map 5.



Land acquisition map 6.



Land acquisition map 7.

Land acquisition map 8.

Land acquisition map 9.

The following table provides the location and acreage for each of the North Fork St. Lucie River and Ten Mile Creek Land Acquisition sites identified in the above map series.

Map #	Parcel #	Section	Township	Range	Lat.	Long.	Acreage	Waterfront (meters)
1	1	26	35S	39E	-80.403	27.406	9.97	800
1	2	26	35S	39E	-80.405	27.406	65.44	800
1	3	26	35S	39E	-80.404	27.408	2.40	0
1	4	26	35S	39E	-80.404	27.403	6.40	305
1	5	26	35S	39E	-80.401	27.402	7.71	375
1	6	26	35S	39E	-80.400	27.402	0.82	0
1	7	26	35S	39E	-80.403	27.400	0.57	0
1	8	26	35S	39E	-80.405	27.399	8.99	88
1	9	25	35S	39E	-80.398	27.401	8.57	0
1	10	25	35S	39E	-80.396	27.397	5.79	0
1	11	25	35S	39E	-80.394	27.404	105.30	1200
1	12	25	35S	39E	-80.395	27.401	24.81	1200
1	13	25	35S	39E	-80.391	27.402	6.14	140
1	14	25	35S	39E	-80.391	27.402	0.82	140
1	15	25	35S	39E	-80.395	27.399	22.58	0
2	16	25	35S	39E	-80.384	27.402	29.23	420
2	17	25	35S	39E	-80.386	27.398	62.90	670
2	18	25	35S	39E	-80.389	27.396	28.96	0
2	19	30	35S	40E	-80.382	27.401	3.66	190
2	20	30	35S	40E	-80.382	27.402	0.93	0
2	21	30	35S	40E	-80.381	27.402	1.05	0
2	22	30	35S	40E	-80.379	27.403	11.56	130
2	23	30	35S	40E	-80.378	27.402	1.45	116
2	24	30	35S	40E	-80.377	27.403	2.95	100
2	25	30	35S	40E	-80.376	27.404	3.23	0
2	26	30	35S	40E	-80.375	27.402	3.08	208
2	27	30	35S	40E	-80.375	27.401	9.87	315
2	28	30	35S	40E	-80.374	27.403	2.08	100
3	29	30	35S	40E	-80.370	27.404	72.62	960
3	30	30	35S	40E	-80.369	27.406	4.96	250
3	31	30	35S	40E	-80.367	27.405	3.19	100
3	32	30	35S	40E	-80.367	27.403	3.05	30
3	33	29	35S	40E	-80.365	27.403	10.39	400
3	34	29	35S	40E	-80.364	27.401	19.00	60
3	35	29	35S	40E	-80.359	27.397	12.20	510
3	36	29	35S	40E	-80.358	27.400	0.27	0
3	37	29	35S	40E	-80.353	27.400	2.38	0
3	38	29	35S	40E	-80.355	27.396	17.60	250
4	39	33	35S	40E	-80.346	27.387	16.42	280
4	40	33	35S	40E	-80.345	27.384	27.33	430
4	41	33	35S	40E	-80.345	27.382	8.67	0
4	42	04	36S	40E	-80.343	27.381	2.88	150
4	43	04	36S	40E	-80.341	27.381	6.36	70
4	44	04	36S	40E	-80.347	27.380	11.13	200
4	45	04	36S	40E	-80.346	27.379	1.50	70
4	46	04	36S	40E	-80.346	27.379	1.44	60
4	47	04	36S	40E	-80.346	27.378	3.46	155
4	48	04	36S	40E	-80.345	27.377	24.31	190
4	49	04	36S	40E	-80.346	27.375	2.21	0
4	50	04	36S	40E	-80.346	27.375	3.91	0
4	51	04	36S	40E	-80.345	27.375	3.62	0
4	52	04	36S	40E	-80.344	27.376	1.43	40
4	53	04	36S	40E	-80.344	27.375	2.00	75
4	54	04	36S	40E	-80.343	27.375	0.27	20
4	55	04	36S	40E	-80.343	27.375	0.39	35
5	56	04	36S	40E	-80.348	27.373	9.43	105
5	57	04	36S	40E	-80.345	27.371	0.60	150
5	58	04	36S	40E	-80.345	27.371	0.75	0
5	59	04	36S	40E	-80.344	27.371	0.67	30
5	60	04	36S	40E	-80.345	27.370	0.64	30
5	61	04	36S	40E	-80.345	27.370	1.02	43
5	62	04	36S	40E	-80.346	27.370	0.25	24
5	63	04	36S	40E	-80.345	27.369	1.04	77

Map #	Parcel #	Section	Township	Range	Lat.	Long.	Acreage	Waterfront (meters)
5	64	04	36S	40E	-80.346	27.369	0.57	87
5	65	04	36S	40E	-80.343	27.373	0.25	96
5	66	04	36S	40E	-80.343	27.373	0.67	10
5	67	04	36S	40E	-80.343	27.373	0.63	33
5	68	04	36S	40E	-80.343	27.372	2.02	95
5	69	04	36S	40E	-80.343	27.371	1.63	72
5	70	04	36S	40E	-80.343	27.371	0.93	38
5	71	04	36S	40E	-80.343	27.371	N/A	98
5	72	04	36S	40E	-80.343	27.370	0.45	40
5	73	04	36S	40E	-80.343	27.370	0.39	40
5	74	04	36S	40E	-80.343	27.370	1.05	250
5	75	04	36S	40E	-80.344	27.370	0.47	47
5	76	04	36S	40E	-80.344	27.369	2.98	68
5	77	04	36S	40E	-80.344	27.368	5.45	100
5	78	04	36S	40E	-80.344	27.368	2.03	35
5	79	04	36S	40E	-80.344	27.367	4.06	68
6	80	09	36S	40E	-80.346	27.365	30.51	2,250
6	81	09	36S	40E	-80.343	27.366	2.47	80
6	82	09	36S	40E	-80.343	27.365	0.99	240
6	83	09	36S	40E	-80.342	27.364	0.54	55
6	84	09	36S	40E	-80.343	27.363	1.95	155
6	85	09	36S	40E	-80.343	27.362	1.83	0
6	86	09	36S	40E	-80.343	27.361	2.15	0
6	87	09	36S	40E	-80.345	27.358	4.28	455
6	88	09	36S	40E	-80.346	27.359	0.99	0
6	89	09	36S	40E	-80.345	27.359	1.05	0
6	90	09	36S	40E	-80.344	27.359	1.05	0
6	91	09	36S	40E	-80.344	27.359	0.60	0
6	92	09	36S	40E	-80.343	27.359	1.73	0
6	93	09	36S	40E	-80.342	27.358	1.51	56
6	94	09	36S	40E	-80.343	27.358	0.52	45
6	95	09	36S	40E	-80.343	27.357	0.39	30
6	96	09	36S	40E	-80.343	27.357	0.37	32
6	97	09	36S	40E	-80.343	27.357	0.42	33
6	98	09	36S	40E	-80.343	27.357	0.22	18
6	99	09	36S	40E	-80.343	27.356	0.23	18
6	100	09	36S	40E	-80.343	27.356	0.76	44
7	101	16	36S	40E	-80.349	27.349	3.02	0
7	102	16	36S	40E	-80.344	27.347	2.44	0
7	103	16	36S	40E	-80.343	27.346	84.52	1,300
7	104	16	36S	40E	-80.340	27.346	21.33	205
7	105	16	36S	40E	-80.344	27.344	11.17	0
7	106	16	36S	40E	-80.343	27.344	4.80	0
7	107	16	36S	40E	-80.345	27.343	7.69	0
7	108	16	36S	40E	-80.348	27.340	21.30	110
7	109	16	36S	40E	-80.346	27.338	2.17	200
7	110	16	36S	40E	-80.340	27.339	84.52	1,325
7	111	16	36S	40E	-80.340	27.341	84.52	800
7	112	16	36S	40E	-80.338	27.347	11.67	300
7	113	16	36S	40E	-80.336	27.348	0.88	0
7	114	16	36S	40E	-80.335	27.347	4.75	0
7	115	16	36S	40E	-80.338	27.346	21.33	205
7	116	16	36S	40E	-80.338	27.345	19.69	162
7	117	16	36S	40E	-80.338	27.343	13.05	180
7	118	16	36S	40E	-80.338	27.342	10.75	387
7	119	16	36S	40E	-80.336	27.338	3.03	286
7	120	21	36S	40E	-80.334	27.334	1.26	157
7	121	22	36S	40E	-80.334	27.333	0.25	10
8	122	27	36S	40E	-80.322	27.316	69.60	4,030
8	123	27	36S	40E	-80.325	27.315	4.60	375
8	124	27	36S	40E	-80.326	27.314	4.16	445
9	125	02	37S	40E	-80.317	27.291	4.31	263
9	126	02	37S	40E	-80.317	27.291	1.53	175
9	127	02	37S	40E	-80.315	27.290	49.45	490
9	128	02	37S	40E	-80.308	27.292	16.55	0
9	129	02	37S	40E	-80.314	27.286	0.85	0

Emergent Vegetation	
Estuarine	
Giant leatherfern	*Acrostichum danaeifolium*
Freshwater	
Beaked panicgrass	*Panicum anceps*
Bitter panicgrass	*Panicum amarum*
Blue water hyssop	*Bacopa caroliniana*
Bog smartweed	*Polygonum setaceum*
Bulltongue arrowhead	*Sagittaria lancifolia*
Chapman's arrowhead	*Sagittaria graminea var. chapmanii*
Common reed	*Phragmites australis*
Dotted smartweed	*Polygonum punctatum*
Fall panicgrass	*Panicum dichotomiflorum*
Gaping panicgrass	*Panicum hians*
Giant leatherfern	*Acrostichum danaeifolium*
Maidencane	*Panicum hematomim*
Panicgrass	*Panicum longifolium*
Pickerel weed	*Pontedaria cordata*
Redtop panicgrass	*Panicum rigidulum*
Sawgrass	*Cladium jamaicense*
Swamp lily	*Crinum americanum*
Swamp smartweed	*Polygonum hydropiperoides*

Submerged Vegetation	
Estuarine	
Shoal grass	*Halodule wrightii*
Widgeon grass	*Ruppia maritima*
Freshwater	
Muskgrass	*Chara sp.*
Pondweed	*Potamogeton illinoiensis*
Pondweed	*Potamogeton pusillus*
Southern water nymph	*Najas guadalupensis*
Tapegrass	*Vallisneria americana*
Widgeon grass	*Ruppia maritima*

Submerged / Floating Vegetation	
Freshwater	
Duckweed	*Lemna sp.*
Yellow water lily (Spadderdock)	*Nuphar lutea*
White water lily	*Nymphaea odorata*

Aquatic vegetation suitable for use in restoration efforts along the North Fork St. Lucie River and its headwaters, Five and Ten Mile Creeks.

Land Use	# Samples	Total P (mg L^{-1})		Total N (mg L^{-1})		Organic N (mg L^{-1})		Inorganic N (mg L^{-1})		NH_3-N (mg L^{-1})		NO_x-N (mg L^{-1})	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Citrus	127	0.29	0.16	1.37	1.23	1.11	1.05	0.26	0.13	0.13	0.06	0.14	0.04
Pasture	53	0.29	0.22	1.46	1.09	1.32	0.94	0.15	0.08	0.11	0.06	0.03	0.01
Urban	115	0.22	0.09	1.07	0.82	0.92	0.72	0.13	0.05	0.06	0.03	0.07	0.01
Golf Course	28	0.24	0.19	1.62	1.51	1.27	1.22	0.32	0.22	0.20	0.10	0.12	0.07
Wetland	30	0.02	0.01	1.18	0.94	1.10	0.99	0.14	0.02	0.14	0.02	0.00	0.00
Row crop	20	0.63	0.45	1.88	1.31	1.14	0.97	0.77	0.33	0.20	0.04	0.57	0.27
Residual	21	0.26	0.20	1.09	0.87	0.87	0.81	0.21	0.14	0.09	0.05	0.11	0.05
Dairy	8	12.54	8.86	38.90	24.60	9.98	7.39	28.90	11.50	28.50	11.00	0.39	0.03

Nutrient levels in stormwater runoff from prominent land use types in the St. Lucie River watershed (Graves et al., 2004).

Heavy Metal	Detection Limit (mg L^{-1})	# Samples Detected	Florida Fresh Water Criteria (mg L^{-1})	Max. Concentration Detected (mg L^{-1})	# Samples Exceeding Florida Criteria	Land Use Above Florida Criteria	Other Detected Land Use
As	3.00	24	50	72.1	1	Golf Course	Urban
Mn	0.25	196	100[3]	865.0	NA	NA	All
Cd	0.30	1	25 - 400	0.44	none	none	Pasture
Cr	1.00	8	66.5 - 644	6.6	none	none	Urban, Citrus
Cu	2.00	141	3.62 - 38.66	77.4	15	Golf Course, Citrus, Row Crop	Urban
Pb	2.00	4	0.545 - 18.6	7.1	1	Urban	Citrus, Row Crop
Ni	2.00	75	48.8 - 509.4	18.2	none	none	Citrus, Row Crop, Urban
Zn	1.80	52	32.7 - 343.1	119.0	2	Row Crop	Citrus, Urban

Heavy metal concentrations in stormwater runoff from prominent land use types within the St. Lucie River watershed (Graves et al., 2004).

Pesticide	Pesticide Type	Rating in Toxiicity to Estuarine Biota*	Rating in Affinity to Soil or Sediment	Rating in Persistence in Aquatic Environment	Detection Limit in Water (mg L^{-1})	FL Chronic Toxicity Standard (mg L^{-1})	# Samples Detected	# Samples Exceeding Florida Criteria	Max Concentration Detected (mg L^{-1})	Land Use Detected
Chlorpyrifos ethyl	Insecticide	High	Very Strong	Moderate	0.1	0.00176	1	1	0.98	Citrus
Diazinon	Insecticide	Moderate	Strong	Moderate	0.1	0.01	1	1	0.12	Urban
Endosulfan	Insecticide	Extremely high	Very Strong	Low	0.01	0.056	2	1	0.086	Row Crop
Ethion	Insecticide	Very high	Very Strong	High	0.05	0.003	4	4	0.068 - 2.7	Citrus
Malathion	Insecticide	Low	Moderate	Low	0.15	0.1	1	1	0.82	Citrus
Metalaxyl	Fungicide	Low	Weak	Moderate	0.6	299	1	0	1.3	Citrus
Atrazine	Herbicide	Very low	Weak	Moderate	0.05	2	22	0	0.85	Citrus, Urban, Golf Course
Bromacil	Herbicide	Very low	Weak	Moderate	0.3	1,400	22	0	63	Citrus, Row Crop
Simazine	Herbicide	Very low	Weak	Moderate	0.05	1	44	12	53	Citrus, Row Crop, Golf Course, Pasture

Analysis of pesticides identified in stormwater runoff taken from prominent land use types located within the St. Lucie River watershed (Graves et al., 2004).

Class III surface water criteria table (modified from chapter 62-302.530 F.A.C.).

62-302.530, Criteria for Surface Water Quality Classifications

Parameter	Units	Class III: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife	
		Predominantly Fresh Waters	Predominantly Marine Waters
(1) Alkalinity	Milligrams/L as $CaCO_3$	Shall not be depressed below 20	
(2) Aluminum	Milligrams/L		≤1.5
(3) Ammonia (un-ionized)	Milligrams/L as NH_3	≤0.02	
(4) Antimony	Micrograms/L	≤4,300	≤4,300
(5) (a) Arsenic (total)	Micrograms/L	≤50	≤50
(5) (b) Arsenic (trivalent)	Micrograms/L measured as total recoverable Arsenic		≤36
(6) Bacteriological Quality (Fecal Coliform Bacteria)	Number per 100 ml (Most Probable Number (MPN) or Membrane Filter (MF))	MPN or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period.	MPN or MF counts shall not exceed a monthly average of 200, nor exceed 400 in 10% of the samples, nor exceed 800 on any one day. Monthly averages shall be expressed as geometric means based on a minimum of 10 samples taken over a 30 day period.
(7) Barium	Milligrams/L		
(8) Benzene	Micrograms/L	≤71.28 annual avg.	≤71.28 annual avg.
(9) Beryllium	Micrograms/L	≤0.13 annual avg.	≤0.13 annual avg.
(10) Biological Integrity	Percent reduction of Shannon-Weaver Diversity Index	The Index for benthic macroinvertebrates shall not be reduced to less than 75% of established background levels as measured using organisms retained by a U.S. Standard No. 30 sieve and collected and composited from a minimum of three Hester-Dendy type artificial substrate samplers of 0.10 to 0.15 m^2 area each, incubated for a period of four weeks.	The Index for benthic macroinvertebrates shall not be reduced to less than 75% of established background levels as measured using organisms retained by a U.S. Standard No. 30 sieve and collected and composited from a minimum of three natural substrate samples, taken with Ponar type samplers with minimum sampling area of 225 cm^2.
(11) BOD (Biochemical Oxygen Demand)		Shall not be increased to exceed values which would cause dissolved oxygen to be depressed below the limit established for each class and, in no case, shall it be great enough to produce nuisance conditions.	
(12) Boron	Milligrams/L		
(13) Bromates	Milligrams/L		≤100
(14) Bromine (free molecular)	Milligrams/L		≤0.1
(15) Cadmium	Micrograms/L See Notes (1) and (3).	$Cd \leq e^{(0.7409\ [\ln H] - 4.719)}$	< 8.8
(16) Carbon tetrachloride	Micrograms/L	≤4.42 annual avg.	≤4.42 annual avg.
(17) Chlorides	Milligrams/L		Not increased more than 10% above normal background. Normal daily and seasonal fluctuations shall be maintained.

62-302.530, Criteria for Surface Water Quality Classifications

Parameter	Units	Class III: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife	
		Predominantly Fresh Waters	Predominantly Marine Waters
(18) Chlorine (total residual)	Milligrams/L	≤0.01	≤0.01
(19) (a) Chromium (trivalent)	Micrograms/L measured as total recoverable Chromium See Notes (1) and (3).	Cr (III) $\leq e^{(0.819\ [\ln H] + 0.6848)}$	
(19) (b) Chromium (hexavalent)	Micrograms/L See Note (3).	≤11	≤50
(20) Chronic Toxicity (see definition in Section 62-302.200(4), F.A.C. and also see below, "Substances in concentrations which...")			
(21) Color, etc. (see also Minimum Criteria, Odor, Phenols, etc.)	Color, odor, and taste producing substances and other deleterious substances, including other chemical compounds attributable to domestic wastes, industrial wastes, and other wastes		
(22) Conductance, Specific	Micromhos/cm	Shall not be increased more than 50% above background or to 1,275, whichever is greater.	
(23) Copper	Micrograms/L	Cu $\leq e^{(0.8545\ [\ln H] - 1.702)}$	≤3.7
(24) Cyanide	Micrograms/L	≤5.2	≤1.0
(25) Definitions (see Section 62-302.200, F.A.C.)			
(26) Detergents	Milligrams/L	≤0.5	≤0.5
(27) 1,1-Dichloroethylene (1,1-dichloroethene)	Micrograms/L	≤3.2 annual avg.	≤3.2 annual avg.
(28) Dichloromethane (methylene chloride)	Micrograms/L	≤ 1,580 annual avg.	≤1,580 annual avg.
(29) 2,4-Dinitrotoluene	Micrograms/L	≤9.1 annual avg.	≤ 9.1 annual avg.
(30) Dissolved Oxygen	Milligrams/L	Shall not be les Normal daily and seasonal fluctuations above these levels shall be maintained.	Shall not average less than 5.0 in a 24-hour period and shall never be less than 4.0. Normal daily and seasonal fluctuations above these levels shall be maintained.
(31) Dissolved Solids	Milligrams/L		
(32) Fluorides	Milligrams/L	≤ 10.0	≤5.0
(33) "Free Froms" (see Minimum Criteria in Section 62-302.500, F.A.C.)			
(34) "General Criteria" (see Section 62-302.500, F.A.C. and individual criteria)			

62-302.530, Criteria for Surface Water Quality Classifications

Parameter	Units	Class III: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife	
		Predominantly Fresh Waters	Predominantly Marine Waters
(35) (a) Halomethanes (Total trihalomethanes) (total of bromoform, chlorodibromomethane, dichlorobromomethane, and chloroform). Individual halomethanes shall not exceed (b) 1. to (b) 5. below.	Micrograms/L		
(35) (b) 1. Halomethanes (individual): Bromoform	Micrograms/L	≤ 360 annual avg.	≤ 360 annual avg.
(35) (b) 2. Halomethanes (individual): Chlorodibromomethane	Micrograms/L	≤ 34 annual avg.	≤ 34 annual avg.
(35) (b) 3. Halomethanes (individual): Chloroform	Micrograms/L	≤ 470.8 annual avg.	≤470.8 annual avg.
(35) (b) 4. Halomethanes (individual): Chloromethane (methyl chloride)	Micrograms/L	≤ 470.8 annual avg.	≤470.8 annual avg.
(35) (b) 5. Halomethanes (individual): Dichlorobromomethane	Micrograms/L	≤ 22 annual avg.	≤22 annual avg.
(36) Hexachlorobutadiene	Micrograms/L	≤49.7 annual avg.	≤49.7 annual avg.
(37) Imbalance (see Nutrients)			
(38) Iron	Milligrams/L	≤ 1.0	≤0.3
(39) Lead	Micrograms/L See Notes (1) and (3).	$Pb \leq e^{(1.273\ [\ln H] - 4.705)}$	≤8.5
(40) Manganese	Milligrams/L		
(41) Mercury	Micrograms/L	0.012	0.025
(42) Minimum Criteria (see Section 62-302.500, F.A.C.)			
(43) Mixing Zones (See Section 62-4.244, F.A.C.)			
(44) Nickel	Micrograms/L See Notes (1) and (3).	$Ni \leq e^{(0.846\ [\ln H] + 0.0584)}$	≤8.3
(45) Nitrate	Milligrams/L as N		
(46) Nuisance Species		Substances in concentrationswhich result in the dominance of nuisance species: none shall be present.	
(47) (a) Nutrients		The discharge of nutrients shall continue to be limited as needed to prevent violations of other standards contained in this chapter. Man-induced nutrient enrichment (total nitrogen or total phosphorus) shall be considered degradation in relation to the provisions of Sections 62-302.300, 62-302.700, and 62-4.242, F.A.C.	
(47) (b) Nutrients		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.	
(48) Odor (also see Color, Minimum Criteria, Phenolic Compounds, etc.)	Threshold odor number		
(49) (a) Oils and Greases	Milligrams/L	Dissolved or emulsified oils and greases shall not exceed 5.0	Dissolved or emulsified oils and greases shall not exceed 5.0

62-302.530, Criteria for Surface Water Quality Classifications

Parameter	Units	Class III: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife	
		Predominantly Fresh Waters	Predominantly Marine Waters
(49) (b) Oils and Greases		No dissolved oil, or visible oil defined as iridescence, shall be present so as to cause taste or odor, or otherwise interfere with the beneficial use of waters.	
(50) Pesticides and Herbicides			
(50) (a) 2,4,5-TP	Micrograms/L		
(50) (b) 2-4-D	Micrograms/L		
(50) (c) Aldrin	Micrograms/L	≤ 0.00014 annual avg.; 3.0 max	≤0.00014 annual avg.; 1.3 max
(50) (d) Beta-hexachlorocyclo-hexane (b-BHC)	Micrograms/L	≤ 0.046 annual avg.	≤0.046 annual avg.
(50) (e) Chlordane	Micrograms/L	≤ 0.00059 annual avg.; 0.0043 max	≤ 0.00059 annual avg.; 0.004 max
(50) (f) DDT	Micrograms/L	≤ 0.00059 annual avg.; 0.001 max	≤ 0.00059 annual avg.; 0.001 max
(50) (g) Demeton	Micrograms/L	≤ 0.1	≤0.1
(50) (h) Dieldrin	Micrograms/L	≤ 0.00014 annual avg.; 0.0019 max	≤ 0.00014 annual avg.; 0.0019 max
(50) (i) Endosulfan	Micrograms/L	≤0.056	≤ 0.0087
(50) (j) Endrin	Micrograms/L	≤0.0023	≤ 0.0023
(50) (k) Guthion	Micrograms/L	≤0.01	≤0.01
(50) (l) Heptachlor	Micrograms/L	≤ 0.00021 annual avg.; 0.0038 max	≤ 0.00021 annual avg.; 0.0036 max
(50) (m) Lindane (g-benzene hexachloride)	Micrograms/L	≤ 0.063 annual avg.; 0.08 max	≤ 0.063. annual avg.; 0.16 max
(50) (n) Malathion	Micrograms/L	≤ 0.1	≤0.1
(50) (o) Methoxychlor	Micrograms/L	≤ 0.03	≤0.03
(50) (p) Mirex	Micrograms/L	≤ 0.001	≤0.001
(50) (q) Parathion	Micrograms/L	≤ 0.04	≤0.04
(50) (r) Toxaphene	Micrograms/L	≤ 0.0002	≤0.0002
(51) (a) pH (Class I and Class IV Waters)	Standard Units		
(51) (b) pH (Class II Waters)	Standard Units		
(51) (c) pH (Class III Waters)	Standard Units	Shall not vary more than one unit above or below natural background of predominantly fresh waters and coastal wate as defined in Section 62-302.520(3)(b), F.A.C. or m ore than two-tenths unit above or below natural background of open waters as defined in Section 62-302.520(3)(f), F.A. C., provided that the pH is not lowered to less than 6 units in predominantly fresh waters, or less than 6.5 units in predominantly marine waters, or raised above 8.5 units. If natural background is less than 6 units in predominantly fres waters or 6.5 units in predominantly marine waters, the pH shall not vary below natural background or vary more than one unit above natural background of predominantly fresh waters and coastal waters, or more than two-tenths unit above natural background of open waters. If natural background is higher than 8.5 units, the pH shall not vary above natural background or vary more than one unit below natural background of predominantly fresh waters and coas waters, or more than two-tenths unit below natural background of open waters.	
(51) (d) pH (Class V Waters)	Standard Units		

62-302.530, Criteria for Surface Water Quality Classifications

Parameter	Units	Class III: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife	
		Predominantly Fresh Waters	Predominantly Marine Waters
(52) (a) Phenolic Compounds: Total		Phenolic compounds other than those produced by the natural decay of plant material, listed or unlisted, shall not taint the flesh of edible fish or shellfish or produce objectionable taste or odor in a drinking water supply.	
(52) (b) Total Chlorinated Phenols and Chlorinated Cresols	Micrograms/L	1. The total of all chlorinated phenols, and chlorinated cresols, except as set forth in (c) 1. to (c) 4. below, shall not exceed 1.0 unless higher vales are shown not to be chronically toxic. Such higher values shall be approved in writing by the Secretary. 2. The compounds listed in (c) 1. to (c) 6. below shall not exceed the limits specified for each compound.	
(52) (c) 1. Phenolic Compound: 2-chlorophenol	Micrograms/L	< 400 See Note (2).	< 400 See Note (2).
(52) (c) 2. Phenolic Compound: 2,4-dichlorophenol	Micrograms/L	< 790 See Note (2).	< 790 See Note (2).
(52) (c) 3. Phenolic Compound: Pentachlorophenol	Micrograms/L	≤ 30 max; ≤ 8.2 annual avg; ≤ e^(1.005 [pH] - 5.29)	≤7.9
(52) (c) 4. Phenolic Compound: 2,4,6-trichlorophenol	Micrograms/L	≤ 6.5 annual avg.	≤ 6.5 annual avg.
(52) (c) 5. Phenolic Compound: 2,4-dinitrophenol	Milligrams/L	≤14.26 See Note (2).	≤14.26 See Note (2).
(52) (c) 6. Phenolic Compound: Phenol	Milligrams/L	≤0.3	≤0.3
(53) Phosphorus (Elemental)	Micrograms/L		≤0.1
(54) Phthalate Esters	Micrograms/L	≤3.0	
(55) Polychlorinated Biphenyls (PCBs)	Micrograms/L	≤ 0.000045 annual avg.; 0.014 max	≤ 0.000045 annual avg.; 0.03 max
(56) (a) Polycyclic Aromatic Hydrocarbons (PAHs). Total of: Acenaphthylene; Benzo(a)anthracene; Benzo(a)pyrene; Benzo(b)fluoran-thene; Benzo(ghi)perylene; Benzo(k)fluoranthene; Chrysene; Dibenzo(a,h)anthracene; Indeno(1,2,3-cd)pyrene; and Phenanthrene	Micrograms/L	≤ 0.031annual avg.	≤ 0.031 annual avg.
(56) (b) 1 (Individual PAHs): Acenaphthene	Milligrams/L	< 2.7 See Note (2).	< 2.7 See Note (2).
(56) (b) 2. (Individual PAHs): Anthracene	Milligrams/L	< 110 See Note (2).	< 110 See Note (2).
(56) (b) 3. (Individual PAHs): Fluoranthene	Milligrams/L	< 0.370 See Note (2).	< 0.370 See Note (2).
(56) (b) 4. (Individual PAHs): Fluorene	Milligrams/L	< 14 See Note (2).	< 14 See Note (2).
(56) (b) 5. (Individual PAHs): Pyrene	Milligrams/L	< 11 See Note (2).	< 11 See Note (2).
(57) (a) Radioactive substances (Combined radium 226 and 228)	Picocuries/L	≤5	≤5

62-302.530, Criteria for Surface Water Quality Classifications

Parameter	Units	Class III: Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife	
		Predominantly Fresh Waters	Predominantly Marine Waters
(57) (b) Radioactive substances (Gross alpha particle activity including radium 226, but excluding radon and uranium)	Picocuries/L	≤15	≤15
(58) Selenium	Micrograms/L	≤ 5.0	≤71
(59) Silver	Micrograms/L See Note (3).	≤0.07	See Minimum criteria in Section 62-302.500(1)(c)
(60) Specific Conductance (see Conductance, Specific, above)			
(61) Substances in concentrations which injure, are chronically toxic to, or produce adverse physiological or behavioral response in humans, plants, or animals		None shall be present.	
(62) 1,1,2,2-Tetrachloroethane	Micrograms/L	≤10.8 annual avg.	≤10.8 annual avg.
(63) Tetrachloroethylene (1,1,2,2-tetrachloroethene)	Micrograms/L	≤ 8.85 annual avg.	≤8.85 annual avg.
(64) Thallium	Micrograms/L	<6.3	<6.3
(65) Thermal Criteria (See Section 62-302.520)			
(66) Total Dissolved Gases	Percent of the saturation value for gases at the existing atmospheric and hydrostatic pressures	≤110% of saturation value	≤110% of saturation value
(67) Transparency	Depth of the compensation point for photosynthetic activity	Shall not be reduced by more than 10% as compared to the natural background value.	Shall not be reduced by more than 10% as compared to the natural background value.
(68) Trichloroethylene (trichloroethene)	Micrograms/L	≤ 80.7 annual avg.	≤ 80.7 annual avg.
(69) Turbidity	Nephelometric Turbidity Units (NTU)	≤ 29 above natural background conditions	≤ 29 above natural background conditions
(70) Zinc	Micrograms/L See Notes (1) and (3).	$Zn \leq e^{(0.8473\ [\ln H] + 0.884)}$	≤ 86

Notes: (1) “ln H” means the natural logarithm of total hardness expressed as milligrams/L of $CaCO_3$. For metals criteria involving equations with hardness, the hardness shall be set at 25 mg/L if actual hardness is < 25 mg/L and set at 400 mg/L if actual hardness is > 400 mg/L; (2) This criterion is protective of human health notof aquatic life; (3) For application of dissolved metals criteria see 62-302.500(2)(d), F.A.C.

B.5.13 / Impaired Basins and TMDL Development Schedule

The North Fork St. Lucie River has been verified as an impaired waterbody, which means that it does not meet the criteria outlined for its designation as a Class III surface waterbody. Total Maximum Daily Loads for nutrients are currently being developed for this waterbody. DEP staff will begin working with local governments to draft a Basin Action Management Plan that will identify specific projects to reduce the amount of nutrients reaching the St. Lucie River.

WBID	Water Segment Name	1998 303(d) Parameters of Concern	New Parameters of Concern from IWR	DEP Impairment Assessment Status	EPA's Integrated Report Category	Projected Year for TMDL Development / Due Date	Responsible Entity for TMDL Development
3160	C-25 CANAL WEST	Dissolved Oxygen	Dissolved Oxygen	PLANNING	3C	Proposed in 2006	EPA
3160	C-25 CANAL WEST	Nutrients	Nutrients	NO DATA	3C	Proposed in 2006	EPA
3163	FT. PIERCE FARM CANAL (BELCHER CAN/TAYLOR CK)	Dissolved Oxygen	Dissolved Oxygen	VERIFIED	5	Proposed in 2006	EPA
3163	FT. PIERCE FARM CANAL (BELCHER CAN/TAYLOR CK)	Nutrients	Nutrients(CHLA)	VERIFIED	5	Proposed in 2006	EPA
3189	COWBONE CREEK (C-25)	Coliforms	Total Coliform	INSUFFICIENT DATA	3C	Proposed in 2006	EPA
3189	COWBONE CREEK (C-25)	Coliforms	Fecal Coliform	PLANNING	3C	Proposed in 2006	EPA
3189	COWBONE CREEK (C-25)	Dissolved Oxygen	Dissolved Oxygen	PLANNING	3C	Proposed in 2006	EPA
3189	COWBONE CREEK (C-25)	Nutrients	Nutrients(CHLA)	NO DATA	3C	Proposed in 2006	EPA
3194	NORTH ST.LUCIE	Coliforms	Total Coliform	INSUFFICIENT DATA	3C	Proposed in 2006	EPA
3194	NORTH ST.LUCIE	Coliforms	Fecal Coliform	INSUFFICIENT DATA	3C	Proposed in 2006	EPA
3211	BESSEY CREEK	Coliforms	Fecal Coliform	INSUFFICIENT DATA	3C	Pro osed in 2006	EPA
3211	BESSEY CREEK	BOD	BOD 5-Day	NO DATA	3C	Pro osed in 2006	EPA
3194	NORTH ST.LUCIE	Dissolved Oxygen	Dissolved Oxygen	VERIFIED	5	2008	DEP
3194	NORTH ST.LUCIE	Nutrients	Nutrients (Hist. CHLA)	VERIFIED	5	2008	DEP
319	C-24	Nutrients	Nutrients (CHLA)	VERIFIED	5	2008	DEP
319	C-24	Dissolved Oxygen	Dissolved Oxygen	VERIFIED	5	2008	DEP
319	C-24		Iron	VERIFIED	5	2008	DEP
3211	BESSEY CREEK	Dissolved Oxygen	Dissolved Oxygen	VERIFIED	5	2008	DEP
3211	BESSEY CREEK	Nutrients	Nutrients (CHLA)	VERIFIED	5	2008	DEP
3194B	ST. LUCIE	Nutrients	Nutrients (CHLA)	VERIFIED	5	2008	DEP
3193	ST. LUCIE RIVER		Nutrients (CHLA)	VERIFIED	5	Dec 2008	DEP
3200	C-23		Nutrients (CHLA)	VERIFIED	5	Dec 2008	DEP
3200	C-23		Dissolved Oxygen	VERIFIED	5	Dec 2008	DEP
3210	TIDAL ST.LUCIE		Nutrients (CHLA)	VERIFIED	5	Dec 2008	DEP
3218	C-44		Dissolved Oxygen	VERIFIED	5	Dec 2008	DEP
3194B	ST. LUCIE		Dissolved Oxygen	VERIFIED	5	Dec 2008	DEP
3190	NORTH COASTAL		Nutrients (CHLA)	VERIFIED	5	Sept 2009	DEP
3190	NORTH COASTAL		Bacteria (in Shellfish)	VERIFIED	5	Sept 2009	DEP
3194	NORTH ST.LUCIE		Copper	VERIFIED	5	Sept 2009	DEP
3200	C-23		Iron	VERIFIED	5	Sept 2009	DEP
3208	MANATEE POCKET		Copper	VERIFIED	5	Sept 2009	DEP
3210	TIDAL ST.LUCIE		Copper	VERIFIED	5	Sept 2009	DEP
3218	C-44		Iron	VERIFIED	5	Sept 2009	DEP
8102	COASTAL OCEAN 2		Bacteria (in Shellfish)	VERIFIED	5	Sept 2009	DEP
8103	COASTAL OCEAN 3		Bacteria (in Shellfish)	VERIFIED	5	Sept 2009	DEP
8104	COASTAL OCEAN 4		Bacteria (in Shellfish)	VERIFIED	5	Sept 2009	DEP
3163B	C-25 EAST SEGMENT		Nutrients (CHLA)	VERIFIED	5	Sept 2009	EPA
3163B	C-25 EAST SEGMENT		Dissolved Oxygen	VERIFIED	5	Sept 2009	EPA
3163B	C-25 EAST SEGMENT		Iron	VERIFIED	5	Sept 2009	DEP
3193A	ROOSEVELT BRIDGE		Bacteria (in Shellfish)	VERIFIED	5	Sept 2009	DEP
3194B	ST. LUCIE		Copper	VERIFIED	5	Sept 2009	DEP
5003A	SOUTH INDIAN RIVER		Bacteria (in Shellfish)	VERIFIED	5	Sept 2009	DEP
3208	MANATEE POCKET	Nutrients	Nutrients (CHLA)	VERIFIED	5	Sept 2011	DEP
3194A	TENMILE CREEK	Dissolved Oxygen	Dissolved Oxygen	VERIFIED	5	Sept 2011	DEP
3194A	TENMILE CREEK	BOD	BOD 5-Day	NO DATA	3C	Sept 2011	EPA
3194A	TENMILE CREEK	Coliforms	Fecal Coliform	INSUFFICIENT DATA	3C	Sept 2011	EPA
3210A	ST. LUCIE CANAL	Dissolved Oxygen	Dissolved Oxygen	VERIFIED	5	Sept 2011	DEP
3210A	ST. LUCIE CANAL	Nutrients	Nutrients (CHLA)	VERIFIED	5	Sept 2011	DEP
3210B	SOUTH FORK ST. LUCIE	Total Suspended Solids	Total Suspended Solids	NO DATA	3C	Sept 2011	EPA
3210B	SOUTH FORK ST. LUCIE	Coliforms	Total Coliform	INSUFFICIENT DATA	3C	Sept 2011	EPA
3210B	SOUTH FORK ST. LUCIE	Dissolved Oxygen	Dissolved Oxygen	VERIFIED	5	Sept 2011	DEP
3210B	SOUTH FORK ST. LUCIE	BOD	BOD 5-Day	INSUFFICIENT DATA	3C	Sept 2011	EPA
3194	NORTH ST.LUCIE	Mercury-Fish	Mercury-Fish	NO DATA	3C	Sept 2012	EPA
8998	FLORIDA ATLANTIC COAST		Mercury (in fish tissue)	VERIFIED	5	Sept 2012	DEP

Integrated Assessment Category Descriptions

* 1 - Attains all designated uses, 2 - Attains some designated uses, 3a - No data and information available to determine if any designated use is attained,
3b - Some data and information available but they are insufficient for determining if any designated use is attained, 3c - Meets planning list criteria and is potentially impaired for one or more designated uses,
4a - Impaired for one or more designated uses and the TMDL is complete, 4b - Impaired for one or more designated uses, but no TMDL is required because a proposed pollution control measure provides reasonable assurance that the water will attain standards in the future,
4c - Impaired for one or more designated uses but no TMDL will be developed because the impairment is not caused by a pollutant, 4b - Impaired for one or more designated uses, but no TMDL is required because a proposed pollution control measure provides reasonable assurance that the water will attain standards in the future,
5 - Water quality standards are not attained and a TMDL is required.

May 17, 2006, Florida Department of Environmental Protection

St. Lucie Basin Impaired Waterbodies and TMDL Development Dates.

81 Natural Communities are classified by the Florida Natural Areas Inventory (FNAI). A Natural Community (NC) is defined as a distinct and reoccurring assemblage of populations of plants, animals, fungi and microorganisms naturally associated with each other and their physical environment. The levels of this classification become increasingly more complex and finely subdivided. At all levels, however, there are overlaps between types because of overlapping species distributions and intergrading physical conditions.

At the broadest level, the Natural Communities are grouped into seven Natural Community Categories based on hydrology and vegetation. A second level of the hierarchy splits the Natural Community Categories into Natural Community Groups. The third level of the classification, Natural Community Types, is the level at which Natural Communities are named and described. Natural Communities are characterized and defined by a combination of physiognomy, vegetation structure and composition, topography, land form, substrate, soil moisture condition, climate, and fire. They are named for their most characteristic biological or physical feature.

3 Levels of Natural Communities

- CATEGORIES - based on hydrology and vegetation
- Groups - defined by landform, substrate, and vegitation
- Types - characterized and defined by a combination of physiognomy, vegetation structure and composition, topography, land form, substrate, soil moisture condition, climate, and fire

7 Natural Community Categories

1. ***Terrestrial Natural Communities*** - upland habitats dominated by plants which are not adapted to anaerobic soil conditions imposed by saturation or inundation for more than 10% of the growing season.
2. ***Palustrine Natural Communities*** - freshwater wetlands dominated by plants adapted to anaerobic substrate conditions imposed by substrate saturation or inundation during 10% or more of the growing season.
3. ***Lacustrine Natural Communities*** - nonflowing wetlands of natural depressions lacking persistent emergent vegetation except around the perimeter.
4. ***Riverine Natural Communities*** - natural, flowing waters from their source to the downstream limits of tidal influence, and bounded by channel banks.
5. ***Subterranean Natural Communities*** occur below ground surface.
6. ***Estuarine Natural Communities*** - subtidal, intertidal, and supratidal zones of coastal water bodies, usually partially enclosed by land but with a connection to the open sea, within which seawater is significantly diluted with freshwater inflow from the land.
7. ***Marine Natural Communities*** – occur in subtidal, intertidal, and supratidal zones of the sea, landward to the point at which seawater becomes significantly diluted with freshwater inflow from the land.

Descriptions of the Natural Community Types found in North Fork St. Lucie River Aquatic Preserve

Terrestrial

Xeric Hammock - characterized as either a scrubby, dense, low canopy forest with little understory other than palmetto, or a multi-storied forest of tall trees with an open or closed canopy.

Scrubby Flatwoods - characterized as an open canopy forest of widely scattered pine trees with a sparse shrubby understory and numerous areas of barren white sand.

Palustrine

Hydric Hammock - characterized as a well developed hardwood and cabbage palm forest with a variable understory often dominated by palms and ferns.

Floodplain Forest - occur on drier soils at slight elevations within floodplains, such as on levees, ridges and terraces, and are usually flooded for a portion of the growing season. Floodplain Forests are largely restricted to the alluvial rivers of the panhandle.

Floodplain Marsh - wetlands of herbaceous vegetation and low shrubs that occur in river floodplains, mainly in Central Florida and along the St. Johns, Kissimmee and Myakka rivers, on sandy alluvial soils with considerable peat accumulation.

Freshwater Tidal Swamp - occur on floodplains near the mouths of rivers just inland from mangroves or saltmarshes. They are swamp forests with well-developed trees inland and increasingly dwarfed trees towards the coast, often with an extensive mat of convoluted surface roots.

Slough - characterized as broad shallow channels, inundated with flowing water, except during extreme droughts, that are the deepest drainageways within Strand Swamps and Swale systems.

Depression Marsh - characterized as a shallow, usually rounded depression in sand substrate with herbaceous vegetation often in concentric bands. Depression Marshes are similar in vegetation and physical features to, but are generally smaller than, Basin Marshes.

Marine and Estuarine

Mineral Based

Unconsolidated Substrate - characterized as expansive, relatively open areas of subtidal, intertidal, and supratidal zones which lack dense populations of sessile plant and animal species. Unconsolidated Substrates are unsolidified material and include coralgal, marl, mud, mud/sand, sand or shell. This community may support a large population of infaunal organisms as well as a variety of transient planktonic and pelagic organisms

Faunal Based

Mollusk Reef - characterized as expansive concentrations of sessile mollusks occurring in intertidal and subtidal zones to a depth of 40 feet. In Florida, the most developed Mollusk Reefs are generally restricted to estuarine areas and are dominated by the American oyster.

Floral Based

Seagrass Bed - characterized as expansive stands of vascular plants. This community occurs in subtidal (rarely intertidal) zones, in clear, coastal waters where wave energy is moderate. Seagrasses are not true grasses.

Tidal Swamp - characterized as dense, low forests occurring along relatively flat, intertidal and supratidal shorelines of low wave energy along southern Florida.

Florida Natural Areas Inventory, Natural Communities Rankings

Below are the relative ranks of the NCs. FNAI uses several criteria to determine the relative rarity and threat to each community type; these are translated or summarized into a global and a state rank, the G and S ranks, respectively. Most G ranks for NCs are temporary pending comparison and coordination with other states using this methodology to classify and rank vegetation types. (Contact Florida Natural Areas Inventory for most recent natural community ranks.) A few NCs and several Plant Communities occur only or mostly in Florida and can be considered endemic to Florida. (See J.W. Muller et al. 1989. “Summary Report on the Vascular Plants, Animals and Plant Communities Endemic to Florida”. Florida Game and Fresh Water Fish Commission, Nongame Wildlife Program, Technical Report No. 7.) The only opportunity for protection of these communities is in Florida and they should be given special consideration in Florida’s protection efforts

Terrestrial	Paulstrine	Marine & Estuarine
Xeric Uplands	**Wet Flatlands**	**Mineral Based**
G3 S3 Xeric Hammock	**G4 S4** Hydric Hammock	G5 S5 Unconsolidated Substrate
Mesic Flatlands	**Floodplain Wetlands**	**Faunal Based**
G3 S3 Scrubby Flatwoods	**G4 S3** Floodplain Forest	G3 S3 Mollusk Reef
	G3 S2 Floodplain Marsh	**Floral Based**
	G3 S3 Freshwater Tidal Swamp	G2 S2 Seagrass Bed
	G3 S3 Slough	G3 S3 Tidal Swamp
	Basin Wetlands	
	G4 S4 Depression Marsh*	

Definition of Global (G) element ranks:

G1 - Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very little remaining area, e.g., <2,000 acres) or because of some factor(s) making it especially vulnerable to extinction;

G2 - Imperiled globally because of rarity (6-20 occurrences or very little remaining area, e.g., <10,000 acres) or because of some factor(s) making it very vulnerable to extinction throughout its range;

G3 - Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range or because of other factors making it vulnerable to extinction throughout its range, 21 to 100 occurrences;

G4 - Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery;

G5 - Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery;

G? - uncertain Global rank.

Definition of State (S) element ranks:

S1 - Critically imperiled in state because of extreme rarity (5 or fewer occurrences or very little remaining area) or because of some factor(s) making it especially vulnerable to extinction;

S2 - Imperiled in state because of rarity (6-20 occurrences or little remaining area) or because of some factor(s) making it very vulnerable to extinction throughout it range;

S3 - Rare or uncommon in state (on the order of 21 to 100 occurrences);

S4 - Apparently secure in state, although it may be rare in some parts of its state range;

S5 - Demonstrably secure in state and essentially ineradicable under present conditions;

S? - uncertain State rank.

Appendix C

Public Involvement

C.1 / Advisory Committee

The following Appendixes contain information about who serves on the North Fork St. Lucie River Aquatic Preserve Advisory Committee, when meetings were held, copies of the public advertisements for those meetings, and summary of each meeting (as required by Ch. 259.032(10), F.S.).

C.1.1 / List of members and their affiliations

Name	Affiliation	County
Greg Kaufmann	DEP Savannas State Park	St. Lucie
Jeff Beal	Florida Fish and Wildlife Conservation Commission	St. Lucie
Doug Coward	St. Lucie County Board of County Commissioners	St. Lucie
Michelle Berger	Port St. Lucie City Council	St. Lucie
Patrick Gostel	South Florida Water Management District	St. Lucie
Boyd Gunsalus	South Florida Water Management District	St. Lucie
Walter England	City of Port St. Lucie	St. Lucie
Anne Birch	The Nature Conservancy	St. Lucie
Gordon Evans	Riparian Land Owner	St. Lucie
Dana Wade	River Lilly Cruises	St. Lucie
Sandy Bogan	Oxbow Eco-Center	St. Lucie
Amy Mott	St. Lucie County Environmental Regulations	St. Lucie
Doug Smith	Martin County Board of County Commissioners	Martin
Bobbie Deemer	Local Resident	Martin

C.1.2 / Florida Administrative Weekly (F.A.W.) Postings

Meeting: ***Wednesday, June 27, 2007***

Florida Administrative Weekly, Volume 33, Number 22, June 1, 2007
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 2551

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date and Time: Wednesday, June 27, 2007, 7:00 p.m.

Place: St. Lucie County Oxbow Eco-Center, 5400 N. E. St. James Dr., Port St. Lucie, FL 34983

General Subject Matter to be Discussed: The purpose is for members of the Advisory Committee to discuss the revision of the North Fork St. Lucie River Aquatic Preserve Management Plan.

A copy of the agenda may be obtained by contacting Aquatic Preserve Manager, Laura Herren at (772)429-2995.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Aquatic Preserve Manager, Laura Herren at (772)429-2995. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

Meeting: ***Wednesday, August 15, 2007***

Florida Administrative Weekly, Volume 33, Number 29, July 20, 2007
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 3245

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date and Time: Wednesday, August 15, 2007, 10:00 a.m.

Place: St. Lucie County Oxbow Eco-Center, 5400 N. E. St. James Dr., Port St. Lucie, FL 34983

General Subject Matter to be Discussed: The purpose is for members of the Advisory Committee to discuss the revision of the North Fork, St. Lucie Aquatic Preserve Management Plan.

A copy of the agenda may be obtained by contacting Aquatic Preserve Manager, Laura Herren at (772)429-7995.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Aquatic Preserve Manager, Laura Herren at (772)429-7995. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

Meeting: ***Thursday, November 15, 2007***

Florida Administrative Weekly Volume 33, Number 42, October 19, 2007
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 4938

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date and Time: Thursday, November 15, 2007, 6:00 p.m.

Place: St. Lucie County Oxbow Eco-Center, 5400 N. E. St. James Dr., Port St. Lucie, FL 34983

General Subject Matter to be Discussed: The purpose is for members of the Advisory Committee to discuss the revision of the North Fork St. Lucie River Aquatic Preserve Management Plan.

A copy of the agenda may be obtained by contacting Aquatic Preserve Manager, Laura Herren at 772)429-2995.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Aquatic Preserve Manager, Laura Herren at (772)429-2995. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

C.1.3 / Meeting Summaries

Wednesday, June 27, 2007, 7:00 P.M. (St. Lucie County Oxbow Eco-Center)

Attendance

Name	Affiliation
Beal, Jeff	Florida Fish and Wildlife Conservation Commission
Berger, Michelle	City of Port St. Lucie
Birch, Anne	The Nature Conservancy
Bogan, Sandra	St. Lucie County Oxbow Eco-Center
Combs, Chris	DEP / CAMA
Cotton, Kim	Port St. Lucie Hometown News
Coward, Doug	St. Lucie County Board of County Commissioners
Coward, Walter	Citizen
England, Walter	City of Port St. Lucie
Evans, David G.	Citizen
Ferry, Steve	Airbourne MTB
Fisher, T.	Citizen
Fousek, Steve	St. Lucie County
Gostel, Pat	South Florida Water Management District
Gunsalus, Boyd	South Florida Water Management District
Haunert, Dan	South Florida Water Management District
Kaplan, David	Citizen
Kaufmann, Greg	DEP / Savannas Preserve State Park
Koroly, Karen	Citizen
Locke, Vera	Marine Industries Association
Mott, Amy	St. Lucie County Environmental Resources Department
Opland, Bruce	Citizen
Paris, Joan	Citizen
Patterson, Mike	Citizen
Perry, Mark	Florida Oceanographic Society
Povinelli, Andrea	The Nature Conservancy
Shea, Eric	DEP - Southeast District
Stinnette, Kevin	Indian River Keeper
Wade, Dana	River Lilly Eco-Cruise River Tours
Wade, Deanna	River Lilly Eco-Cruise River Tours
Ward, Gerald M	Marine Industries Association
Wetherell, Cathy	City of Port St. Lucie
Wyskowski, Alan	Citizen
Zano, Frank	Citizen

Meeting Summary

The meeting started with brief introductions. The North Fork St. Lucie River Aquatic Preserve manager, Laura Herren, gave a presentation about the current state of the Aquatic Preserve. Karen Bareford provided summary of the Management Plan review process and went over key dates with the Committee. Finally, the meeting was turned over to the Advisory Committee to provide input about what they thought the issues and concerns facing the North Fork are. A summary of the Advisory Committee members comments are below.

Advisory Committee Comments

Doug Coward (St. Lucie County BOCC)

- Invite elected official from Martin County to Advisory Committee
- Active environmental restoration - local and state funding
- Environmental education and community involvement - understanding leads to ownership
- Public access - work in concert with Port St. Lucie and St. Lucie County trail system
- Land acquisition
- Mitigation within Aquatic Preserve rather than outside affected area
- Prohibit South Florida sludge disposal in St. Lucie County
- 3-tier approach to issues and document structure:
    1. what affects the Aquatic Preserve but is outside the watershed - can make recommendations,
    2. what affects to Aquatic Preserve and is within the watershed, and
    3. what affects the Aquatic Preserve and is within the Aquatic Preserve boundary
- Water quality - public health
- Support CERP
- Specific action plan for issues
- Draft Management Plan framework requested

Dana Wade (River Lilly River Cruise)

- Erosion
- Runoff
- Exotic species
- Enforcement
- Who to report problems to
- Update speed limits - north of Prima Vista Boulevard should be no wake zone because of public safety and erosion due to boat wakes

Greg Kaufmann (Savannas State Park)

- Encroachment on and protection of the wetlands and uplands surrounding the submerged lands
- Exotic species
- Land use changes and proposed infrastructure changes
- Land acquisition
- Law enforcement - vegetation cutting, vessels, urban encroachment - need to be more proactive
- Permitting - development setbacks, current construction, floodplain changes
- Make recommendations for Aquatic Preserve Rule and local codes so laws are enforceable

Jeff Beal (Florida Fish and Wildlife Conservation Commission)

- 1984 Management Plan describes the state of the North Fork rather than goals and objectives
- Water quality
- Floodplain constrained and modified
- Encroachment of development
- Public health and safety - *E. coli*, boating safety, pathogens, and pollutants
- CERP efforts - Aquatic Preserve staff need to continue to be involved
- North Fork is the least understood of all the tributaries in the IRL
- Exotic aquatic species
- Leave C-44 in watershed - volume and quality of water affects Aquatic Preserve
- Define Management Plan audience - Aquatic Preserve staff, partners, and public

Anne Birch (The Nature Conservancy)

- Resource-based management plan with public use that would not compromise the resources
- Include global warming and outside issues that affect Aquatic Preserve but that Aquatic Preserve staff can not change
- Proposed Advisory Committee meeting after public meeting - Wednesday August 15 at 10am at Oxbow
- Management Plan boilerplate requested

Michelle Berger (Port St. Lucie City Council)

- Sunshine Law - how to talk to back-up member of Advisory Committee
- Port St. Lucie planning restoration and dredging of runoff areas - expand to entire Aquatic Preserve
- Collaborate with counties and other organizations about river issues
- Runoff into the river from C-44, C-24, Lake Okeechobee - *E. coli*, cattle antibiotics, agriculture
- Include Harbor Branch in Advisory Committee - *E. coli* and dolphin work
- Alternate Advisory Committee meeting times between AM and PM

Boyd Gunsalus (South Florida Water Management District)

- Bigger picture - 10 Mile Creek Reservoir, C-23 Reservoir, C-24 Reservoir, TMDL, CERP Science plan for North Fork
- Include C-23, C-24, Bessey Creek Basins
- C-25 Basin not in Aquatic Preserve watershed - empties into IRL
- 5 Mile Creek has its own watershed
- Management Plan framework requested

Dan Haunert (South Florida Water Management District)

- Define the geographic scope of Management Plan
- What areas can you actually manage - Lake Okeechobee discharges out of purview, take on too • • much if include Aquatic Preserve watershed
- Management Plan strawman requested

Pat Gostel [sitting in for Yongshan Wan] (South Florida Water Management District)

- Identify funding sources for projects to address issues

Amy Mott (St. Lucie County Environmental Resources Department)

- Education programs - target North Fork homeowner issues - they become stewards
  1. Limit the fertilizer, pesticide, and herbicide
  2. Capture rainwater to decrease stormwater runoff
  3. Alternatives to seawalls
  4. Plant natives rather than exotics and xeriscape
- Code consistency within cross-jurisdictional boundaries - Port St. Lucie, Ft. Pierce, and St. Lucie County
- Increased development pressure
- Bank erosion
- Septic tanks - MSTU's community tax increase for city sewer and water
- Support CERP
- Process to extend Aquatic Preserve boundary north of Midway Road
- Can improve county codes and compliance in concert with Aquatic Preserve Management Plan
- Speed zone changes - make recommendations to other agencies
- Support other agency's tasks in existing water quality improvements
- Support legislation to increase funding
- Land acquisition

Gordon Evans (Riparian home owner)

- Set boat speed limit on North Fork like ICW - speed applicable to middle third of river, but east and west of channel is no wake zone
- Existing boundary of Aquatic Preserve was political decision - proposed boundary included 10 Mile Creek up to turnpike; St. Lucie County had a proposed drainage project north of Midway Rd.; six months later tax for drainage project voted down and project never occurred and boundary remained at Midway Road.

Public Comments

Kevin Stinnette

- Timed public comment period before Advisory Committee meeting
- Alternate Advisory Committee meeting dates; 3rd Wed. each month is Conservation Alliance of St. Lucie County meeting
- Water quality testing broadened and done more frequently
- Chris Wilson of IFAS North Fork water quality study - aldecarb, ethion
- North Fork is Class III, so maintain it for swimming
- Storm water discharges - Lake Okeechobee, Port St. Lucie
- Control structures for the C-23, C-24, and the North Fork need improvements - discharging from the top not the bottom
- Support the Rivers Coalition
- Global warming

Dave Kaplan

- Water quality monitoring
- C-24 human waste
- Open trench watering for groves
- Nutrient loads - test for visibility, NTUs, *E. coli*
- Education - cut grass shouldn't be blown into storm drains
- Local water quality monitoring with Secchi disk
- Combine water testing between agencies
- Solo-Gabriele of U. Miami North Fork water quality study
- Involve IRCC CSI lab in tracking source of water pollutants

Mark Perry

- Pull together TMDL, CERP, other science since 1984 Management Plan
- Haunert study - pesticides and copper in sediment
- Graves 1994 study - ethion and other chemicals in C-23 and C-24
- Take on outside influences and impacts that affect the Aquatic Preserve
- Develop strategies with specific actions, who is responsible to implement, and follow through

Bruce Opland

- Guidelines on cleaning solvents for docks and boats
- Emphasis on public use of the waterway - use leads to care for and support of waterway

Gerald Ward

- How is the meeting being recorded and reported - provide a copy (119)
- Public access to public waters - fishing, boating, swimming
- Resolve conflict between the 1984 Aquatic Preserve Management Plan Trustee description as wilderness preserve versus statutory description (258.38)
- Split the Aquatic Preserve in two zones - north of C-28A and south
- 1954 Authorization of C-23A
- Resource inventory and reference list from 1984 Aquatic Preserve Management Plan - provide a copy (18-20.013)
- Schedule rejected (120)
- Adopted 1984 Management Plan into rule (18-20.004-7)
- Stakeholder is a bad term
- Management Plan is a direction to staff rather than feel-good document
- Advisory Committee is biased towards government representatives - need more public involved in developing Management Plan
- Limit boundary

Steve Fousek

- Lower speed limits on the North Fork
- Coordinate with St. Lucie County on 25 public access sites along North Fork and 10 Mile Creek
- Coordinate with North St. Lucie River Water Control District

Written Public Comments

David Kaplan | david.kaplan@gbfinc.net

Thank you for leading such a great cause. I hope you have many successes. Finding achievable goals will be a daunting. The sewage being dump on open ground sites next to the C-24 canal is something you can only believe when you smell it and see it.

I would like to submit this article I wrote, and read some from at the Oxbow meeting, for our home owners association's earth day newsletter, as my public comment. Our home is on the River as well as many of the members in our association. The River Park Marina was our community park and pool site when General Development built our neighborhood.

It was nice to see Jamie working with you. She dove with the dive team I help found in Broward County while in graduate school at NOVA. She has shown dedicated desire to help our environment for many years now, Thank you again!

Don't Swim or Drink the Water in River Park?

June 28, 2007

Data provided by University of Miami Dr. Solo-Gabriele during Surfriders' monthly meeting March 10th 2007, (www.surfrider.org), raises great concern. Guest speaker Dr. Solo-Gabriele led a 2005 -2007 study of the IRL after high bacteria counts closed Martin County beaches. One of her eight sample points is Prima Vista bridge at the River Park Marina. Prima Vista and White City have been in the top two worst samples for every time river water was tested. All samples are directly affected by rain. The only times samples are found over the considered safe minimum daily counts, are after rain events. Rain moves enough water through our storm drain pipes that it flushes surface water and purges drain fields and septic tanks putting higher than considered safe limits for bacteria into the river.

The other sad reality discussed is that NO ONE knows what to sample for or what to do when limits are exceeded. This is by far the most in-depth sampling I've ever seen. Dr. Solo-Gabriele admits it is only for a select few indicators that they test for. At each of her samples sites they have three different sample methods. Two use filters that require many gallons of water to be passed through filters that are electrically charged so that they attract their targeted prey. Thanks to Senator Ken Pruitt for getting the money again this year for another study. Twenty four samples cost $100,000.00 to process. The only certified lab for this data is in Tampa and Harbor Branch runs the other tests. The actual poisonous virus requires another set of tests to determine what strain it is. An additional down side to this very well thought out laborious testing, is what do you do when it doesn't rain? High readings happen after rain events, but this has been an unusually dry period. Two years ago they had to pick the dates when samples would be collected. So it looks like this year's results will show all sites within the safe allowable limits.

February 28th Scripps reported that Ocean Research & Conservation Association is testing a new water sampling device in the IRL. It will collect six different bits of information and send it via wireless to be reported on a web site. The information will be color coded as to the quality of water in the lagoon. You will be able to check out the quality of water behind your house. Go to www.oceanrecon.org for more info. Bacteria are NOT one of the indicators that they will be sampling for.

February issue of Sea Technology editorial by University of Connecticut Peter J. Austerr states, "What do we measure, where do we measure it, at what point do we act and what do we do to reverse the trend in any particular metric?" See more at www.sea-technology.com .

February 24, 2007 Sun Sentinel reporter Andy Reid wrote, "Testing soon may tell Everglade's clean-up status." He quotes U.S. Sugar spokeswoman Judy Sanchez as saying, "Pointing fingers and setting deadlines does not clean one drop of water." Years of wrangling led to a Dec. 31, 2006 deadline to clean up phosphors. Billions of dollars have been spent and now the deadline has come and gone and the results are not in. That's for only one chemical compound. Our river has many influential compounds affecting it.

When water is found unsafe Martin County Health officials will post signs on the beaches, DO NOT SWIM. In Saint Lucie County they post signs Beware of the Alligators. IS THE WATER SAFE? It depends to who you talk to and the weather. I would not encourage you to swim or eat fish from our river. From all I've read and seen no one knows just what is in our water and where it is coming from. All these articles and meetings leave me feeling that we are no better off than we were years ago. No one knows what to look for or what to do about it. The DEP and EPA both use different indicators. Some organizations look at the beaches for indicators and others look in the lagoon. No one is coordinating all the different groups. The latest is testing for DNA to prove that the bacteria indicators are from humans or animals. $$$$ expensive to say the least. In these times of tight budgets we must take the next step. Testing and labs cost a lot of money.

This month Scripps reported that the Water Resources Development Act passed House Committee and the Governor will sign the bill soon. The legislation would authorize $1.37 billion to restore habitat in the IRL by removing 7.7 million cubic yards of muck. Congress has not passed the act since 2000. To do nothing will mean the certain death of the River. Call your representatives today!

I would also ask for your support for the IRCC Crime lab that will have the ability to test for DNA. What a great opportunity for our local students to be trained in the CSI profession. I would hope that they would be allowed to run DNA tests on the bacteria found in the water. Torrey Pines will have the type of labs we need but are not working on our water problem. This is the level and quality of testing required if we are going to find the answers to our water problems.

Pumping water from the river for our yard, this year for the first time, all the leaves on our grapefruit tree fell off after being hit by canal water from our sprinkler. Why is this year different from any other? I don't know and it looks like no one else knows either. For copies of these articles and others e-mail me at david.kaplan@gbfinc.net or call 879 - 6237.

April 22 from 1PM till 3PM River Park Homeowners Ass. will hold a rally barbeque at River Park Marina/boat ramp and I encourage you to come out and support River Parks effort to make our community a better place to live. Be safe and be part of the solution and not the problem, support RPHOA.

David Kaplan Treasurer/Director River Park Homeowners Assoc., Unit-4B,
Director South Florida Reef Research Team, Inc. (954) 275-5638
DON'T DRINK OR SWIM IN THE WATER IN THE NORTH FORK OF THE SAINT LUCIE RIVER!

Vera Locke, Executive Director
Marine Industries Association of the Treasure Coast
mia_tc@bellsouth.net
P.O. Box 1639
Stuart, FL 34995
(772) 693-7599

There should be representation form Martin County on your committee. The North Fork does flow into Martin County. Gary Roderick? Paul Miller? Mark Perry of Florida Oceanographic Society? Kevin Henderson of St. Lucie River Initiative? *Also, Martin County Commissioners Doug Smith & Michael D. Ferlizzi – Parts of their districts are on the North Fork.

Anonymous
Boating speed limit should be reduced from marker 33 north. Water skiing takes place during the early evening in this narrow channel.

Bruce Opland, 871-1220
Include Elcam Waterway in access venues defined in plan.
Provide guidelines on cleaning solvents recommended for docks and boats along the waterway.

Kevin Stinnette, Indian River Keeper, 631-5827, keeper@indianriverkeeper.org
The public needs assurance that the water is swimmable. IFAS testing has indicated very high levels of gldicarb, ethion and other agricultural chemicals. Their must be a monitoring program for organic compounds and water quality.
The Savannas Reserve State Park must not be diminished or damaged by a bridge.
Pubic information should document impacts and consequences. ie. Turbidity impact from discharges should be know.

Mark Perry, Florida Oceanographic Society
6/27/07
Issues – Water Quality – Aquatic Habitat, (Watershed Habitat)
TSS- Climate Change
Tiered Approach (Doug Coward
Need "Actions" for Plan

Mary Murphy, DEP - Port St. Lucie
Conversation held with Dan Haunert (South Florida Water Management District)
A large reason no oysters in upper North Fork, believed to have historically been there, due to sediment build up and muck bottom. Restoration of substrate for oyster and grass growth will most likely have to address demucking. Not only would it improve suitable substrate, but reduce nutrient load and improve clarity. This would probably be a strategy to achieve a large goal.

Wednesday, August 15, 2007, 10:00 A.M. (St. Lucie County Oxbow Eco-Center)

Attendance

Name	Affiliation
Beal, Jeff	Florida Fish and Wildlife Commission
Berger, Michelle	City of Port St. Lucie
Bogan, Sandra	St. Lucie County Oxbow Eco-Center
Coward, Doug	St. Lucie County Board of Commissions
Evans, Gordon	Riparian Homeowner
Evans, Nancy	Citizen
Gostel, Pat	South Florida Water Management District
Kaufmann, Greg	Florida Department of Environmental Protection Savannas Preserve State Park
Mott, Amy	St. Lucie County Environmental Resources Department
Nadeau, Larry	City of Port St. Lucie
Povinelli, Andrea (sitting in for Anne Birch)	The Nature Conservancy
Ward, Gerald	Marine Industries Association

The meeting started with brief introductions and an update of the Advisory Committee members and the Public scoping Meeting by the North Fork St. Lucie River Aquatic Preserve manager, Laura Herren. The Advisory Committee met to discuss Issues/Goals/Objectives/Strategies that incorporated concerns and suggestions by both the Advisory Committee at the June 27, 2007 Briefing Meeting and the general public from the July 18, 2007 Public Scoping Meeting. A summary of the Advisory Committee members comments regarding Issues/Goals/Objectives/Strategies for the management plan follow.

Advisory Committee Comments

- Provide a clearing house of information on water quality studies occurring in and around the North Fork
- As best as possible, assist with the synthesis of water quality data that has been, and is, collected. [city is working on the development of pdf files of data]
- Pull in post doc for verification of data synthesis [SFWMD is working on an assessment of the St. Lucie watershed data] possibly utilize a university based involvement
- Comment on IRL CCMP Update
- Comment on the St. Lucie River Watershed Protection Plan
- Potential $ from North Everglades Restoration Planning
- Fecal Coliform taskforce data synthesis effort funded by DEP? (check with Jennifer Gihring in Tally)
- Hold an annual "status of the AP" symposium
- Incorporate commenting on any other plans that may arise over time
- For shoreline stabilization need to add submergent and emergent vegetation.
- Seek restoration funds (and others: e.g. St. Lucie River Watershed Protection Plan)
- Attempt planting of vegetation (submergent & emergent) within the Preserve (wait until WQ improves)
- Map submergent & emergent habitats within the Preserve
- Study to find out what is actually causing the erosion to the shorelines
- Obtain and maintain GIS maps of the current stormwater drainage systems that include all outfalls to the Preserve. [Michelle Berger can provide] Remember that not everything that is out there is mapped somewhere.
- Possible partner with IFAS to improve the aesthetics of neighborhoods
- Work with IFAS, local governments, utilities, (etc.) to educate the public about options for retention, etc. (possible retreat for education, working group, documentary type television coverage, etc.)
- Work with local governments on to standardize ordnances
- Figure out how to identify land for acquisition and then prioritize for buffer and retention
- Utility companies may have info on septic locations and conditions
- Need action item(s) to address gained knowledge from above strategies (may be proposals for ERPA, WMD public interest project ideas)
- We may need to develop materials that are North Fork specific (but not re-create the wheel)
- Possibly work with local landscaping companies to certify them in 'river friendly' best mgmt practices (provide signage to the companies & their customers as 'green') the certification process exists, find out who does it & what it takes
- The only way to get to the public is via TV or school programs
- Possibly 'certify' homeowners associations in 'green practices' (County has an association of homeowner associations that meets every month – they have a database/mailing list)
- Potential strategy/goal for "muck" removal
- Brazilian Pepper as a water quality issue
- In management plan, incorporate specific targets
- The amount and current status – develop condition indices of the different Aquatic habitat within the North Fork St Lucie River
- Establish a baseline) [Woodward Clide, 1999] for aquatic habitat
- Measure change over time (after baseline is established) need to identify a consistent timing of this
- Importance of need to protect and restore habitats needs to be prominent
- Tie this into a reason to monitor.
- Provide information regarding the actual resources, and their importance, in the preserve to regulatory staff)
- Ties into habitat mapping, est. of diversity range, importance of specific habitats for settlement & aggregation [note: can be extremely sensitive to salinity changes] areas, historic breeding grounds "hot spots")
- Develop habitat maps for commercially and recreationally important species (e.g. snooks, edible shrimp, blue crabs, tarpon, redfish)
- May also include St. Lucie County & Water Mgmt Districts in quarterly resource updates
- Need to specify exactly what will be monitored (can not do it all so pick your targets well – may want to get with Grant Gillmore & Dan Haunert
- Potentially use citizen groups to monitor where appropriate (can partner with Oxbow Center, County & Harbor Branch)
- If possible maintain an exotic species database.
- Focus primarily on aquatic species for the brochure and possibly place in kiosks
- Needed Goal: Improve condition of exotic species (e.g. Assist other agencies, esp. FWC, in identifying and implement eradication strategies for existing and new exotic, or invasive exotic, species)
- Possibly add "and entering", the amount of debris in the preserve
- Michelle Berger will assist with coordination of discussing debris in aquatic environments
- Remove submerged debris (crab traps, etc.).
- Identify the location of submerged debris
- Evaluation of Strategy(ies)
- Identify sources of debris
- Seek opportunities for the installation of bottle return (funds) [Michelle Berger will assist with coordination]
- Enforcement of manatee protection plans

- For the Bird rookeries possibly use the sheriff's office volunteer program or retired people working on the water & the Coast Guard Auxiliary
- Include Five Mile Creek up to the Miller Property (northern limits of the Buffer Preserve) in the possibility of the preserve expansion
- Need more information on what "Blueways" are and what the designation means

Public Comments

Gerald Ward

- Recognize that Martin County and the recreational boating community is not represented.
- Environmental Quality - obtain data from higher level government officials for the Aquatic Preserves.
- Funding potentials need to be incorporated in the Manage Plan as provided by the legislators
- Water quality related health issues
- Did not address the boundaries and differentiation of the preserve north and south
- Find a reference list of what has been done

Written Public Comments

Larry Nadeau

- Provide a $ incentive to septic locations that have a municipal sewer line and that have been granted and exemption to connecting until septic failure, to encourage an early connection
- For debris: Recommend a stronger recycling program, State mandates thresholds Bottle law – redeem/recycling and etc., Stronger litter laws
- Link and or reference the relationships between goals, objectives, and or strategies
- Develop a management plan for both environmental and stormwater benefits through maintenance
- Fund at 75-25 plan developments
- Recommend guards on propellers (boat)

Christy J. Church

- I am deeply concerned with regard to water quality and human health. We need improved water quality testing and monitoring
- Port St. Lucie drainage canals and discharges from the C-23 and C-24 canals should be addressed
- Excessive fresh water filled with pollutants are having a SEVERE detrimental effect on the North Fork Aquatic Preserve
- Limit herbicide use in canals
- Protection of wetland areas
- Removal of exotic vegetation and species. (note: Nile monitor lizard already identified in C-24 Canal)
- Update speed limits due to public safety and erosion
- Increased Law Enforcement
- Support CERP
- Land Acquisition
- Environmental Education
- Clean Water Act 1972

Thursday, November 15, 2007, 6:00 P.M. (St. Lucie County Oxbow Eco-Center)

Attendance

Name	Affiliation	AC Member
Beal, Jeff	Florida Fish and Wildlife Conservation Commission	Yes
Evans, David G.	Citizen	Yes
Gunsalus, Boyd	South Florida Water Management District	Yes
Coward, Doug	St. Lucie County Board of County Commissioners	Yes
Birch, Anne	The Nature Conservancy	Yes
Kaufmann, Greg	DEP / State Parks	Yes
Deemer, Bobbie	Citizen	Yes
Bogan, Sandra	SLC Oxbow / Environmental Resources Department	Yes
England, Walter	City of Port St. Lucie	Yes
Gostel, Pat	South Florida Water Management District	Yes
Wade, Dana	Citizen	Yes
Ward, Gerald	Marine Industries Association Technical Committee	No
Evans, Nancy	Citizen	No
Kaplan, David	River Park Homeowners Association	No
Coward, Walt	Citizen	No

The meeting started with brief introductions. A PowerPoint presentation outlining the management plan timeline and the incorporation of major revisions after the draft was distributed to the Advisory Committee was delivered by the North Fork St. Lucie River Aquatic Preserve manager, Laura Herren. The Advisory Committee met to discuss the first draft of the North Fork St. Lucie River Aquatic Preserve management plan. A summary of the Advisory Committee members comments regarding the management plan and management plan process follow.

Advisory Committee Comments

Comment	*Source*	*Location*
Population of PSL – 112 sq mi; Maps- some of straight sections of river blasted by navy seals- Dept. of war records 1920s – file can be obtained from Walter.	W. England	Page 10
How was property acquired from PSL – 1995 sold to DNR over 1000 acres along water $1.5 mil, uplands and wetlands – file can be obtained from Walter	W. England	Page 12
Veteran's Memorial Parkway – Veteran's Memorial Park – old railroad trestle still on island as you cross river – harvested lumber west of river – PSL Blvd/ Cane Slough Rd.	W. England	
Veteran's Memorial Parkway – Veteran's Memorial Park – on boardwalk used to be able to see pilings	G. Evans	
Restoration Map – PSL owns property for Site 5 – Greg will look into whether or not it is State Park property.	W. England	Page 66
Information undocumented – personal communication – need format.	W. England	
Name, Title, document the rest in the literature cited.	B. Gunsalus	
Coordination of all projects going on in the river very important.	B. Deemer	Page 63 Research, 2nd Paragraph
Reporting suspicious activities – one goal should be to have an orderly way to bring things to the attention of the proper authorities so that it can be taken care of quickly (esp. for homeowners).	B. Deemer	
Homeowners guide could have a list of numbers for different issues.	M. Shirley	
Map of additional oxbow reconnections; at Site 5 recently and saw good things and wildlife that haven't been seen recently or in other areas of the river.	D. Wade	
Education materials can be non-consumptive (i.e., website, gov't access TV, webcasts, recycled paper for brochures); higher education (i.e., FAU); industry education (i.e., commercial, landscapers).	S. Bogan	Objective 3
TMC archeological society – artifacts – source SFWMD, DHR, Sandy has copy, NewSouth contractor for SFWMD.	S. Bogan	History
Archeological – Spruce Bluff – goals objectives, etc. about preserving these resources (SLC ESL, Savannas-NF).	D. Coward	
Interest in promoting higher education for natural resources (UF, FAU, HBOI) – encourage university system in this area with programs for envt'l engineering, fisheries, etc.	D. Coward	
Local residents to have ownership – CSO.	D. Coward	Page 45
Community ownership – goal or objective is to resurrect CSO and other strategies under this goal – on page 84 objective 1	D. Coward	Page 95
Mitigation – Platt's Creek Mitigation Bank will require $5 mil, probably won't come to fruition; concern about mitigation in region as opposed to within or adjacent to preserve (i.e., reconnect oxbows and other AP restoration needs) – for small projects, have permitting agencies pool $ until a large project can be done	D. Coward	Page 70, middle paragraph
Strategy to coordinate with permitters for above recommendation	A. Birch	Natural Resource Management Goal 2
Tabulate mitigation value of restoration projects	D. Coward	

Comment	*Source*	*Location*
Restoration efforts – N. Everglades $ - goal/objective to use these funds to restore AP and watershed; different from CERP because not so much engineering; strategy for state legislature	D. Coward	
Natural Communities Map – acreages includes private and public lands – recommend to remove acreage and just describe habitats because some of it may be developed, and acreage is larger than that of conservation lands around the river	G. Kaufmann	
"working with" or "identifying" language not specific enough – state top priority of restoration projects	G. Kaufmann	
Strategy - Floodplain team as vehicle for restoration priorities	J. Beal & M. Shirley	
Chapter 5 lays out what we'll do, but prioritize is important and not in chapter 5 (i.e., top 5 oxbows to do in next 5 years); Timeframe doesn't pop out – public will want to see timeframe and priorities; State that we have an annual workplan and that it will be how these projects get done; The clearer it is stated, the more support we can get from the public	P. Gostel	
Implementation schedule column in MP will help with priorities; annual workplan will come from this MP	M. Shirley	
Implementation date can be different from priority (due to date, funding availability)	B. Gunsalus	
TNC feels prioritization needs to spelled out – tools exist to do that – partners need to know CAMA's priorities	A. Birch	
Develop report cards for how we're doing based on the plan	P. Gostel	
Talk to Scott Taylor about Rivulus capture #1	J. Beal	Page 37
Add grass carp to exotic species – recent electroshock efforts – don't know if there is a breeding population	J. Beal	Page 41
Grass carp being added to pond by PSL for aquatic vegetation management – send concerns to W. England	G. Kaufmann	
Seagrass monitoring – change title to and include submerged and emergent	J. Beal	Page 61
Other monitoring with hydro rest – turbidity and DO	J. Beal	Page 65
Platt's Creek Mitigation Bank – next few weekd will have more info for public access, restoration, envt'l education	J. Beal	
Number of letter strategies within chapter 5	J. Beal	
Species list documentation (reference) important	J. Beal	
Include CERP performance measures (salinity), additional proposed conveyance; human health and water quality, work with partners to alert people; strategies need to be measurable; priorities necessary, but perhaps not top 5 oxbow reconnects – not ready for that yet	J. Beal	
Exec sum needs to match document – expand to 4-5 pages with priorities at end; Potentially 2 reports – AP Mgmt Plan; background and history a support doc; Oxbow recon – WQ and fisheries habitat; Several pages can be put into map or other graphic – can work with SFWMD on these; Edit Redundancy; Ed and outreach – practical to bring awareness to residents; ag industry steps up more then urban; Work with universities to help urban; Science plan – w quantity each canals; Ground-truth for accurate habitat maps; TMC problem verbiage – built before Hurricane Katrina – new design criteria; Needs to be easily read and shorter	B. Gunsalus	
WQ&Q – need to address quantity in goals and strategies; Additional goal in WQ&Q – to protect lands as buffer (right now it's a strategy); Goal 1 – other strategies (W Quantity, CERP projects that improve WQ&Q); G1, I1, Obj 2 – education - printed piece not always successful – speak with group to see what their needs are and how best to present info to group; Pathogens and parasites (look into & partner with NEP biotoxin program); Define conversion of high-priority areas to sewer; Agree with mitigation comments earlier; I2 – add implementation on management not just monitoring G2 – if being specific, include shellfish, finfish, SAV – or save specifics for workplan; Eradication of exotics – need to implement not just monitor; Prioritize	A. Birch	Chapter 5

Comment	*Source*	*Location*
Record of alligator breeding – 23 babies when bought property; Greg & Dana Wade can show us nests; Miami group to survey SLR in '60s – Evans Creek was full of water hyacinth and saw many alligators; Number of plants listed is meager in natural communities description – live oaks and other oaks dominate certain areas, cypress trees - list more obvious trees; Need to have someone in charge of public relations – people are interested in knowing what's going on (ie., Mosquito Control effective with particular reporter at newspaper interested in natural areas) – AP can use this type of publicity to get the public interested; can be managed out of AP office; Have someone survey AP at least once/month – presence, observe, combine with sampling – can catch problems before they get too big (i.e., like Riverkeeper) – Wade's on river every day (Nov 1- July) – expand so survey entire river	G. Evans	Page 39
Cypress at Miller property	G. Kaufmann	
Cypress at oxbow recon	D. Wade	
Public relations – SL County TV to get message out – AP staff do special show – what we're doing, deadlines, give website so they can see plan – check with DEP PR staff	D. Coward	
Oxbow SLR exhibit Dec 3-10 installed – promotion of river	S. Bogan	
JD state park Riverfest – make one event specific to river to build support and awareness	G. Kaufmann	
Piece of AP video that was done on NF – copy to Sandy	J. Beal	
Not just routine ed&out, but 1 person with marketing point of view	P. Gostel	
Working group – Archie Carr has one meets 3x/year with citizens, agency, etc. -	A. Birch	
Need a community group to help with tasks that AP staff don't have time (i.e., exotic species removal, person with marketing experience)	D. Coward	
Girl Scouts were working on river at one time	B. Deemer	
Grant $ for community group not available to just agency (501c3)	D. Coward	
GTM NERR has standing adv group meets couple of times a year – brainstorm over stumbling blocks once implement MP – can be informal, goal to help implement plan – working group; Different than GTM CSO	M. Shirley	
Recommend both CSO (for public awareness, outreach, and fundraising) and working group/TAC (for resource management); otherwise goals can conflict	G. Kaufmann & A. Birch	
Get with Kelly to determine how to arrange CSO and working group.	M. Shirley	
Timeline – can we have an extension if necessary to create best product possible; Letter from committee to CAMA director and CZM Program re: 1) high quality plan needs to take priority over deadlines; and 2) more meaningful public involvement Motion to extend at least 1 month - voted	B. Gunsalus	
Reference the fact that there are workplans; People need to know to go to workplan to see details that aren't in MP	P. Gostel	
Pushing it back allows for more meaningful public involvement (i.e., TV show and other outlets)	D. Coward	
Provide email with essential persons for letter writing.	A. Birch	

Public Comments

Gerald Ward

- Represents Marine Industries and Florida Engineering Conservation and Environmental Quality
- Has had no contact since September
- Major Ch. 120 problems – DEP lawyer needs to be at meetings
- Meeting pursuant to Ch. 258 37.1
- Mr. England told us some major problems – pay attention
- Asked for existing resource inventory pursuant to Ch. 119
- Mr. Coward raised issue of ROMAs – not a good idea
- Expanding docks and mitigation contrary to 258 44 and the rule
- Verbal comments expunged from previous summaries
- CSO – state park system has better process, or standing committee suggestion more productive than CSO
- Abolish CAMA, put under Division of Recreation and Parks
- 180 pages is obnoxious – goal should be under 100 pages, double spaced

- No Martin County representative
- No Marine Industries representative
- Focus on 8 square miles

Walt Coward
- Property owner along North Fork
- Sees merit in community involvement goal of reestablishing CSO as a vehicle to have volunteers help AP staff with activities
- Suggests different angle for additional community involvement goal: co/joint-management by creating a "standing committee," composed of agency folk as well as community group, to assist AP staff with implementing management plan activities as well as periodic updating of management plan

Written Public Comments

David Kaplan
- How soon will brochure /flyer be ready? I would like to include it in our home owner news letter going out Dec 7th.

C.2 / Public Scoping Meeting(s)

The following Appendixes contain information about the Public Scoping Meeting(s) which was held in order to obtain input from the public as what they thought the issues in North Fork St. Lucie River Aquatic Preserve were. There are copies of the public advertisements for those meetings, a list of attendees, a summary of the meeting(s) (as required by Ch. 259.032(10), F.S.), and a copy of the written comments received.

C.2.1 / Florida Administrative Weekly (F.A.W.) Posting

Meeting: ***Wednesday, July 18, 2007***

Florida Administrative Weekly, Volume 33, Number 22, June 1, 2007
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 2552

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date and Time: Wednesday, July 18, 2007, 7:00 p.m.

Place: University of Florida Indian River Research and Education Center, 299 South Rock Rd., Fort Pierce, FL 34945

General Subject Matter to be Discussed: The purpose of this meeting is to inform the public on the management plan review process and to solicit input on issues they are interested in seeing addressed in the plan.

A copy of the agenda may be obtained by contacting Aquatic Preserve Manager, Laura Herren at (772)429-2995. Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Aquatic Preserve Manager, Laura Herren at (772)429-2995. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, (800)955-8771 (TDD) or (800)955-8770 (Voice).

Meeting: ***Wednesday, July 18, 2007***

Florida Administrative Weekly Volume 33, Number 24, June 15, 2007
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 2730

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date and Time: Wednesday, July 18, 2007, 7:00 p.m.

Place: University of Florida Indian River Research and Education Center, 299 South Rock Rd., Fort Pierce, FL 34945

General Subject Matter to be Discussed: The June 1, 2007 notice regarding the July 18, 2007 meeting for the purpose of informing the public on the management plan review process and to solicit input on issues they are interested in seeing addressed in the plan inadvertently omitted the name of the site being discussed. This meeting is for the North Fork, St. Lucie River Aquatic Preserve.

A copy of the agenda may be obtained by contacting Aquatic Preserve Manager, Laura Herren at (772)429-2995.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Aquatic Preserve Manager, Laura Herren at (772)429-2995. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, (800)955-8771 (TDD) or (800)955-8770 (Voice).

Meeting: ***Wednesday, July 18, 2007***

Florida Administrative Weekly Volume 33, Number 26, June 29, 2007
Section VI - Notices of Meetings, Workshops and Public Hearings, p. 2942

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date and Time: Wednesday, July 18, 2007, 7:00 p.m.

Place: University of Florida Indian River Research and Education Center, 299 South Rock Rd., Fort Pierce, FL 34945

General Subject Matter to be Discussed: The North Fork, St. Lucie Aquatic Preserve Advisory Committee meeting will be held in conjunction with the public meeting advertised in the June 1, 2007, F.A.W., to inform the public on the management plan review process and to solicit input on issues they are interested in seeing addressed in the North Fork, St. Lucie Aquatic Preserve Management Plan.

A copy of the agenda may be obtained by contacting Aquatic Preserve Manager, Laura Herren at (772)429-2995.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting Aquatic Preserve Manager, Laura Herren at (772)429-2995. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

Florida Department of Environmental Protection • Office of Coastal & Aquatic Managed Areas

North Fork St. Lucie River Aquatic Preserve

Public Meeting

Wednesday, July 18, 2007, 7:00 pm

University of Florida Indian River
Research & Education Center
2199 South Rock Rd.
Fort Pierce, FL 34945

The Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas (CAMA) is responsible for the management of Florida's 41 Aquatic Preserves, 3 National Estuarine Research Reserves (NERR), 1 National Marine Sanctuary, and the Coral Reef Conservation Program. These protected areas comprise more than 4 million acres of the most valuable submerged lands and select coastal uplands in Florida. CAMA is updating the site specific management plans, and currently has three plans under review. These sites will be holding formal public meetings to receive input on the new draft plans.

These scoping meetings will assist in crafting the content for individual site management plans.The information from each meeting will be recorded, compiled, and presented to CAMA by facilitators.The objectives of the public scoping meetings are to:

- Inform the public about the history, purpose, and scope of management plan development
- Solicit public input regarding issues and opportunities that should be addressed in the management plan

For more information, please contact Aquatic Preserve Manager, Laura Herren, at (772) 429-2995/laura.herren@dep.state.fl.us, or visit our website at www.aquaticpreserves.org. Written comments are welcome and can be submitted via by fax: (850) 245-2110 Attn: North Fork; or email North.Fork@dep.state.fl.us.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the a agency at least 5 days before the workshop/meeting by contacting Laura Herren at (772) 429-2995. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, (800) 955-8771 (TDD) or (800) 955-8770 (Voice).

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Wednesday, July 18, 2007, 7:00 P.M. (University of Florida Indian River Research and Education Center)

Attendance

Name	Affiliation	County
Beall, Baret	Martin County Parks	Martin
Berger, Michelle	City of Port St. Lucie	St. Lucie
Birch, Anne	The Nature Conservancy	St. Lucie
Cassens, Steve	North St. Lucie Water Control District	St. Lucie
Chapman, Mary	EAC- Lawyer	Martin
Cook, Fred	Citizen	St. Lucie
Coward, Doug	SLC Board of County Commissioners	St. Lucie
Coward, Rose	Citizen	St. Lucie
Dahan, Mike	Citizen	St. Lucie
Dahan, Amy	Heathcote Botanical Gardens	St. Lucie
Deemer, Bobbie	Advisory Committee	St. Lucie
Dewey, Gretchen	G. Dewey Realtor	
Ehrlich, Barry	K&S	Broward
England, Walter	City of Port St. Lucie	St. Lucie
Evans, Gordon	Advisory Committee	St. Lucie
Evans, Nancy	Riparian Homeowner	St. Lucie
Garcia, Ray	IBFH/ North St. Lucie Water Control District	Martin
Gordon, Bill	Citizen	St. Lucie
Gostel, Pat	South Florida Water Management District	Martin
Gunsalus, Boyd	South Florida Water Management District	Martin
Herren, Rick	Indian River County	Indian River
Hiller, John	Port St. Lucie Citizen	St. Lucie
Hilley, Louise	Citizen	St. Lucie
Holt, John	Citizen	St. Lucie
Kaplan, David	Port St. Lucie	St. Lucie
Kaufman, Greg	DEP/Savannas Preserve State Park	St. Lucie
Kean, Bridgit	City of Port St. Lucie	St. Lucie
Keller, Doug	Creech Engineers	Martin
LaMartina, Kathy	South Florida Water Management District	Martin
McDevitt, Erin	FFWCC	St. Lucie
Opland, Bruce	Citizen	St. Lucie
Phillips, Harold	St. Lucie Audubon	St. Lucie
Povinelli, Andrea	The Nature Conservancy	
Price, April Comm	ASMFC	St. Lucie
Rau, Kenneth	Creech Engineers	Martin
Richards, Joe	Citizen	St. Lucie
Richards, Richards	Citizen	St. Lucie
Sculley, Jim	Citizen	St. Lucie
Small, Danna	Kimley Horn Assoc.	
Steward, Kristine	Keith & Schnars	Broward
Stinnette, Kevin	Indian Riverkeeper	Martin
Tanblyn, Mark	Florida Inland Navigation District	
Turner, Wade	Florida Dept. of Environmental Protection	Martin
Ward, Gerald	Fes-Ced Miatc Leg. Comm	

Introduction

On July 18, 2007 the St. Lucie Aquatic Preserve conducted a public meeting to meet the following objectives:

1. Review purpose of and process for reviewing the site management plan.
2. Receive input regarding the perceived issues and concerns for the North Fork St. Lucie River Aquatic Preserve.

This was the first public meeting related to the drafting of the site's management plan. A second meeting will be planned to review the findings from this first public meeting

The meeting followed the following agenda:

- Official Welcome and introduction to meeting
- Overview Presentation: presentation that describes the management area's boundaries, available management resources, current projects, and other key points that participants should have before providing input.
- Public Comment and Stakeholder Feedback: Opportunity for public to provide written and verbal input to the management area staff by visiting a "kiosks."
- Kiosk Reports: Staff provides a verbal summary of the comments they received at their kiosk.
- Public Comment: Participants who wanted to make a verbal public statement were asked to sign a posted "speakers list". An opportunity for those participants that signed the "speakers list" to make public statement to the full assembly was given at the end of each evening. Only written comments were included in this meeting summary.

The meeting was designed to encourage dialogue between the public and staff on specific issues as well as providing a forum for general comments and observations.

CAMA's Planning Program

The Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas (CAMA) is responsible for the management of Florida's 41 Aquatic Preserves, 3 National Estuarine Research Reserves (NERR), 1 National Marine Sanctuary, and the Coral Reef Conservation Program. These protected areas comprise more than 4 million acres of the most valuable submerged lands and select coastal uplands in Florida. CAMA is currently in the process of revising its site management plans, including the plan for the North Fork St. Lucie River Aquatic Preserve. These plans will provide a critical management framework for the sites, setting priorities and guiding implementation for the next 10 years.

This document

This document includes both written comments received at the workshops and by email/postal mail during the comment period. It also includes a summary of the reports made by the staff at the end of the kiosk period. This summary is not meant to be a detailed description of the proceedings, but a record of the major themes and comments received. Only written comments were included in this meeting summary.

General Summary of the Meeting

Below is an overall summary of the comments received during the public meeting process:

- The importance of focusing on a reasonable number of issues and management actions that could be successfully implemented within the Aquatic Preserve's current and anticipated human and financial resources. The incomplete implementation of the previous management plan was noted.
- Impact, both in terms of quality and quantity of water, from drainage canals and its affect on the water quality, flora and fauna within the Aquatic Preserve.
- The importance of connecting the community with the Aquatic Preserve and enlisting them to mitigate local impacts.
- Increasing potential for user group conflicts.
- Storm water management within the Aquatic Preserve boundary and its affect on the water quality.

Written comments received on comment cards at meeting

As a past member and twice Chairman of the Port St. Lucie City Planning and Zoning Board, I have been aware of the need for and the progress of our cities third east-west corridor from our western beaches to US HWY 1. The preserve now has 5000 acres in Martin and St. Lucie counties. In 1991 St. Lucie sold 1000+ acres of the river land to the state for $1,502,000.00, approximately $1380 dollars an acre. At that time a request to provide access across the river was denied, reason, too premature. Now 15 years later we are still discussing the ways to cross the river. Mean time the City is constructing its G lane Cross Town Parkway a program many are calling the highway to nowhere causing more problems for our community citizens. With today's knowledge and equipment this area can be traversed with little or no harm to the river area. So why is it being delayed, or in my opinion, ignored? *Comment provided Fred Cook 22 Year resident of Port St. Lucie, FL.*

Do we coordinate and/or cooperate with Martin County so that we don't duplicate and/or work against each other but reinforce the work completed as the river is continuous. *Comment provided by Anonymous*

Public education to inform recreational water users as to how to have minimal impact. *Comment provided by Anonymous*

The plan should incorporate advocacy for TMDL's that will address salinity and turbidity as well as previously identified parameters. There needs to be a salinity based control that provides species the right salinity at the right times for their life cycles. The quantity of water discharged is important turbidity standards should preclude turbid water being discharged. *Comment provided by Kevin Stinnette*

Just as a suggestion- need to focus on what did not work for current plan and then look at needs and realistic revisions. Focus on what can actually be addressed in management plan in these meetings- beyond that is not a good use of the public's time. *Danna Small, danna.small@kimley-horn.com*

The biggest issue is land use and drainage in the watershed. Polluting chemicals, including nutrients, do not evaporate or disappear during dry periods. Even setting ponds do not destroy them. When the rain comes, the pollutants run off. With wind, sediments are stirred up and release more. All the pollutants on the watershed end in the north fork, the St. Lucie Riugtz, and then the IRL and the ocean. *Comment provided by John Holt, holteki@aol.com*

Need control of speed of boats- the river is narrow in many places and the wake results in erosion. There is also a safety issue- the wakes can upset canoes and kayaks. Also there seems to be a problem about police jurisdiction on the river- is it PLS or County or Wildlife Management? *Comment provided by anonymous*

There should be a program of land acquisitions to try to exert better control of polluting run-off. I realize this is probably beyond your scope. There should be a greater effort at public education for landowners and boaters as to how their practices affect the preserve. *Comment provided by anonymous.*

Make sure baseline studies are complete so that we know what species re there those that we need to help preserve and exotics that need to be controlled and/or eradicated. *Comment provided by anonymous*

Are we trying to increase land acquisition to increase the Preserve and buffer as development increases. *Comment provided by anonymous*

Opossum Pipefish Habitat must be protected. There must be limits on herbicide use in canals and important plants must be protected (*Panicum* and others). Wetlands must be protected in the watershed. *Comment provided by anonymous*

Storm water attenuation needs to be expanded all along the boundaries of the preserve. Port St. Lucie needs to remove swale liners that increase storm water to the preserve. *Comment provided by anonymous*

St. Lucie Audubon Society and Audubon of Florida support the "NoBuild" option re: a proposed Bridge crossing on the north fork St. Lucie River. When will CAMA request a ELA and why has the work progressed this far to Stage 4 without a ELA being requested. What is the impact on the watershed of the Parkway (West Virginia Corridor) does CAMA support a no build option? If not why? *Comment provided by Harold Philips- Conservation Officer St. Lucie Audubon Society.*

Please address agricultural pollution coming from the canals as well as the swale scale run-off from the neighborhoods, (lawns, leaking septic tanks) and municipalities (storm water sewers). *Comments provided by Gretchen L. Dewey- Recitor Martin Company, Environmentalist*

My personal and professional goals include: 1. Educating Treasure Coast residents in wise water- management and chemical garden applications that affect run-off and water and environmental quality, 2. Inspiring residents to appreciate our natural landscape, 3. Partnering with other agencies, volunteers and non-profits to achieve this, 4. Promoting native plants and avoidance of massive exotics. *Comment provided by Amy Dahan, Director, Heathcote Botanical Gardens, adahan@heathcotebotanicalgardens.org*

Within the watershed, what improvements have been made to improve H2O quality since 1984? Have you involved all the municipalities and counties within the watershed? Do you intend to do so? *Comment provided by Amy Price, ASMFC, southyacht@aol.com*

Create a manual informing new waterfront home buyers about not removing water edge vegetation to preserve the river bank in its natural state. Eliminate need to rip rap to preserve the river bank. *Comment provided by anonymous.*

Martin County would like to see a Blueways program associated with the preserve the county would be interested in partnering with DEP/CAMA to implement this program. A blueways program currently exists in Martin County and could easily be expanded to include areas in the preserve. *Comments provided by anonymous*.

More reconnections and expansion of preserve North. *Comments provided by anonymous.*

Concern about pollution run-off coming from larger scale agriculture operations as well as storm water run-off coming from municipalities and residential neighborhoods (sewers, leaking septic tanks, etc). Perhaps more pressure on governments to inact/enforce regulations? *Comments provided by Gretchen Dewey- Martin County Realtor- Environmentalist.*

Are we acquiring the most strategic land areas within the watershed to help buffer the effects as development on the preserve itself. *Comment provided by anonymous*.

Piggy back on existing posters and storm drain inlet markers, stencils, everyone is down stream. *Comment provided by Q. Kaple.*

There should be greater effort at public education about the preserve and how the practices of individuals, businesses, and the government agencies affect the preserve. Also, let the public know the value of the preserve. *Comment provided by anonymous.*

What management changes are you expecting to adopt that are not in the current plan. 2. What have been the results that have been adhered to date based on the current management plan? 3. What do you consider to be the primary issues? *Comments provided by April Price, FL Commissioner, Atlantic States Marine Fisheries Commission, southyacht@aol.ocm*

What are you doing for public access? What forms? Are we in compliance with Chapter 120? I suggest you narrow your scope to the 10 year plan to items that you have not been able to accomplish in your 20 year plan to date! *Comments provided by April Price, FL Comm., ASMFC. southyacht@aol.ocm*

The Miami area employs an "Urban Development Boundary" to protect the areas west of Dade County. With the rapid growth of Port St. Lucie in mind, do you believe a similarly boundary will be discussed in the near future? *Comment provided by Doug Keller, 317-840-7382.*

Written comments submitted during comment period.

These are written comments received within the comment period, which ended on May 7th.

From: Ray Garcia [ray-g@lbfh.com]

Subject: Public Scoping Meeting July 18, 2007

Ms. Herren,

It was a pleasure meeting you at the North Fork St. Lucie River Aquatic Preserve meeting last week. The following are two comments we had representing the North St. Lucie River Water Control District (NSLRWCD), which we did not have time submit during the meeting.

1. Regarding the North Fork St. Lucie River Aquatic Preserve watershed boundary, we recommend you revise the north boundary line to coincide with the north boundary line of the NSLRWCD. There are some individual connections between NSLRWCD and the SFWMD C-25 Canal, however, a majority of the annual runoff from this area travels south.

2. We suggest you include the Five Mile Creek and Ten Mile Creek systems north of Midway Road into the management program. The NSLRWCD was designed around these streams in the early part of the century, however, NSLRWCD does not own right-of-way along these streams and they are not currently in any agency maintenance program that we are aware of. In the early days, they were modified to facilitate drainage for roughly 65,000 acres. These still function in concept as originally designed, however, NSLRWCD does not have jurisdiction for maintenance. Large portions of these reaches are in poor condition, and contain invasives and sedimentation which can adversely impact the downstream preserve system. Restrictions to flow through this area were noticeable during the recent hurricane activity. Improving these systems would improve control of the upstream flow, which is also an important element in water quality.

Please call me at any time if you have any questions or would like to further discuss the NSLRWCD system.

Sincerely,

Ray Garcia, PE, LBFH Incorporated

Consulting Civil Engineers, Surveyors & Mappers

3550 SW Corporate Parkway , Palm City, FL 34990

772-219-2832, 772-286-3925/fax, ray-g@lbfh.com

From: Phil and Gerry Tafoya [philandgerryt@comcast.net]

Subject: St Lucie Estuary

Dear Laura:

Sorry we could not make the meeting. The following are some ideas we have to make our river a better place for people and especially our wildlife that is slowly disappearing.

We feel there should be stricter enforcement on how close people build to the water. We had to have a 50 foot setback when we built our home, but we see other houses much closer to the water. We have seen people building docks without turbidity booms, sawing the pressure treated wood with pieces and sawdust falling into the water. We do not need more arsenic in the water. I do not know if they have permits for the docks and retention walls that are going up. I do know when we built our dock the Army Corp. and the DEP came to our house and told us where we could build our dock and gave us guidelines on keeping the water clean. I also thought you needed permits to remove live trees unless they are pepper trees. This too needs closer watch. The County issues too many permits. I know there is still a few million dollars in the "Save Our Lands" kitty. I hear they are looking to buy land for a school with this. What is that about? I think we need more retention areas or at least more baffle boxes.

I could go on but I know I have said enough. You probably do not have the authority to do most of these things, but if something could be done it is better than nothing. Thank you for your time and interest in preserving our river. We love it here and it would be a shame to loose this to more building.

Bye, Phil and Gerry Tafoya

From: Ted Guy [mailto:guywe@gate.net]

Subject: Aquatic Preserve management plan

Laura,

Please put me on your mailing list and send me any agendas for the series of meetings you're holding in St. Lucie County, and any draft of the management plan.

I attended your July 2006 meeting in Palm Bay, but apparently did not get put on the list.

Also, I would like to be appointed to your North Fork advisory committee since I represent user groups such as the Marine Industry, a major stakeholder, and have been involved in Aquatic Preserve Plan formulation since prior to 1984.

Unfortunately, I was out of town for your June meeting and could not attend tonight's meeting due to family visiting from Chicago; therefore I submit these comments in writing, related to the North Fork of the St. Lucie River Aquatic Preserve:

1. I'm not aware that FDEP has ever accomplished the resources inventory for the North Fork. Wasn't that required by the 1984 Plan? Shouldn't it be accomplished before the new plan goes to press? How can we plan intelligently without it? Wasn't it to provide a base line to measure progress against? Are we going in to a new plan still without a baseline? Or am I missing something?

2. The most significant and important influences on water quality and the health of the benthic community on sovereignty submerged lands in the North Fork Aquatic Preserve are the discharges from the C-23 and C-24 drainage canals, as well as some Port St. Lucie drainage canals. I don't remember those discharges being addressed in the 1984 plan, but they should be addressed most prominently in the new plan. Everything else addressed by the plan pales by comparison with those major influences on the health of the preserve.

3. The next most significant influence on the health of the Preserve is the excessive fresh, nutrient laden, toxic algae producing dumping of Lake Okeechobee water into the estuary, such as occurred in 1995, 1998, 2003, 2004, and 2005 from the C-44 canal. Shouldn't we be addressing those discharges?

4. Manatees are NOT the hot issue they used to be in 1984. The manatee population has recovered nicely since then, roughly tripling the Florida species population, and when was the last time you heard of one being killed by a boat in the North Fork Aquatic Preserve?

The comments above are very general and preliminary; it's hard to get more specific without seeing a draft plan.

W.E. "Ted" Guy, Jr., Stuart, FL 34997

From: Michael Kiefer [Mike.Kiefer@Kimley-Horn.com]

Subject: RE: Aquatic Preserve management plan

Laura, I concur with Ted's comments. I was involved in the permitting of docks at Harbour Ridge in the mid 80's; I conducted extensive aerial flights over the North Fork and South Fork performing manatee observations, and I have permitted a number docks in the North Fork since then. I likewise submit these written comments related to the North Fork of the St. Lucie River Aquatic Preserve:

a. Does the North Fork of the St. Lucie River still meet the criteria for designation as an Aquatic Preserve?

b. Should not the boundaries be changed to focus more on narrow upper reaches of the North Fork? What is so significant about the wide open waters of the North Fork that separates it apart from the South Fork or the rest of the St. Lucie River? The aquatic resources are limited.

c. If we have not accomplished most of the goals in the management plan, why have a plan? If you are going to continue with a plan I would suggest taking out those items which you are not likely to accomplish. The program didn't have the money then, (although it had more manpower); it doesn't have the money now, and it won't likely have the money in the future to implement many of the actions and goals in the management plan.

d. Given the limited money and manpower, relative to managing AP's, we should focus on what is truly important, and manage it well.

I know these are general thoughts and comments, and I will likely want to offer more as this progresses.

Thank you.

Michael E. Kiefer, Jr., Kimley-Horn And Associates, Inc.

10521 SW Village Center Drive, Suite 103, Port St. Lucie, FL 34987

Voice 772-345-3800 Direct Dial 772-345-3824, Fax 772-286-0138 , Mike.Kiefer@Kimley-Horn.com

The following Appendixes contain information about the Formal Public Meeting(s) which was held in order to obtain input from the public about the North Fork St. Lucie River Aquatic Preserve Draft Management Plan. There are copies of the public advertisements for those meetings, a list of attendees, a summary of the meeting(s) (as required by Ch. 259.032(10), F.S.), and a copy of the written comments received.

C.3.1 / Florida Administrative Weekly (F.A.C.) Posting(s)

Florida Administrative Weekly Volume 34, Number 6, February 8, 2008
Section VII - Notices of Meetings, Workshops and Public Hearings, p. 831

The Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas, acting as staff to the Board of Trustees of the Internal Improvement Trust Fund announces a public meeting to which all persons are invited.

Date and Time: Thursday, March 20, 2008, 6:00 p.m.

Place: University of Florida Indian River Research and Education Center, 2199 South Rock Rd., Ft. Pierce, FL 34945

General Subjec Matter to be Considered: The purpose is to receive public comment on the draft North Fork, St. Lucie River Aquatic Preserve Management Plan. A copy of the draft plan will be available for viewing starting February 15, 2008, at www.dep.state.fl.us/coastal. The North Fork, St. Lucie River Aquatic Preserve Advisory Committee will be participating.

A copy of the agenda may be obtained by contacting: Aquatic Preserve Manager, Laura Herren at (772)429-2995.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the agency at least 5 days before the workshop/meeting by contacting: Aquatic Preserve Manager, Laura Herren at (772)429-2995. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, 1(800)955-8771 (TDD) or 1(800)955-8770 (Voice).

Florida Department of Environmental Protection • Office of Coastal & Aquatic Managed Areas

North Fork St. Lucie River Aquatic Preserve

Public Meeting

Thursday, March 20, 2008, 6:00 pm

University of Florida Indian River
Research & Education Center
2199 South Rock Rd.
Ft. Pierce, FL 34945

The Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas (CAMA) is responsible for the management of Florida's 41 Aquatic Preserves, 3 National Estuarine Research Reserves (NERR), 1 National Marine Sanctuary, and the Coral Reef Conservation Program. These protected areas comprise more than 4 million acres of the most valuable submerged lands and select coastal uplands in Florida. CAMA is updating these management plans, and is currently working on the North Fork St. Lucie River Aquatic Preserve plan. This site will hold a public meeting to receive input on the draft plan. The information from the meeting will be compiled and presented to CAMA by a facilitator.

For more information, please contact Aquatic Preserve Manager, Laura Herren, at (772) 429-2995 / laura.herren@dep.state.fl.us, or visit our website at www.aquaticpreserves.org. Written comments are welcome and can be submitted via fax: (850) 245-2110 Attn: North Fork; or email North.Fork@dep.state.fl.us.

Pursuant to the provisions of the Americans with Disabilities Act, any person requiring special accommodations to participate in this workshop/meeting is asked to advise the a agency at least 5 days before the workshop/meeting by contacting Laura Herren at (772) 429-2995 or laura.herren@dep.state.fl.us. If you are hearing or speech impaired, please contact the agency using the Florida Relay Service, (800) 955-8771 (TDD) or (800) 955-8770 (Voice).

This publication funded in part through a grant agreement from the Florida Department of Environmental Protection, Florida Coastal Management Program by a grant provided by the Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended, National Oceanic and Atmospheric Administration (NOAA) Award No. NA07NOS4190071-CZ823. The views, statements, finding, conclusions, and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida, NOAA, or any of its subagencies. February, 2008.

Thursday, March 20, 2008, 6:00 P.M. (University of Florida Indian River Research and Education Center)

Attendance

Name	Affiliation	AC Member
Jeff Bach	DEP - Recreation and Parks	No
Jeff Beal	Florida Fish and Wildlife Conservation Commission	Yes
Baret Beall	Martin County	No
Robert Day	St. Johns River Water Management District	No
Bobbie Deemer	Citizen	Yes
Gordon Evans	Citizen	Yes
Nancy Evans	Citizen	No
Grant Gilmore	Estuarine, Coastal and Ocean Science, Inc.,	No
Patrick Gostel	South Florida Water Management District	Yes
Boyd Gunsalus	South Florida Water Management District	No
Ted Guy	Marine Industries Association of the Treasure Coast	No
Rick Herren	Indian River County	No
David Kaplan	River Party Home Owners Association	No
Greg Kaufmann	DEP - Recreation and Parks	Yes
Josh Liller	Citizen	No
Tom McGowan	Boyle Engineering	No
Larry Patterson	Citizen	No
Andrea Povinelli (*for Ann Birch*)	The Nature Conservancy	Yes
Octavio Reis	Creech Engineers	No
Jim Sculley	Port St. Lucie Conservation Alliance	No
Kris Stewart	Keith Schnars	No
Mark Tamblyn	Florida Inland Navigation District	No
John Tucker	St. Lucie County	No
Bruce Turner	Citizen	No
Dana Wade	River Lilly Eco-Cruise River Tours	Yes
Deena Wade	River Lilly Eco-Cruise River Tours	No
Gerald M. Ward	Florida Engineering Society & Marine Industries Association of the Treasure Coast	No

Meeting Summary

This report funded in part through a grant agreement form the Florida Department of Environmental Protection, Florida Coastal Management Program, by a grant provided by the Office of Ocean and Coastal Resource Management under the Coastal Zone Management Act of 1972, as amended, National Oceanic and Atmospheric Administration Award No. NA07NOS4190071CZ823. The views, statements, findings, conclusions and recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of the State of Florida, NOAA or any of its subagencies. April 2008.

Introduction

On March 20, 2008 the North Fork St. Lucie River Aquatic Preserve conducted a public meeting to meet the following objectives:

1. Present current draft of Site Management Plan, with a focus on issues and objectives.
2. Receive feedback from the public on the current draft management plan.

This was the second public meeting related to the drafting of the site's management plan.

The meeting followed the following agenda:

- Official Welcome and Introduction
- Overview Presentation: Described the management area's boundaries, available management resources, current projects, and proposed issues and management actions.
- Public Comment and Stakeholder Feedback: Opportunity for the public to provide written and verbal comments to staff by visiting "kiosks" organized according to the issues identified in the draft plan (Water Quality, Natural Resource Management, Coastal Development, and Public Use and Access).
- Public Comment: An opportunity for participants who wanted to make a verbal public statement to the full assembly was given at the end of the evening. Only written comments were included in this meeting summary.

The workshop was designed to encourage deep dialogue between the public and the focus teams on specific issues as well as providing a forum for general comments and observations.

Coastal and Aquatic Managed Areas Background

The Florida Department of Environmental Protection's Office of Coastal and Aquatic Managed Areas (CAMA) is responsible for the management of Florida's 41 Aquatic Preserves, 3 National Estuarine Research Reserves (NERR), 1 National Marine Sanctuary, and the Coral Reef Conservation Program. These protected areas comprise more than 4 million acres of the most valuable submerged lands and select coastal uplands in Florida. CAMA is currently in the process of revising its site management plans, including the plan for the North Fork St. Lucie River Aquatic Preserve. These plans will provide a critical management framework for the sites, setting priorities and guiding implementation for the next 10 years.

This document

This document includes both written comments received at the workshops and by email/postal mail during the comment period. It also includes a summary of the reports made by the staff at the end of the kiosk period. This summary is not meant to be a detailed description of the proceedings, but a record of the major themes and comments received. Only written comments were included in this meeting summary.

Summary of comments

Below is an overall summary of the comments received by the North Fork St. Lucie River Aquatic Preserve during the public meeting process:

- Overall, the public endorsed the focus and approach being applied by North Fork St. Lucie River Aquatic Preserve Plan. The public recognized that, generally, the management issues and proposed action that have been identified accurately reflect the priority issues and possible actions that the aquatic preserve has the authority and capacity to address.
- The value and importance of improving water quality was raised consistently and noted as a critical part of the overall plan of action.
- Comments where made about expanding the preserve's boundaries to the north.
- Recreational boating was noted as an important issue with many different management facets. The team was encouraged to consider different options as it addresses boat speed and use in the preserve and to increase boating access to the preserve's waterways.

Written comments received on comment cards at meeting

General Comments:

Focus on oysters versus shellfish makes no sense. Half of the preserve is in a county that has multiple shellfish experts- many for force (Harbor Branch) Bifurcation of preserve discussed earlier meeting. South half is more useful as scientific vs. biological or. Destination. Expansion to North is needed to be considered. Comment provided by Gerald Ward-wardgm@gate.net

I support the expansion of the North, whatever it requires, dredging or not. Office of Coastal & Aquatic Managed Areas should over see this area. Comment provided by David Kaplan, 854-275-5638

Water Quality:

Goal 1. to stop degradation of water in the preserve. 2. Make water safe to humans. 3. Percent algae blooms and red tides. 4. Make fish safe to eat. Job well done. Hats off to all of you putting together this plan. Comment provided by David Kaplan, Riverpark Homeowners Assoc. 954-275-5638

Muck removal is the greatest single need and would be of the most useful benefit! Comment provided by Ted Guy, MIA-TC, gguywe@gate.net

Natural Resource Management:

The expansion of the Preserve Boundary would be of great value to the North Fork St. Lucie River Aquatic Preserve. Comment provided by Mike Patterson.

I heartily support more canoe/ kayak access points to increase and support recreation use of the river. I also support the expansion to include 5 mile and 10-mile creek. Oxbow reopening is not only good for the wildlife water quality but also decreases boat vs. canoe/ kayak conflict and makes the river more attractive to canoes & kayaks. Comment provided by anonymous.

Coastal Development:

Re: Global Warming and sea level- just provide web links to both sides of the controversy.

There is no point in wasting money on printing more - information is already available on the web. Comment provided by Ted Guy, MIA-TC, guywe@gate.net

Pg. 119 Species List - Alphabetize by Latin name. Comment provided by anonymous

Following recent hurricanes that damaged many of the shoreline protection systems built along the river, more research needs to be done to establish hardier systems that can withstand large storms. Comment provided by anonymous

Public Use and Access:

I wish that we could have some type of law enforcement on a regular basis on the North Fork of the St. Lucie River. We need to update the speed limits and manatee zones on the river.

Comment provided by Dana Wade, 772-489-8344

Why is there no line item for public boat launches for motorized boats? That is the biggest single need for public use and access. Comment provided by Ted Guy, MIA-TC, guywe@gate.net

Stop Speeding Boats and Boat Wakes Comment Provided by David Kaplan, Riverpark Homeowners Assoc.

Written comments submitted during comment period

These are written comments received within the comment period, which ended on March 27, 2008.

VIA e-mail and US Mail / March 24, 2008

Trustees of the Internal Improvement Trust Fund

c/o Florida Department of Environmental Protection

Office of Coastal and Aquatic Managed Areas

3300 Lewis Street

Fort Pierce, Florida 34981

Attention: Laura Herren, Manager Southeast Florida Aquatic Preserves

Re: North Fork St. Lucie River Aquatic Preserve Management Plan Update Drafts 18-20.005(7) Florida Administrative Code

Ladies & Gentlemen:

As staff to the trustees of the internal Improvement Trust Fund, you have not initiated Rule Development for the referenced Rule and Management Plan Update. Several of our association members have participated with some difficulty in notice and process, since the summer of 2006 for your Indian River Lagoon and vicinity meetings, and we do wish to continue to be fully involved in your updating of not just the North Fork St. Lucie River Management Plan, but all plans affecting our Association's area.

Two of our members were able to attend last Thursday evening's meeting before Good Friday, but the structure of the meeting once again did not lend itself to correcting some nearly 210 pages of so-called Management Plan document. The one week given until 27 March 2008 for further written comments is grossly inadequate for providing such comments, regardless of the short time the materials were posted prior to your 20 March 2008 "Formal Public Meeting". Since the Department is required to use the Chapter 120 Florida Statutes rulemaking process as its further means of accomplishing a North Fork St. Lucie River Management Plan. We hereby request particular notice to the letterhead addresses of any future actions, meetings and rulemaking.

We do understand that the Department may be intending to further "rewrite" the DRAFT materials to more correctly provide a "management" plan format. We request we be notified at each time changes are made in the DRAFT materials.

Very truly yours,

MARINE INDUSTRIES ASSOCIATION OF THE TREASURE COAST, INC.

Vera Locke, Executive Director

Cc:

MIATC Legislative Committee

MIATC Board of Directors

From: Tom McGowan [mailto:Tom-M@BoyleEngineering.com]

Sent: Friday, March 28, 2008 2:12 PM

To: Herren, Laura

Cc: kristin-f@up1.dep.state.fl.us

Subject: RE: Draft North Fork St. Lucie River Aquatic Preserve Management Plan Draft Available

Laura,

At it's Board meeting yesterday, the NSLRWCD Board of Supervisors did ask that I add a comment to the public record regarding the expansion of the aquatic preserve to include the north fork of the St. Lucie River, 10-Mile Creek to Gordy Road and 5-Mile Creek to Edwards Road. Their comment was relatively basic and is consistent with what we discussed the night of the public meeting. While 5-Mile and 10-Mile Creek are important to the overall environmental health of our area, they are no longer exclusively "natural" systems and are in fact the backbone of a very large drainage system, and they must be able to be cleaned (sediment removal) and kept free of excessive downed vegetation in order to continue to function as a viable drainage conveyance system for the area. This is especially true in light of the increased volume of water anticipated to be released into the NSLRWCD from the SFWMD / ACOE C-23/C24 reservoir and STA project - potentially doubling the volume of water flowing down 10-Mile Creek. This water in turn will be discharged via the Varn Control Structure at Gordy Road into 10-Mile Creek and what would be an aquatic preserve. What provisions are being made to allow for this necessary maintenance and what entity(ies) will be permitted to perform and/or be responsible for this work? Our same concerns are shared for that portion of 5-Mile Creek being considered for inclusion in the aquatic preserve.

Hope this is not too late, and thanks for your consideration.

Thomas F. McGowan, PE

District Engineer

North St. Lucie River Water Control District

772-219-2825 - direct

772-260-8370 - cell

Appendix D

Goals, Objectives, and Strategies Table

D.1 / Current Goals, Objectives and Strategies Table

The following table is a summary of the issues, goals, objectives and strategies identified in Chapter 6. The "Management Program" column identifies which management program each strategy falls within. The "Implementation Date" column identifies the fiscal year when the strategy was, or will be, initiated. The "Project Initiation" column indicates if this is an activity that is already underway, currently under initial development, or will occur in the future. The "Length of Initiative" column indicates how long it is expected to complete the strategy, and the "Estimated Yearly Cost" column identifies the anticipated expenses associated with the strategy.

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Issue 1: **Water Quality**				
WQ Goal 1: Maintain and improve water quality within and entering the preserve to meet the needs of the natural resources.				
WQ Objective 1.1: Regularly assess water quality conditions within the preserve and the potential impacts on natural resources.				
WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	Ecosystem Science	2007-2008	Recurring	$32,000
WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	Ecosystem Science	2007-2008	Recurring	$250
WQ Objective 1.2: Protect natural resources by restoring altered areas that contribute to low water quality conditions within the preserve.				
WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	Resource Management	2002-2003	Recurring	$200,000
WQ1.2.2: Stabilize eroding shorelines using natural materials and appropriate native plants.	Resource Management	2010-2011	Recurring	$20,000
WQ1.2.3: Restore oyster reefs to historic structure and function using natural, biodegradable materials.	Resource Management	2010-2011	Recurring	$65,000
WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	Resource Management	2002-2003	Recurring	$250
WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	Resource Management	2008-2009	Recurring	$250
WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	Resource Management	2004-2005	Recurring	$500
WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	Resource Management	2008-2009	Recurring	$250
WQ Objective 1.3: Reduce water quality impacts caused by stormwater and septic sources systems within the watershed.				
WQ1.3.1: Inventory stormwater retrofit systems to help identify future improvement needs.	Resource Management	2011-2012	2 yrs	$200
WQ1.3.2: Form a working group to address stormwater drainage issues and relevant best management practices.	Resource Management	2012-2013	Recurring	$500
WQ1.3.3: Promote the standardization of local stormwater drainage ordinances.	Resource Management	2010-2011	Recurring, as necessary	$250
WQ1.3.4: Encourage local governments to convert high-priority areas to sewer.	Resource Management	2010-2011	Recurring	$250
WQ1.3.5: Promote best management practices that maintain or improve water quality.	Resource Management	2010-2011	Recurring	$200
WQ Objective 1.4: Protect lands to conserve the water quality and natural resources of the preserve.				
WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	Resource Management	2008-2009	Recurring	$250

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
WQ Goal 2: Increase public awareness about water quality issues within the preserve.				
WQ Objective 2.1: Inform the public and partners about water quality conditions within the preserve.				
WQ2.1.1 Distribute water quality information to the public and partners.	Education and Outreach	2011-2012	Recurring	$400
WQ Objective 2.2: Facilitate knowledge and understanding of how activities in the watershed impact the preserve.				
WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	Education and Outreach	2008-2009	Recurring	$300
WQ2.2.2: Provide educational boat tours to inform the public about the effect of watershed practices on the preserve's natural resources.	Education and Outreach	2013-2014	Recurring	$400
WQ2.2.3: Reactivate the Stewards for the Southeast Florida Aquatic Preserves Citizen Support Organization.	Education and Outreach	2011-2012	1 yr	$4,400
WQ2.2.4: Create and promote a *Homeowner's Guide to Living on the North Fork St. Lucie River Aquatic Preserve.*	Education and Outreach	2010-2011	1 yr	$2,000
WQ2.2.5: Inform students about local issues.	Education and Outreach	2013-2014	Recurring	$250
WQ2.2.6: Expand the Indian River Lagoon drain stenciling and signage program in highly developed areas adjacent to the preserve.	Education and Outreach	2014-2015	1 yr	$10,000
Issue 2: **Natural Resource Management**				
NR Goal 1: Document the natural resources within the preserve.				
NR Objective 1.1: Establish a baseline of the current locations, extents, and conditions of the different habitat types.				
NR1.1.1: Survey and map each habitat type located within the preserve.	Ecosystem Science	2010-2011	3 yrs	$50,000
NR1.1.2: Ground-truth habitat maps on a five-year cycle.	Ecosystem Science	2015-2016	3 yrs	$30,000
NR Objective 1.2: Associate aquatic species, especially rare and protected species, with specific habitats located within the preserve.				
NR1.2.1: Develop a GIS database and maps that link species locations to specific aquatic habitats.	Ecosystem Science	2011-2012	1 yr	$300
NR1.2.2: Maintain a comprehensive species inventory.	Resource Management	2007-2008	Recurring	$200
NR Objective 1.3: Monitor changes to the resources resulting from Northern Everglades restoration efforts.				
NR1.3.1: Map the location of the estuarine-freshwater transition zone of the North Fork St. Lucie River every two years.	Ecosystem Science	2009-2010	Recurring	$1,000
NR1.3.2: Document seagrass and oyster recruitment sites within the preserve.	Ecosystem Science	2015-2016	Recurring	$300
NR Goal 2: Implement management practices that maintain or improve viable habitats and populations within the preserve.				
NR Objective 2.1: Establish and implement routine biological monitoring programs for essential habitats and rare and listed species.				
NR2.1.1: Monitor bird rookeries.	Ecosystem Science	2006-2007	Recurring	$1,500
NR2.1.2: Monitor great land and fiddler crab locations and densities.	Ecosystem Science	2011-2012	3 yrs	$1,400
NR2.1.3: Monitor mangrove rivulus populations at sites documented to support great land and fiddler crabs.	Ecosystem Science	2012-2013	2 yrs	$1,400

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
NR2.1.4: Document and monitor fish aggregation, spawning, and recruitment sites within the preserve.	Ecosystem Science	2010-2011	Recurring	$1,300
NR2.1.5: Monitor benthic community structure.	Ecosystem Science	2010-2011	Recurring	$1,300
NR2.1.6: Assist partners with natural resource monitoring efforts.	Ecosystem Science	1986-1987	Recurring	$1,300
NR2.1.7: Collaborate with academic institutions to meet research and monitoring needs.	Ecosystem Science	2009-2010	Recurring	$300
NR Objective 2.2: Synthesize and distribute species and community data to inform policy, regulatory, and natural resource management decisions.				
NR2.2.1: Establish a program to collect information from researchers and commercial fishermen within the preserve.	Resource Management	2016-2017	2 yrs	$300
NR2.2.2: Provide resource updates to regulatory staff issuing permits within or adjacent to the preserve.	Resource Management	2011-2012	Recurring	$400
NR Objective 2.3: Document and reduce the abundance and diversity of non-native aquatic species within the preserve.				
NR2.3.1: Create a non-native species database and sightings map.	Resource Management	2013-2014	1 yr	$200
NR2.3.2: Assist other agencies in controlling non-native aquatic species.	Resource Management	2015-2016	Recurring	$250
NR Goal 3: Protect the preserve's natural resources at an ecosystem scale.				
NR Objective 3.1: Work with partners to protect the preserve's headwaters.				
NR3.1.1 Collaborate with partners to evaluate the proposal to expand the preserve boundary based on scientific data.	Ecosystem Science	2010-2011	Recurring, as necessary	$1,000
Issue 3: **Coastal Development**				
CD Goal 1: Protect the preserve from impacts related to land use changes that disrupt the ecological functions of the natural resources.				
CD Objective 1.1: Coordinate with regulatory programs, local government, and adjacent land owners to reduce impacts to the preserve from adjacent development activities.				
CD1.1.1: Review and provide recommendations for local comprehensive plans that address development adjacent to the preserve.	Resource Management	2010-2011	Recurring	$250
CD1.1.2: Comment on proposed large-scale coastal developments adjacent to the North Fork St. Lucie River and its headwaters.	Resource Management	2010-2011	Recurring	$250
CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	Resource Management	1986-1987	Recurring	$250
CD1.1.4: Recommend use of soft, living shorelines to decrease erosion and protect the water quality and resources within and upstream of the preserve.	Resource Management	2010-2011	Recurring	$250
CD Objective 1.2: Inform local residents about their contribution to global issues that impact the preserve.				
CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	Education and Outreach	2007-2008	Recurring	$1,400
CD1.2.2: Inform residents about climate change and sea-level rise, and how they could affect the preserve.	Education and Outreach	2014-2015	Recurring	$250
CD1.2.3: Provide options to residents for reducing their carbon footprint.	Education and Outreach	2010-2011	Recurring	$250

Goals, Objectives & Integrated Strategies	Management Program	Implementation Date (Planned)	Length of Initiative	Estimated Yearly Cost
Issue 4: **Public Use and Access**				
PU Goal 1: Maintain a safe environment for fish, wildlife, and user groups.				
PU Objective 1.1: Reduce the amount of debris and contaminants associated with user group activities.				
PU1.1.1: Organize two community-based clean-up events each year.	Resource Management	2007-2008	Recurring	$1,300
PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	Resource Management	2007-2008	Recurring	$500
PU1.1.3: Promote DEP's Clean Marina Program to Club Med - Sandpiper.	Education and Outreach	2010-2011	1 yr	$250
PU1.1.4: Install and maintain monofilament recycling containers at all public boat ramps and fishing piers.	Resource Management	2009-2010	1 yr	$500
PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	Resource Management	2006-2007	Recurring	$15,000
PU1.1.6: Post signage about debris in aquatic environments at public access points.	Education and Outreach	2013-2014	1 yr	$1,500
PU Objective 1.2: Better understand the impact of current speed limits on the preserve and its user groups.				
PU1.2.1: Document and monitor boating impacts to natural resources.	Ecosystem Science	2015-2016	3 yrs	$500
PU Objective 1.3: Increase the amount and frequency of law enforcement and citizen patrol within the preserve.				
PU1.3.1: Facilitate regular communication with law enforcement for rapid response to illegal activities.	Resource Management	2011-2012	Recurring	$500
PU1.3.2: Coordinate with local citizens to help patrol the preserve.	Resource Management	2011-2012	Recurring	$1,500
PU Goal 2: Promote low impact recreational opportunities.				
PU Objective 2.1: Support the addition of canoe stopovers and launches on public lands.				
PU2.1.1: Identify and support appropriate locations for canoe stopovers and launches.	Resource Management	2010-2011	1 yr	$500
PU Objective 2.2: Promote complete inclusion of the preserve into county waterway programs.				
PU2.2.1: Promote Waterway Program consistency.	Resource Management	2011-2012	1 yr	$200

D.2 / Budget Table

The following table provides a cost estimate for conducting the priority management activities identified in this plan. Activities are carried out with the help of various partners, thus estimates reflect the aquatic preserve program role in each project. The data is organized by year and Management Program with subtotals for each program and year. The following represents the actual budgetary needs for managing the resources of the Aquatic Preserve. This budget was developed using data from CAMA and other cooperating entities, and is based on actual costs for management activities, equipment purchases and maintenance, and for development of fixed capital facilities. The budget below exceeds the funds CAMA has been receiving through the state appropriations process, but is consistent with the direction necessary to achieve the goals and objectives identified in the Goals, Objectives and Strategies Table in Appendix D.1. Budget categories identified correlate with the CAMA Management Program Areas. Estimates are subject to change based on detailed cost analysis.

Issue	Strategy	Project Initiation	Estimated Yearly Cost
2008-2009 Cost Estimate			
Ecosystem Science			
Water Quality	WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	2007-2008	$32,000
Water Quality	WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	2007-2008	$250
Natural Resource Management	NR2.1.1: Monitor bird rookeries.	2006-2007	$1,500
Natural Resource Management	NR2.1.6: Assist partners with natural resource monitoring efforts.	1986-1987	$1,300
	Ecosystem Science Subtotal		$35,050
Resource Management			
Water Quality	WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	2002-2003	$200,000
Water Quality	WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	2002-2003	$250
Water Quality	WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	2008-2009	$250
Water Quality	WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	2004-2005	$500
Water Quality	WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	2008-2009	$250
Water Quality	WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	2008-2009	$250
Natural Resource Management	NR1.2.2: Maintain a comprehensive species inventory.	2007-2008	$200
Coastal Development	CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	1986-1987	$250
Public Use and Access	PU1.1.1: Organize two community-based clean-up events each year.	2007-2008	$1,300
Public Use and Access	PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	2007-2008	$500
Public Use and Access	PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	2006-2007	$15,000
	Resource Management Subtotal		$218,750
Education & Outreach			
Water Quality	WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	2008-2009	$300
Coastal Development	CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	2007-2008	$1,400
	Education & Outreach Subtotal		$1,700
$255,500	**2008-2009 Total**		

Issue	Strategy	Project Initiation	Estimated Yearly Cost
2009-2010 Cost Estimate			
Ecosystem Science			
Water Quality	WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	2007-2008	$32,000
Water Quality	WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	2007-2008	$250
Natural Resource Management	NR1.3.1: Map the location of the estuarine-freshwater transition zone of the North Fork St. Lucie River every two years.	2009-2010	$1,000
Natural Resource Management	NR2.1.1: Monitor bird rookeries.	2006-2007	$1,500
Natural Resource Management	NR2.1.6: Assist partners with natural resource monitoring efforts.	1986-1987	$1,300
Natural Resource Management	NR2.1.7: Collaborate with academic institutions to meet research and monitoring needs.	2009-2010	$300
	Ecosystem Science Subtotal		$36,350
Resource Management			
Water Quality	WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	2002-2003	$200,000
Water Quality	WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	2002-2003	$250
Water Quality	WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	2008-2009	$250
Water Quality	WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	2004-2005	$500
Water Quality	WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	2008-2009	$250
Water Quality	WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	2008-2009	$250
Natural Resource Management	NR1.2.2: Maintain a comprehensive species inventory.	2007-2008	$200
Coastal Development	CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	1986-1987	$250
Public Use and Access	PU1.1.1: Organize two community-based clean-up events each year.	2007-2008	$1,300
Public Use and Access	PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	2007-2008	$500
Public Use and Access	PU1.1.4: Install and maintain monofilament recycling containers at all public boat ramps and fishing piers.	2009-2010	$500
Public Use and Access	PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	2006-2007	$15,000
	Resource Management Subtotal		$219,250
Education & Outreach			
Water Quality	WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	2008-2009	$300
Coastal Development	CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	2007-2008	$1,400
	Education & Outreach Subtotal		$1,700
$257,300	**2009-2010 Total**		

Issue	Strategy	Project Initiation	Estimated Yearly Cost
2010-2011 Cost Estimate			
Ecosystem Science			
Water Quality	WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	2007-2008	$32,000
Water Quality	WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	2007-2008	$250
Natural Resource Management	NR1.1.1: Survey and map each habitat type located within the preserve.	2010-2011	$50,000
Natural Resource Management	NR2.1.1: Monitor bird rookeries.	2006-2007	$1,500
Natural Resource Management	NR2.1.4: Document and monitor fish aggregation, spawning, and recruitment sites within the preserve.	2010-2011	$1,300
Natural Resource Management	NR2.1.5: Monitor benthic community structure.	2010-2011	$1,300
Natural Resource Management	NR2.1.6: Assist partners with natural resource monitoring efforts.	1986-1987	$1,300
Natural Resource Management	NR2.1.7: Collaborate with academic institutions to meet research and monitoring needs.	2009-2010	$300
Natural Resource Management	NR3.1.1 Collaborate with partners to evaluate the proposal to expand the preserve boundary based on scientific data.	2010-2011	$1,000
	Ecosystem Science Subtotal		$88,950
Resource Management			
Water Quality	WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	2002-2003	$200,000
Water Quality	WQ1.2.2: Stabilize eroding shorelines using natural materials and appropriate native plants.	2010-2011	$20,000
Water Quality	WQ1.2.3: Restore oyster reefs to historic structure and function using natural, biodegradable materials.	2010-2011	$65,000
Water Quality	WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	2002-2003	$250
Water Quality	WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	2008-2009	$250
Water Quality	WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	2004-2005	$500
Water Quality	WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	2008-2009	$250
Water Quality	WQ1.3.3: Promote the standardization of local stormwater drainage ordinances.	2010-2011	$250
Water Quality	WQ1.3.4: Encourage local governments to convert high-priority areas to sewer.	2010-2011	$250
Water Quality	WQ1.3.5: Promote best management practices that maintain or improve water quality.	2010-2011	$200
Water Quality	WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	2008-2009	$250
Natural Resource Management	NR1.2.2: Maintain a comprehensive species inventory.	2007-2008	$200
Coastal Development	CD1.1.1: Review and provide recommendations for local comprehensive plans that address development adjacent to the preserve.	2010-2011	$250
Coastal Development	CD1.1.2: Comment on proposed large-scale coastal developments adjacent to the North Fork St. Lucie River and its headwaters.	2010-2011	$250
Coastal Development	CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	1986-1987	$250
Coastal Development	CD1.1.4: Recommend use of soft, living shorelines to decrease erosion and protect the water quality and resources within and upstream of the preserve.	2010-2011	$250
Public Use and Access	PU1.1.1: Organize two community-based clean-up events each year.	2007-2008	$1,300

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Public Use and Access	PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	2007-2008	$500
Public Use and Access	PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	2006-2007	$15,000
Public Use and Access	PU2.1.1: Identify and support appropriate locations for canoe stopovers and launches.	2010-2011	$500
	Resource Management Subtotal		$305,700
Education & Outreach			
Water Quality	WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	2008-2009	$300
Water Quality	WQ2.2.4: Create and promote a *Homeowner's Guide to Living on the North Fork St. Lucie River Aquatic Preserve.*	2010-2011	$2,000
Coastal Development	CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	2007-2008	$1,400
Coastal Development	CD1.2.3: Provide options to residents for reducing their carbon footprint.	2010-2011	$250
Public Use and Access	PU1.1.3: Promote DEP's Clean Marina Program to Club Med - Sandpiper.	2010-2011	$250
	Education & Outreach Subtotal		$4,200
$398,850	**2010-2011 Total**		

2011-2012 Cost Estimate

Ecosystem Science			
Water Quality	WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	2007-2008	$32,000
Water Quality	WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	2007-2008	$250
Natural Resource Management	NR1.1.1: Survey and map each habitat type located within the preserve.	2010-2011	$50,000
Natural Resource Management	NR1.2.1: Develop a GIS database and maps that link species locations to specific aquatic habitats.	2011-2012	$300
Natural Resource Management	NR1.3.1: Map the location of the estuarine-freshwater transition zone of the North Fork St. Lucie River every two years.	2009-2010	$1,000
Natural Resource Management	NR2.1.1: Monitor bird rookeries.	2006-2007	$1,500
Natural Resource Management	NR2.1.2: Monitor great land and fiddler crab locations and densities.	2011-2012	$1,400
Natural Resource Management	NR2.1.4: Document and monitor fish aggregation, spawning, and recruitment sites within the preserve.	2010-2011	$1,300
Natural Resource Management	NR2.1.5: Monitor benthic community structure.	2010-2011	$1,300
Natural Resource Management	NR2.1.6: Assist partners with natural resource monitoring efforts.	1986-1987	$1,300
Natural Resource Management	NR2.1.7: Collaborate with academic institutions to meet research and monitoring needs.	2009-2010	$300
Natural Resource Management	NR3.1.1 Collaborate with partners to evaluate the proposal to expand the preserve boundary based on scientific data.	2010-2011	$1,000
	Ecosystem Science Subtotal		$91,650
Resource Management			
Water Quality	WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	2002-2003	$200,000
Water Quality	WQ1.2.2: Stabilize eroding shorelines using natural materials and appropriate native plants.	2010-2011	$20,000
Water Quality	WQ1.2.3: Restore oyster reefs to historic structure and function using natural, biodegradable materials.	2010-2011	$65,000

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Water Quality	WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	2002-2003	$250
Water Quality	WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	2008-2009	$250
Water Quality	WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	2004-2005	$500
Water Quality	WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	2008-2009	$250
Water Quality	WQ1.3.1: Inventory stormwater retrofit systems to help identify future improvement needs.	2011-2012	$200
Water Quality	WQ1.3.3: Promote the standardization of local stormwater drainage ordinances.	2010-2011	$250
Water Quality	WQ1.3.4: Encourage local governments to convert high-priority areas to sewer.	2010-2011	$250
Water Quality	WQ1.3.5: Promote best management practices that maintain or improve water quality.	2010-2011	$200
Water Quality	WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	2008-2009	$250
Natural Resource Management	NR1.2.2: Maintain a comprehensive species inventory.	2007-2008	$200
Natural Resource Management	NR2.2.2: Provide resource updates to regulatory staff issuing permits within or adjacent to the preserve.	2011-2012	$400
Coastal Development	CD1.1.1: Review and provide recommendations for local comprehensive plans that address development adjacent to the preserve.	2010-2011	$250
Coastal Development	CD1.1.2: Comment on proposed large-scale coastal developments adjacent to the North Fork St. Lucie River and its headwaters.	2010-2011	$250
Coastal Development	CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	1986-1987	$250
Coastal Development	CD1.1.4: Recommend use of soft, living shorelines to decrease erosion and protect the water quality and resources within and upstream of the preserve.	2010-2011	$250
Public Use and Access	PU1.1.1: Organize two community-based clean-up events each year.	2007-2008	$1,300
Public Use and Access	PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	2007-2008	$500
Public Use and Access	PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	2006-2007	$15,000
Public Use and Access	PU1.3.1: Facilitate regular communication with law enforcement for rapid response to illegal activities.	2011-2012	$500
Public Use and Access	PU1.3.2: Coordinate with local citizens to help patrol the preserve.	2011-2012	$1,500
Public Use and Access	PU2.2.1: Promote waterway program consistency.	2011-2012	$200
	Resource Management Subtotal		$308,000
Education & Outreach			
Water Quality	WQ2.1.1 Distribute water quality information to the public and partners.	2011-2012	$400
Water Quality	WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	2008-2009	$300
Water Quality	WQ2.2.3: Reactivate the Stewards for the Southeast Florida Aquatic Preserves Citizen Support Organization.	2011-2012	$4,400
Coastal Development	CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	2007-2008	$1,400
Coastal Development	CD1.2.3: Provide options to residents for reducing their carbon footprint.	2010-2011	$250
	Education & Outreach Subtotal		$6,750
$406,400	**2011-2012 Total**		

Issue	Strategy	Project Initiation	Estimated Yearly Cost
2012-2013 Cost Estimate			
Ecosystem Science			
Water Quality	WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	2007-2008	$32,000
Water Quality	WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	2007-2008	$250
Natural Resource Management	NR1.1.1: Survey and map each habitat type located within the preserve.	2010-2011	$50,000
Natural Resource Management	NR2.1.1: Monitor bird rookeries.	2006-2007	$1,500
Natural Resource Management	NR2.1.2: Monitor great land and fiddler crab locations and densities.	2011-2012	$1,400
Natural Resource Management	NR2.1.3: Monitor mangrove rivulus populations at sites documented to support great land and fiddler crabs.	2012-2013	$1,400
Natural Resource Management	NR2.1.4: Document and monitor fish aggregation, spawning, and recruitment sites within the preserve.	2010-2011	$1,300
Natural Resource Management	NR2.1.5: Monitor benthic community structure.	2010-2011	$1,300
Natural Resource Management	NR2.1.6: Assist partners with natural resource monitoring efforts.	1986-1987	$1,300
Natural Resource Management	NR2.1.7: Collaborate with academic institutions to meet research and monitoring needs.	2009-2010	$300
Natural Resource Management	NR3.1.1 Collaborate with partners to evaluate the proposal to expand the preserve boundary based on scientific data.	2010-2011	$1,000
	Ecosystem Science Subtotal		$91,750
Resource Management			
Water Quality	WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	2002-2003	$200,000
Water Quality	WQ1.2.2: Stabilize eroding shorelines using natural materials and appropriate native plants.	2010-2011	$20,000
Water Quality	WQ1.2.3: Restore oyster reefs to historic structure and function using natural, biodegradable materials.	2010-2011	$65,000
Water Quality	WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	2002-2003	$250
Water Quality	WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	2008-2009	$250
Water Quality	WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	2004-2005	$500
Water Quality	WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	2008-2009	$250
Water Quality	WQ1.3.1: Inventory stormwater retrofit systems to help identify future improvement needs.	2011-2012	$200
Water Quality	WQ1.3.2: Form a working group to address stormwater drainage issues and relevant best management practices.	2012-2013	$500
Water Quality	WQ1.3.3: Promote the standardization of local stormwater drainage ordinances.	2010-2011	$250
Water Quality	WQ1.3.4: Encourage local governments to convert high-priority areas to sewer.	2010-2011	$250
Water Quality	WQ1.3.5: Promote best management practices that maintain or improve water quality.	2010-2011	$200
Water Quality	WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	2008-2009	$250
Natural Resource Management	NR1.2.2: Maintain a comprehensive species inventory.	2007-2008	$200
Natural Resource Management	NR2.2.2: Provide resource updates to regulatory staff issuing permits within or adjacent to the preserve.	2011-2012	$400
Coastal Development	CD1.1.1: Review and provide recommendations for local comprehensive plans that address development adjacent to the preserve.	2010-2011	$250

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Coastal Development	CD1.1.2: Comment on proposed large-scale coastal developments adjacent to the North Fork St. Lucie River and its headwaters.	2010-2011	$250
Coastal Development	CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	1986-1987	$250
Coastal Development	CD1.1.4: Recommend use of soft, living shorelines to decrease erosion and protect the water quality and resources within and upstream of the preserve.	2010-2011	$250
Public Use and Access	PU1.1.1: Organize two community-based clean-up events each year.	2007-2008	$1,300
Public Use and Access	PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	2007-2008	$500
Public Use and Access	PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	2006-2007	$15,000
Public Use and Access	PU1.3.1: Facilitate regular communication with law enforcement for rapid response to illegal activities.	2011-2012	$500
Public Use and Access	PU1.3.2: Coordinate with local citizens to help patrol the preserve.	2011-2012	$1,500
	Resource Management Subtotal		$308,300
Education & Outreach			
Water Quality	WQ2.1.1 Distribute water quality information to the public and partners.	2011-2012	$400
Water Quality	WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	2008-2009	$300
Coastal Development	CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	2007-2008	$1,400
Coastal Development	CD1.2.3: Provide options to residents for reducing their carbon footprint.	2010-2011	$250
	Education & Outreach Subtotal		$2,350
$402,400	**2012-2013 Total**		

2013-2014 Cost Estimate

Ecosystem Science			
Water Quality	WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	2007-2008	$32,000
Water Quality	WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	2007-2008	$250
Natural Resource Management	NR1.3.1: Map the location of the estuarine-freshwater transition zone of the North Fork St. Lucie River every two years.	2009-2010	$1,000
Natural Resource Management	NR2.1.1: Monitor bird rookeries.	2006-2007	$1,500
Natural Resource Management	NR2.1.2: Monitor great land and fiddler crab locations and densities.	2011-2012	$1,400
Natural Resource Management	NR2.1.3: Monitor mangrove rivulus populations at sites documented to support great land and fiddler crabs.	2012-2013	$1,400
Natural Resource Management	NR2.1.4: Document and monitor fish aggregation, spawning, and recruitment sites within the preserve.	2010-2011	$1,300
Natural Resource Management	NR2.1.5: Monitor benthic community structure.	2010-2011	$1,300
Natural Resource Management	NR2.1.6: Assist partners with natural resource monitoring efforts.	1986-1987	$1,300
Natural Resource Management	NR2.1.7: Collaborate with academic institutions to meet research and monitoring needs.	2009-2010	$300
Natural Resource Management	NR3.1.1 Collaborate with partners to evaluate the proposal to expand the preserve boundary based on scientific data.	2010-2011	$1,000
	Ecosystem Science Subtotal		$42,750

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Water Quality	WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	2002-2003	$200,000
Water Quality	WQ1.2.2: Stabilize eroding shorelines using natural materials and appropriate native plants.	2010-2011	$20,000
Water Quality	WQ1.2.3: Restore oyster reefs to historic structure and function using natural, biodegradable materials.	2010-2011	$65,000
Water Quality	WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	2002-2003	$250
Water Quality	WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	2008-2009	$250
Water Quality	WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	2004-2005	$500
Water Quality	WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	2008-2009	$250
Water Quality	WQ1.3.2: Form a working group to address stormwater drainage issues and relevant best management practices.	2012-2013	$500
Water Quality	WQ1.3.3: Promote the standardization of local stormwater drainage ordinances.	2010-2011	$250
Water Quality	WQ1.3.4: Encourage local governments to convert high-priority areas to sewer.	2010-2011	$250
Water Quality	WQ1.3.5: Promote best management practices that maintain or improve water quality.	2010-2011	$200
Water Quality	WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	2008-2009	$250
Natural Resource Management	NR1.2.2: Maintain a comprehensive species inventory.	2007-2008	$200
Natural Resource Management	NR2.2.2: Provide resource updates to regulatory staff issuing permits within or adjacent to the preserve.	2011-2012	$400
Natural Resource Management	NR2.3.1: Create a non-native species database and sightings map.	2013-2014	$200
Coastal Development	CD1.1.1: Review and provide recommendations for local comprehensive plans that address development adjacent to the preserve.	2010-2011	$250
Coastal Development	CD1.1.2: Comment on proposed large-scale coastal developments adjacent to the North Fork St. Lucie River and its headwaters.	2010-2011	$250
Coastal Development	CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	1986-1987	$250
Coastal Development	CD1.1.4: Recommend use of soft, living shorelines to decrease erosion and protect the water quality and resources within and upstream of the preserve.	2010-2011	$250
Public Use and Access	PU1.1.1: Organize two community-based clean-up events each year.	2007-2008	$1,300
Public Use and Access	PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	2007-2008	$500
Public Use and Access	PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	2006-2007	$15,000
Public Use and Access	PU1.3.1: Facilitate regular communication with law enforcement for rapid response to illegal activities.	2011-2012	$500
Public Use and Access	PU1.3.2: Coordinate with local citizens to help patrol the preserve.	2011-2012	$1,500
	Resource Management Subtotal		$308,300

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Education & Outreach			
Water Quality	WQ2.1.1 Distribute water quality information to the public and partners.	2011-2012	$400
Water Quality	WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	2008-2009	$300
Water Quality	WQ2.2.2: Provide educational boat tours to inform the public about the effect of watershed practices on the preserve's natural resources.	2013-2014	$400
Water Quality	WQ2.2.5: Inform students about local issues.	2013-2014	$250
Coastal Development	CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	2007-2008	$1,400
Coastal Development	CD1.2.3: Provide options to residents for reducing their carbon footprint.	2010-2011	$250
Public Use and Access	PU1.1.6: Post signage about debris in aquatic environments at public access points.	2013-2014	$1,500
	Education & Outreach Subtotal		$4,500
$355,550	**2013-2014 Total**		

2014-2015 Cost Estimate			
Ecosystem Science			
Water Quality	WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	2007-2008	$32,000
Water Quality	WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	2007-2008	$250
Natural Resource Management	NR2.1.1: Monitor bird rookeries.	2006-2007	$1,500
Natural Resource Management	NR2.1.4: Document and monitor fish aggregation, spawning, and recruitment sites within the preserve.	2010-2011	$1,300
Natural Resource Management	NR2.1.5: Monitor benthic community structure.	2010-2011	$1,300
Natural Resource Management	NR2.1.6: Assist partners with natural resource monitoring efforts.	1986-1987	$1,300
Natural Resource Management	NR2.1.7: Collaborate with academic institutions to meet research and monitoring needs.	2009-2010	$300
Natural Resource Management	NR3.1.1 Collaborate with partners to evaluate the proposal to expand the preserve boundary based on scientific data.	2010-2011	$1,000
	Ecosystem Science Subtotal		$38,950
Resource Management			
Water Quality	WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	2002-2003	$200,000
Water Quality	WQ1.2.2: Stabilize eroding shorelines using natural materials and appropriate native plants.	2010-2011	$20,000
Water Quality	WQ1.2.3: Restore oyster reefs to historic structure and function using natural, biodegradable materials.	2010-2011	$65,000
Water Quality	WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	2002-2003	$250
Water Quality	WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	2008-2009	$250
Water Quality	WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	2004-2005	$500
Water Quality	WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	2008-2009	$250
Water Quality	WQ1.3.2: Form a working group to address stormwater drainage issues and relevant best management practices.	2012-2013	$500

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Water Quality	WQ1.3.3: Promote the standardization of local stormwater drainage ordinances.	2010-2011	$250
Water Quality	WQ1.3.4: Encourage local governments to convert high-priority areas to sewer.	2010-2011	$250
Water Quality	WQ1.3.5: Promote best management practices that maintain or improve water quality.	2010-2011	$200
Water Quality	WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	2008-2009	$250
Natural Resource Management	NR1.2.2: Maintain a comprehensive species inventory.	2007-2008	$200
Natural Resource Management	NR2.2.2: Provide resource updates to regulatory staff issuing permits within or adjacent to the preserve.	2011-2012	$400
Coastal Development	CD1.1.1: Review and provide recommendations for local comprehensive plans that address development adjacent to the preserve.	2010-2011	$250
Coastal Development	CD1.1.2: Comment on proposed large-scale coastal developments adjacent to the North Fork St. Lucie River and its headwaters.	2010-2011	$250
Coastal Development	CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	1986-1987	$250
Coastal Development	CD1.1.4: Recommend use of soft, living shorelines to decrease erosion and protect the water quality and resources within and upstream of the preserve.	2010-2011	$250
Public Use and Access	PU1.1.1: Organize two community-based clean-up events each year.	2007-2008	$1,300
Public Use and Access	PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	2007-2008	$500
Public Use and Access	PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	2006-2007	$15,000
Public Use and Access	PU1.3.1: Facilitate regular communication with law enforcement for rapid response to illegal activities.	2011-2012	$500
Public Use and Access	PU1.3.2: Coordinate with local citizens to help patrol the preserve.	2011-2012	$1,500
	Resource Management Subtotal		$308,100
Education & Outreach			
Water Quality	WQ2.1.1 Distribute water quality information to the public and partners.	2011-2012	$400
Water Quality	WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	2008-2009	$300
Water Quality	WQ2.2.2: Provide educational boat tours to inform the public about the effect of watershed practices on the preserve's natural resources.	2013-2014	$400
Water Quality	WQ2.2.5: Inform students about local issues.	2013-2014	$250
Water Quality	WQ2.2.6: Expand the Indian River Lagoon drain stenciling and signage program in highly developed areas adjacent to the preserve.	2014-2015	$10,000
Coastal Development	CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	2007-2008	$1,400
Coastal Development	CD1.2.2: Inform residents about climate change and sea-level rise, and how they could affect the preserve.	2014-2015	$250
Coastal Development	CD1.2.3: Provide options to residents for reducing their carbon footprint.	2010-2011	$250
	Education & Outreach Subtotal		$13,250
$360,300	**2014-2015 Total**		

Issue	Strategy	Project Initiation	Estimated Yearly Cost
2015-2016 Cost Estimate			
Ecosystem Science			
Water Quality	WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	2007-2008	$32,000
Water Quality	WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	2007-2008	$250
Natural Resource Management	NR1.1.2: Ground-truth habitat maps on a five-year cycle.	2015-2016	$30,000
Natural Resource Management	NR1.3.1: Map the location of the estuarine-freshwater transition zone of the North Fork St. Lucie River every two years.	2009-2010	$1,000
Natural Resource Management	NR1.3.2: Document seagrass and oyster recruitment sites within the preserve.	2015-2016	$300
Natural Resource Management	NR2.1.1: Monitor bird rookeries.	2006-2007	$1,500
Natural Resource Management	NR2.1.4: Document and monitor fish aggregation, spawning, and recruitment sites within the preserve.	2010-2011	$1,300
Natural Resource Management	NR2.1.5: Monitor benthic community structure.	2010-2011	$1,300
Natural Resource Management	NR2.1.6: Assist partners with natural resource monitoring efforts.	1986-1987	$1,300
Natural Resource Management	NR2.1.7: Collaborate with academic institutions to meet research and monitoring needs.	2009-2010	$300
Natural Resource Management	NR3.1.1 Collaborate with partners to evaluate the proposal to expand the preserve boundary based on scientific data.	2010-2011	$1,000
Public Use and Access	PU1.2.1: Document and monitor boating impacts to natural resources.	2015-2016	$500
	Ecosystem Science Subtotal		$70,750
Resource Management			
Water Quality	WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	2002-2003	$200,000
Water Quality	WQ1.2.2: Stabilize eroding shorelines using natural materials and appropriate native plants.	2010-2011	$20,000
Water Quality	WQ1.2.3: Restore oyster reefs to historic structure and function using natural, biodegradable materials.	2010-2011	$65,000
Water Quality	WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	2002-2003	$250
Water Quality	WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	2008-2009	$250
Water Quality	WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	2004-2005	$500
Water Quality	WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	2008-2009	$250
Water Quality	WQ1.3.2: Form a working group to address stormwater drainage issues and relevant best management practices.	2012-2013	$500
Water Quality	WQ1.3.3: Promote the standardization of local stormwater drainage ordinances.	2010-2011	$250
Water Quality	WQ1.3.4: Encourage local governments to convert high-priority areas to sewer.	2010-2011	$250
Water Quality	WQ1.3.5: Promote best management practices that maintain or improve water quality.	2010-2011	$200
Water Quality	WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	2008-2009	$250
Natural Resource Management	NR1.2.2: Maintain a comprehensive species inventory.	2007-2008	$200
Natural Resource Management	NR2.2.2: Provide resource updates to regulatory staff issuing permits within or adjacent to the preserve.	2011-2012	$400

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Natural Resource Management	NR2.3.2: Assist other agencies in controlling non-native aquatic species.	2015-2016	$250
Coastal Development	CD1.1.1: Review and provide recommendations for local comprehensive plans that address development adjacent to the preserve.	2010-2011	$250
Coastal Development	CD1.1.2: Comment on proposed large-scale coastal developments adjacent to the North Fork St. Lucie River and its headwaters.	2010-2011	$250
Coastal Development	CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	1986-1987	$250
Coastal Development	CD1.1.4: Recommend use of soft, living shorelines to decrease erosion and protect the water quality and resources within and upstream of the preserve.	2010-2011	$250
Public Use and Access	PU1.1.1: Organize two community-based clean-up events each year.	2007-2008	$1,300
Public Use and Access	PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	2007-2008	$500
Public Use and Access	PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	2006-2007	$15,000
Public Use and Access	PU1.3.1: Facilitate regular communication with law enforcement for rapid response to illegal activities.	2011-2012	$500
Public Use and Access	PU1.3.2: Coordinate with local citizens to help patrol the preserve.	2011-2012	$1,500
	Resource Management Subtotal		$308,350
Education & Outreach			
Water Quality	WQ2.1.1 Distribute water quality information to the public and partners.	2011-2012	$400
Water Quality	WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	2008-2009	$300
Water Quality	WQ2.2.2: Provide educational boat tours to inform the public about the effect of watershed practices on the preserve's natural resources.	2013-2014	$400
Water Quality	WQ2.2.5: Inform students about local issues.	2013-2014	$250
Coastal Development	CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	2007-2008	$1,400
Coastal Development	CD1.2.2: Inform residents about climate change and sea-level rise, and how they could affect the preserve.	2014-2015	$250
Coastal Development	CD1.2.3: Provide options to residents for reducing their carbon footprint.	2010-2011	$250
	Education & Outreach Subtotal		$3,250
$382,350	**2015-2016 Total**		

2016-2017 Cost Estimate

Ecosystem Science			
Water Quality	WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	2007-2008	$32,000
Water Quality	WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	2007-2008	$250
Natural Resource Management	NR1.1.2: Ground-truth habitat maps on a five-year cycle.	2015-2016	$30,000
Natural Resource Management	NR1.3.2: Document seagrass and oyster recruitment sites within the preserve.	2015-2016	$300
Natural Resource Management	NR2.1.1: Monitor bird rookeries.	2006-2007	$1,500

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Natural Resource Management	NR2.1.4: Document and monitor fish aggregation, spawning, and recruitment sites within the preserve.	2010-2011	$1,300
Natural Resource Management	NR2.1.5: Monitor benthic community structure.	2010-2011	$1,300
Natural Resource Management	NR2.1.6: Assist partners with natural resource monitoring efforts.	1986-1987	$1,300
Natural Resource Management	NR2.1.7: Collaborate with academic institutions to meet research and monitoring needs.	2009-2010	$300
Natural Resource Management	NR3.1.1 Collaborate with partners to evaluate the proposal to expand the preserve boundary based on scientific data.	2010-2011	$1,000
Public Use and Access	PU1.2.1: Document and monitor boating impacts to natural resources.	2015-2016	$500
	Ecosystem Science Subtotal		$69,750
Resource Management			
Water Quality	WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	2002-2003	$200,000
Water Quality	WQ1.2.2: Stabilize eroding shorelines using natural materials and appropriate native plants.	2010-2011	$20,000
Water Quality	WQ1.2.3: Restore oyster reefs to historic structure and function using natural, biodegradable materials.	2010-2011	$65,000
Water Quality	WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	2002-2003	$250
Water Quality	WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	2008-2009	$250
Water Quality	WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	2004-2005	$500
Water Quality	WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	2008-2009	$250
Water Quality	WQ1.3.2: Form a working group to address stormwater drainage issues and relevant best management practices.	2012-2013	$500
Water Quality	WQ1.3.3: Promote the standardization of local stormwater drainage ordinances.	2010-2011	$250
Water Quality	WQ1.3.4: Encourage local governments to convert high-priority areas to sewer.	2010-2011	$250
Water Quality	WQ1.3.5: Promote best management practices that maintain or improve water quality.	2010-2011	$200
Water Quality	WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	2008-2009	$250
Natural Resource Management	NR1.2.2: Maintain a comprehensive species inventory.	2007-2008	$200
Natural Resource Management	NR2.2.1: Establish a program to collect information from researchers and commercial fishermen within the preserve.	2016-2017	$300
Natural Resource Management	NR2.2.2: Provide resource updates to regulatory staff issuing permits within or adjacent to the preserve.	2011-2012	$400
Natural Resource Management	NR2.3.2: Assist other agencies in controlling non-native aquatic species.	2015-2016	$250
Coastal Development	CD1.1.1: Review and provide recommendations for local comprehensive plans that address development adjacent to the preserve.	2010-2011	$250
Coastal Development	CD1.1.2: Comment on proposed large-scale coastal developments adjacent to the North Fork St. Lucie River and its headwaters.	2010-2011	$250
Coastal Development	CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	1986-1987	$250
Coastal Development	CD1.1.4: Recommend use of soft, living shorelines to decrease erosion and protect the water quality and resources within and upstream of the preserve.	2010-2011	$250
Public Use and Access	PU1.1.1: Organize two community-based clean-up events each year.	2007-2008	$1,300

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Public Use and Access	PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	2007-2008	$500
Public Use and Access	PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	2006-2007	$15,000
Public Use and Access	PU1.3.1: Facilitate regular communication with law enforcement for rapid response to illegal activities.	2011-2012	$500
Public Use and Access	PU1.3.2: Coordinate with local citizens to help patrol the preserve.	2011-2012	$1,500
	Resource Management Subtotal		$308,650
Education & Outreach			
Water Quality	WQ2.1.1 Distribute water quality information to the public and partners.	2011-2012	$400
Water Quality	WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	2008-2009	$300
Water Quality	WQ2.2.2: Provide educational boat tours to inform the public about the effect of watershed practices on the preserve's natural resources.	2013-2014	$400
Water Quality	WQ2.2.5: Inform students about local issues.	2013-2014	$250
Coastal Development	CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	2007-2008	$1,400
Coastal Development	CD1.2.2: Inform residents about climate change and sea-level rise, and how they could affect the preserve.	2014-2015	$250
Coastal Development	CD1.2.3: Provide options to residents for reducing their carbon footprint.	2010-2011	$250
	Education & Outreach Subtotal		$3,250
$381,650	**2016-2017 Total**		

2017-2018 Cost Estimate

Ecosystem Science			
Water Quality	WQ1.1.1: Collaborate with groups collecting water quality data within the preserve to stay informed about water quality conditions.	2007-2008	$32,000
Water Quality	WQ1.1.2: Identify natural and manmade sources of toxins and pathogens in the St. Lucie River.	2007-2008	$250
Natural Resource Management	NR1.1.2: Ground-truth habitat maps on a five-year cycle.	2015-2016	$30,000
Natural Resource Management	NR1.3.1: Map the location of the estuarine-freshwater transition zone of the North Fork St. Lucie River every two years.	2009-2010	$1,000
Natural Resource Management	NR1.3.2: Document seagrass and oyster recruitment sites within the preserve.	2015-2016	$300
Natural Resource Management	NR2.1.1: Monitor bird rookeries.	2006-2007	$1,500
Natural Resource Management	NR2.1.4: Document and monitor fish aggregation, spawning, and recruitment sites within the preserve.	2010-2011	$1,300
Natural Resource Management	NR2.1.5: Monitor benthic community structure.	2010-2011	$1,300
Natural Resource Management	NR2.1.6: Assist partners with natural resource monitoring efforts.	1986-1987	$1,300
Natural Resource Management	NR2.1.7: Collaborate with academic institutions to meet research and monitoring needs.	2009-2010	$300
Natural Resource Management	NR3.1.1 Collaborate with partners to evaluate the proposal to expand the preserve boundary based on scientific data.	2010-2011	$1,000
Public Use and Access	PU1.2.1: Document and monitor boating impacts to natural resources.	2015-2016	$500
	Ecosystem Science Subtotal		$70,750

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Resource Management			
Water Quality	WQ1.2.1: Reconnect artificially isolated oxbows and floodplain habitat.	2002-2003	$200,000
Water Quality	WQ1.2.2: Stabilize eroding shorelines using natural materials and appropriate native plants.	2010-2011	$20,000
Water Quality	WQ1.2.3: Restore oyster reefs to historic structure and function using natural, biodegradable materials.	2010-2011	$65,000
Water Quality	WQ1.2.4: Support restoration efforts that will promote reestablishment of submerged grasses.	2002-2003	$250
Water Quality	WQ1.2.5: Support large-scale muck removal projects within the St. Lucie River.	2008-2009	$250
Water Quality	WQ1.2.6: Actively support Northern Everglades restoration efforts that will benefit the preserve.	2004-2005	$500
Water Quality	WQ1.2.7: Encourage incorporation of restoration strategies into other protective plans for the St. Lucie River and Indian River Lagoon.	2008-2009	$250
Water Quality	WQ1.3.2: Form a working group to address stormwater drainage issues and relevant best management practices.	2012-2013	$500
Water Quality	WQ1.3.3: Promote the standardization of local stormwater drainage ordinances.	2010-2011	$250
Water Quality	WQ1.3.4: Encourage local governments to convert high-priority areas to sewer.	2010-2011	$250
Water Quality	WQ1.3.5: Promote best management practices that maintain or improve water quality.	2010-2011	$200
Water Quality	WQ1.4.1: Identify and advocate acquisition of lands that, if protected, will have a direct benefit on the preserve's resources.	2008-2009	$250
Natural Resource Management	NR1.2.2: Maintain a comprehensive species inventory.	2007-2008	$200
Natural Resource Management	NR2.2.1: Establish a program to collect information from researchers and commercial fishermen within the preserve.	2016-2017	$300
Natural Resource Management	NR2.2.2: Provide resource updates to regulatory staff issuing permits within or adjacent to the preserve.	2011-2012	$400
Natural Resource Management	NR2.3.2: Assist other agencies in controlling non-native aquatic species.	2015-2016	$250
Coastal Development	CD1.1.1: Review and provide recommendations for local comprehensive plans that address development adjacent to the preserve.	2010-2011	$250
Coastal Development	CD1.1.2: Comment on proposed large-scale coastal developments adjacent to the North Fork St. Lucie River and its headwaters.	2010-2011	$250
Coastal Development	CD1.1.3: Comment on permit applications for construction activities on sovereign submerged lands within the preserve.	1986-1987	$250
Coastal Development	CD1.1.4: Recommend use of soft, living shorelines to decrease erosion and protect the water quality and resources within and upstream of the preserve.	2010-2011	$250
Public Use and Access	PU1.1.1: Organize two community-based clean-up events each year.	2007-2008	$1,300
Public Use and Access	PU1.1.2: Remove debris, especially monofilament line, entangled in and adjacent to bird rookeries prior to each nesting season.	2007-2008	$500
Public Use and Access	PU1.1.5: Facilitate preemptive removal of abandoned vessels and removal of derelict vessels and submerged debris within the preserve.	2006-2007	$15,000
Public Use and Access	PU1.3.1: Facilitate regular communication with law enforcement for rapid response to illegal activities.	2011-2012	$500
Public Use and Access	PU1.3.2: Coordinate with local citizens to help patrol the preserve.	2011-2012	$1,500
	Resource Management Subtotal		$308,650

Issue	Strategy	Project Initiation	Estimated Yearly Cost
Education & Outreach			
Water Quality	WQ2.1.1 Distribute water quality information to the public and partners.	2011-2012	$400
Water Quality	WQ2.2.1: Deliver presentations to promote knowledge and stewardship of the preserve to adults, children, and students.	2008-2009	$300
Water Quality	WQ2.2.2: Provide educational boat tours to inform the public about the effect of watershed practices on the preserve's natural resources.	2013-2014	$400
Water Quality	WQ2.2.5: Inform students about local issues.	2013-2014	$250
Coastal Development	CD1.2.1: Provide hands-on volunteer opportunities within the preserve to promote knowledge through personal interactions.	2007-2008	$1,400
Coastal Development	CD1.2.2: Inform residents about climate change and sea-level rise, and how they could affect the preserve.	2014-2015	$250
Coastal Development	CD1.2.3: Provide options to residents for reducing their carbon footprint.	2010-2011	$250
	Education & Outreach Subtotal		$3,250
$382,650		**2017-2018 Total**	

D.3 / Budget Summary Table

2008-2009 Cost Estimate	
Ecosystem Science Subtotal	$35,050
Resource Management Subtotal	$218,750
Education & Outreach Subtotal	$1,700
2008-2009 Total	**$255,500**

2009-2010 Cost Estimate	
Ecosystem Science Subtotal	$36,350
Resource Management Subtotal	$219,250
Education & Outreach Subtotal	$1,700
2009-2010 Total	**$257,300**

2010-2011 Cost Estimate	
Ecosystem Science Subtotal	$88,950
Resource Management Subtotal	$305,700
Education & Outreach Subtotal	$4,200
2010-2011 Total	**$398,850**

2011-2012 Cost Estimate	
Ecosystem Science Subtotal	$91,650
Resource Management Subtotal	$308,000
Education & Outreach Subtotal	$6,750
2011-2012 Total	**$406,400**

2012-2013 Cost Estimate	
Ecosystem Science Subtotal	$91,750
Resource Management Subtotal	$308,300
Education & Outreach Subtotal	$2,350
2012-2013 Total	**$402,400**

2013-2014 Cost Estimate	
Ecosystem Science Subtotal	$42,750
Resource Management Subtotal	$308,300
Education & Outreach Subtotal	$4,500
2013-2014 Total	**$355,550**

2014-2015 Cost Estimate	
Ecosystem Science Subtotal	$38,950
Resource Management Subtotal	$308,100
Education & Outreach Subtotal	$13,250
2014-2015 Total	**$360,300**

2015-2016 Cost Estimate	
Ecosystem Science Subtotal	$70,750
Resource Management Subtotal	$308,350
Education & Outreach Subtotal	$3,250
2015-2016 Total	**$382,350**

2016-2017 Cost Estimate	
Ecosystem Science Subtotal	$69,750
Resource Management Subtotal	$308,650
Education & Outreach Subtotal	$3,250
2016-2017 Total	**$381,650**

2017-2018 Cost Estimate	
Ecosystem Science Subtotal	$70,750
Resource Management Subtotal	$308,650
Education & Outreach Subtotal	$3,250
2017-2018 Total	**$382,650**

D.4 / Major Accomplishments since the Approval of the Previous Plan

The North Fork St. Lucie River Aquatic Preserve was adopted by the Trustees of the Internal Improvement Trust Fund on March 30, 1972. Until the establishment of a local field office in 1986, all aquatic preserve matters were handled in Tallahassee. Management of the field office, four southeast aquatic preserves and one state buffer preserve (from 1997 to 2004) has been overseen by five separate managers. Previous managers were interviewed to ensure that all significant management efforts have been accurately documented since adoption of 1984 management plan. Increased communication with previous managers and the public has helped to establish a foundation on which to base future management planning.

Over the first 10 years (1986-1996), activities in the preserve involved natural resource protection through the regulatory permit review process and education and outreach. Staff routinely coordinated with the regulatory division when permit applications were submitted for projects within the preserve. This included site visits of the proposed project areas and completing detailed reports for the regulatory office to review. Organization of educational canoe trips out of White City Park was historically one of the strongest outreach programs. An informative children's coloring book, Aquatic Preserves are Exceptional, was designed by Southeast Florida Aquatic Preserve staff in the early 1990s and is still produced and distributed state-wide today. Signage identifying the preserve was installed at two public boat ramps: White City Park and Veteran's Memorial Park at Rivergate. In June 1996, preserve staff also helped to establish the Stewards for the Southeast Florida Aquatic Preserves Inc., a 501(c)(3) Citizen Support Organization. The CSO projects on the North Fork St. Lucie River included boat tours, canoe trips, and clean-ups. Guided tours at the Halpatiokee Canoe and Nature Trail, exotic species removal, planting of native vegetation, and marsh reconnection were conducted adjacent to the preserve.

Although the protection and management of the natural resources within the Aquatic Preserve has always been a priority, the primary focus along the North Fork St. Lucie River since the adoption of the 1984 plan has been management of the North Fork St. Lucie River Buffer Preserve. The highlights of the work associated with the buffer preserve by the Office of Coastal and Aquatic Managed Areas (CAMA) staff include the drafting of two management plans (DEP, 1997; 2003), removal of exotic species (>$1 Million), installing fence lines and posting signage along the 967 acre property, and managing a 50 acre CARL parcel (Halpatiokee) embedded within the buffer preserve. Exotic species removal, especially Brazilian pepper and old world climbing fern (See Appendix B.4.2) occurred throughout the buffer preserve, but Halpatiokee was, and remains today, a priority parcel. Other improvements at Halpatiokee include one parking lot, educational signage, trails, boardwalks, and a canoe/kayak launch. Halpatiokee and a northern parcel at the confluence of Five and Ten Mile Creeks, the Miller-Wild parcel, are the only two public access points to the buffer preserve. Halpatiokee is the only direct access point to the Aquatic Preserve through state park lands. FNAI maps were created and ground-truthed for the buffer preserve in 2003. Management of all state buffer preserves, including the North Fork St. Lucie River Buffer Preserve, was transferred from CAMA to the Division of Land and Recreation (state parks) in 2004. The buffer preserve is now a parcel managed under Savannas Preserve State Park. A revision to the 1997 North Fork St. Lucie River Buffer was drafted prior to transfer of management to state parks. This revision has not been adopted by the Trustees and therefore only serves as an updated source of information for preserve and state park staff at this time.

Involvement with the CERP and, more specifically, the IRL-S Project became a priority for preserve staff in 2002. Due to dedicated efforts from CAMA staff, reconnection of the North Fork floodplain and oxbows is identified as a priority in the IRL-S PIR (USACE and SFWMD 2004). A cost analysis for hydrologic restoration from Prima Vista Boulevard Bridge through Ten Mile Creek was prepared by PBS&J in 2003 for DEP with St. Lucie River Issues Team, U.S. Fish and Wildlife Service Coastal Program, SFWMD, and Florida Department of Transportation mitigation monies. CAMA staff also worked with contractors to reconnect one oxbow just south of Platts Creek in 2002 and three berm breaches to rehydrate isolated floodplain approximately 1/2 mile north of Prima Vista Boulevard in 2003. Biological monitoring of fish and invertebrates associated with the restoration sites took place for three years. Shoreline stabilization along the river's edge of the three berm breech projects were completed in 2004 (See Appendix B.5.2). Research and monitoring projects designed to document the success of CERP restoration projects through the CERP Research, Coordination, and Verification (RECOVER) teams have been supported by CAMA staff as well as other agency staff within and adjacent to the preserve. These include fish studies and a floodplain vegetation study overseen by SFWMD.

Due to the improvement of Geographic Information Systems (GIS) capabilities at the field office, ArcGIS software is routinely used in all aspects of managing the North Fork St. Lucie River Aquatic Preserve. GIS gives staff the capability to better document and use the current condition data to help foster local stewardship and protect natural resources within the preserve. Access and derelict vessel surveys were performed throughout the length of the preserve in June 2007. The Southeast Florida Aquatic Preserves Field Office is currently working with DEP regulatory staff and FWC law enforcement to remove the derelict vessels located within the preserve. A GIS-based exotic species database has also been created to document and manage exotic species.

The most notable educational materials produced since 1986 for the preserve include the children's coloring book, a tri-fold brochure, and a species poster. Data created and routinely maintained by preserve staff include: 1) species list, 2) exotic species sightings database, 3) e-mail distribution list for preserve stakeholders, and 4) agency contact list for boating, wildlife, and other work-related emergencies. In 2007, staff created an advisory committee for assistance with the management plan revision process and initiated a biannual community-based clean-up program for the preserve.

The following directives were outlined in the May 22, 1984 plan:

1. field familiarization and documentation;
2. literature familiarization;
3. monitoring of plant and animal species for changes due to natural causes;
4. protection of plant and animal life from human uses of the aquatic preserve;
5. identification of research needs;
6. identify restoration needs;
7. restoration of plant and animal-based communities;
8. coordination with other researchers;
9. familiarization with and monitoring of activities and users which regularly contribute pollutants to preserve waters;
10. familiarization with the jurisdiction, personnel, and monitoring programs of government agencies and other entities;
11. monitoring of water resources by cooperative data collection and review
12. permit and lease application review for aquatic preserve uses and watershed activities that would affect the preserve resources; and
13. guideline preparation for the management of the endangered species within the aquatic preserve.

All directives, except (13) guideline preparation for the management of endangered species within the preserve, have been addressed to some extent in the management program over the past 24 years. Management of the preserve has been affected by shortage of staff, undersized annual budgets, and management responsibility over four additional preserves (three aquatic and one buffer). The St. Lucie River is receiving national, state, and local attention due to the well-documented need to improve the quality of the water. Additional staff would be the most effective way for CAMA to support these high priority efforts.

North Fork St. Lucie River Aquatic Preserve
Management Plan • August 2009 - July 2019

North Fork St. Lucie River Aquatic Preserve
3300 Lewis Street
Fort Pierce, FL 34981
772.429.2995

Florida Department of Environmental Protection
Coastal and Aquatic Managed Areas
3900 Commonwealth Blvd., MS #235
Tallahassee, FL 32399 • aquaticpreserves.org