LOXAHATCHEE RIVER BASIN WETLAND PLANNING PROJECT FOR MARTIN COUNTY

Technical Summary Document
Cooperative Agreement X994588-94-7

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For Submission to:

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August 2000

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ACRONYMS

ADID	Advanced Identification
CARL	Conservation and Recreational Lands
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
DEM	Digital Elevation Model
DEP	Florida Department of Environmental Protection
DLG	Digital Line Graph
DNR	Florida Department of Natural Resources
DOF	Florida Division of Forestry
DOT	Florida Department of Transportation
EPA	U.S. Environmental Protection Agency
ERDAS	Earth Resources Data Analysis System
ERM	Palm Beach County Environmental Resource Management
ESRI	Environmental Systems Research Institute
FAC	Florida Administrative Code
FLUCCS	Florida Land Use Cover and Classification System
FNAI	Florida Natural Areas Inventory
FS	Florida Statutes
FWC	Florida Fish and Wildlife Conservation Commission
FWPCA	Federal Water Pollution Control Act
GFWFC	Florida Game and Fresh Water Fish Commission
GIS	Geographic Information System
HGM	Hydrogeomorphic Methodology
JDSP	Jonathan Dickinson State Park
NAPP	National Aerial Photography Program
NGVD	National Geodetic Vertical Datum
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
MCCGMP	Martin County Comprehensive Growth Management Plan
MSL	Mean Sea Level
PAMP	Preserve Area Management Plan
SFWMD	South Florida Water Management District
SOR	Save Our Rivers
TCRPC	Treasure Coast Regional Planning Council
TM	Thematic Mapper
USC	U.S. Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Service
WCA	Water Catchment Area
WMA	Wildlife Management Area
WMD	Water Management District
WPA	Water Preserve Area
WRAP	Wetlands Rapid Assessment Procedure

ACKNOWLEDGMENTS

Many individuals and agencies contributed their expertise and time in the development and completion of the Loxahatchee River Basin Wetland Planning Project. With respect to project initiation and early planning stages, we thank Lorraine Roberts, Jonathan Dickinson State Park Interpretive Association; Nathaniel Reed, Florida Greenways Program; Herb Zebuth, Loxahatchee River Management Coordinating Council; Senator Bob Graham; Dan Cary, former Executive Director of TCRPC; Susan Adams, former Director of Martin County Growth Management Department; Scott Webber, Martin County Engineering Department; Martin County Commissioners Janet Gettig and Jeff Krauskopf; John Hall, Bert Heimer and Ralph Pasquale of the COE; Frank Lund, Thomas MacVicar, David Black and Paul Millar of the SFWMD; Richard Walesky, Kay Brennan and Barbara Conmy of ERM; and Rosalind Moore, Eric Hughes and Ray Cunningham of the EPA.

For assistance with project planning, wetland functional assessment development and implementation, we thank Liberta Scotto, formerly with TCRPC; Beverly Barta and Hugo Carter of the Martin County Growth Management Department; David Ferrell, USFWS; Linda Ferrell, Terry Morgan, and Tori Agramonte of the COE; John Wrublik, GFWFC; Kevin Sullivan, USDA Natural Resource Conservation Service; Richard Roberts, Alyssa Zanorcak, and Denise Janson of the Florida Park Service; Douglas Strom, Tom Monroe, and Cheryl McKee of the DEP; Boyd Gunsalus, Raymond Miller, Steve Krupa, and Kent Van Horn of the SFWMD; David Gillings and Steve Farnsworth of ERM; Denise Cromp Malone of Palm Beach County Planning Department; Jerry Fensch, Palm Beach County Soil and Water Conservation District; Sally Black of S.E. Black & Associates, Inc.; and Kevin Thames, Veronica Fasselt and Kathy Matthews of the EPA.

Appreciation is also extended to all those who participated in the public meeting process and outreach presentations, including Richard Dent of the Loxahatchee Environmental Control District for providing public meeting facilities. We also thank the John D. and Catherine T. MacArthur Foundation for providing access to properties for the field evaluation of wetlands.

The project managers and principal authors of this document are: Bradford S. Rieck, Fish and Wildlife Biologist, USFWS (representing EPA), Gary Roderick and J. Ross Wilcox, Environmental Planning Administrators, Martin County Growth Management Department, and Dewey Worth, Principal Environmental Planner, Martin County Growth Management Department. Geographic Information Systems (GIS) analysis and preparation of graphics provided by Dewey Worth. Veronica Fasselt, Environmental Scientist, EPA and Peter G. Merritt, Regional Ecologist, TCRPC provided review of a draft of this document.

AGENCY APPROVAL

The undersigned and the agencies they represent do agree with and support the contents of this document.

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U.S. Environmental Protection Agency

Colonel James G. May, District Engineer
U.S. Army Corps of Engineers

Marshal L. Wilcox, Chairman
Martin County Board of County Commissioners

EXECUTIVE SUMMARY

The Loxahatchee River Basin Wetland Planning Project was initiated in 1994 by the U.S. Environmental Protection Agency (EPA) in response to requests and support of private citizens, state agencies, and local government officials. The Martin County government was chosen to conduct the portion of the project in Martin County. At the request of Palm Beach County and EPA, the Treasure Coast Regional Planning Council (TCRPC) was selected to conduct the Palm Beach County portion of the project. The two project teams worked together as much as possible to coordinate the approach and methodologies used in the project.

The purpose of the Loxahatchee River Basin Wetland Planning Project is to identify wetlands in the Loxahatchee River Basin and provide information about the functions and values of these wetlands for planning purposes. The goals of the project are:

1. To provide information that would assist in protecting the quality and quantity of water entering the Loxahatchee River.

2. To identify, classify, and evaluate the ecological functions and values of wetlands in the project area.

3. To provide a relative ranking of the quality of wetlands in the project area based on an assessment of wetland functions.

4. To promote the protection of high quality wetlands and to identify appropriate locations for wetland restoration and mitigation.

5. To provide information useful to the U.S. Army Corps of Engineers (COE), South Florida Water Management District (SFWMD), Florida Department of Environmental Protection (DEP) and local governments in their review of dredge and fill applications and development plans.

6. To promote consistency in regulatory determinations from involved agencies.

7. To provide a document useful to private citizens, land owners, planners, developers, and agencies in promoting good planning and permitting decisions and directing development to appropriate areas.

This document and the accompanying maps are to be used for planning purposes only. The wetland boundaries shown on the maps are only approximate. These wetland boundaries and classifications do not represent official jurisdictional determinations for any state or federal agency or local government. However, this document is designed to serve as a tool for wetland protection. For example, the information provided may be useful to conservation and environmental organizations to prioritize lands for conservation. It also provides land owners, consultants, and land developers useful

information for creating site development alternatives. The functional assessment gives land use planners and government regulators a data base for land use decisions and better information to manage the remaining natural resources as a system. It is intended that the information provided will promote a more sustainable use of the land by indicating where reasonable development can be supported while minimizing the impacts to natural resources.

Project Area:

The project area chosen by the two project teams included the majority of wetlands in the watershed of the Loxahatchee River and headwater wetlands of the South Fork of the St. Lucie River. A primary consideration was to include areas with the highest potential for future development. A secondary consideration was to include areas where linkages between major wetland systems could be examined.

The portion of the project area in Martin County covers approximately 77,000 acres. It extends from U.S. Highway 1 in the east, to Cove Road in the north, to the Palm Beach County line in the south, and to a north-south line west of CR 711 in the west (Figures 1 and 2). The Palm Beach County portion of the project area includes about 65,000 acres.

Three major types of wetlands occur in the project area, including palustrine, lacustrine, and riverine wetlands. Palustrine systems are freshwater wetlands dominated by plants adapted to anaerobic substrate conditions imposed by substrate saturation or inundation during 10 percent or more of the growing season. Examples of palustrine wetlands include hydric hammock, wet flatwoods, wet prairie, marshes, swamps, and sloughs. Lacustrine systems occur as non-flowing wetlands in natural depressions lacking persistent emergent vegetation except around the perimeter. The flatwoods/prairie/marsh lake is an example of a lacustrine wetland. Riverine systems are natural, flowing waters from their source to the downstream limits of tidal influence, and bounded by channel banks. The Northwest Fork of the Loxahatchee River and the South Fork St. Lucie River are the only true riverine systems in the Project Area in Martin and Palm Beach Counties.

Wetland Evaluation and Assessment:

The project team applied a two-fold wetland assessment approach in this project. This involved: 1) a remote analysis based on the interpretation of infrared aerial photographs; and 2) a field analysis using a functional assessment methodology developed by the SFWMD. Both approaches were applied by a team comprised of agencies including: EPA, USFWS, COE, NRCS, GFWFC, DEP, SFWMD, TCRPC, ERM, and the Martin County Environmental Planning Division.

The first level of analysis of wetlands in the project area was through the interpretation of aerial photography. This type of analysis had the advantage that it could be applied equally to all wetlands within the entire project area. The most recent color infrared aerial

photographs available through the National Aerial Photograph Program and taken in 1994 and 1995 were used for this analysis. The photographs were mounted, covered with clear acetate, and displayed adjacent to one another for purposes of conducting this analysis. The project team worked together to evaluate each photograph. Photographic interpretation of adjacent land cover, drainage networks, and wetland water levels formed the basis of this remote analysis methodology, which was designed specifically for this project.

The second level of analysis of wetlands in the project area was through field inspections. The advantages to field inspections were that much greater details about the wildlife utilization, vegetation, hydrology, and water quality could be obtained than from the interpretation of aerial photography. After considering several methodologies, the project team selected the Wetland Rapid Assessment Procedure (WRAP). This procedure was selected because its variables and evaluation methods were sensitive to conditions in the project area and could be applied to a typical wetland within 1-2 hours of field time. The WRAP was applied to 46 wetlands (39 site locations) in the Martin County portion of the project area from June 19, 1997 to October 21, 1997.

Interpretation of the infrared aerial photographs resulted in the identification of areas of high, medium and low quality wetlands. These wetland quality classes were based on a composite assessment of variables such as land cover, drainage networks, and water levels to describe wetland conditions in context with the surrounding landscape. High quality wetlands were relatively pristine in condition and appeared to be well buffered from secondary development impacts (runoff, alterations in hydrology by ditching, or land disturbance). Medium quality wetlands appeared moderately degraded compared to high quality wetlands and were partially exposed to secondary development impacts. Low quality wetlands exhibited obvious signs of degradation and were strongly subjected to secondary development impacts. The NWI wetland boundaries were used to identify wetland areas. Seventy-two percent of the wetlands in the project area were classified as areas of high quality wetlands, 21 percent were classified as areas of medium quality wetlands, and three percent were classified as areas of low quality wetlands.

The largest areas of high quality wetlands occur in predominately undeveloped regions of the project area such as Jonathan Dickinson State Park, the Atlantic Coastal Ridge Ecosystem, Pal Mar, and the South Fork of the St. Lucie River (Figure 3). The largest areas of medium quality wetlands occur along the north and northwest quarters of the project area. The impacts to the wetlands are generally the result of urbanization and development of subdivisions and the impacts of semi-improved and improved pasture south of Cove Road and agricultural development both north and south of CR 708. The next largest areas of medium quality wetlands occur in the south central portion of the project area, also the result of urbanization and development of subdivisions and the impacts of semi-improved and improved pasture. These wetlands are impacted by dredge and filling or related land disturbances prior to State and County wetland protection provisions implemented in 1977 and 1982. Secondary impacts such as indirect alterations in hydrology and water quality from projects developed since 1982

may have also contributed to the loss of quality in these wetlands. The main areas of low quality wetlands include improved pasture, vegetable farmed areas, and citrus dominated agricultural areas located adjacent to Interstate 95 (I-95) and north of CR 708.

In general, the WRAP scores are consistent with and verify the results of the remote analysis. WRAP scores provide a good indication of the relative functionality and range of variation of wetland functions in different parts of the project area. For example, when WRAP is performed on 20 wetlands located in areas identified by the remote analysis as having high quality wetlands, the mean WRAP score in these areas is 0.81 with a range of 0.48 to 1.0. Of the 24 wetlands examined in areas of medium quality wetlands, the WRAP score mean is 0.67, with a range of 0.39 to 0.85. In areas of low quality wetlands, the mean WRAP score of the two wetlands examined is 0.56 with a range from 0.50 to 0.61. Usually, the wetlands that have a low WRAP score in an area of high quality wetlands are impacted by a road, ditch, or nearby canal.

Low WRAP scores are useful for identifying which wetlands are most in need of restoration. One wetland received a score of 1.0, indicating maximum functionality and minimal disturbance. This wetland is located in the Kitchen Creek area. A discussion of the WRAP scores at different locations within the project area is provided in this report.

Although numerous data sources are used in the evaluation of project wetlands, these sources are not always reliable or accurate in their description of wetland resources due to differences in spatial scale and time periods from which the data were derived. Spatial overlays combining the hydric soils data, NWI wetlands data and the TM classified wetlands provide the most comprehensive identification of potential wetlands within the project area. A composite overlay of these data also reveal some interesting patterns and weaknesses in these different data sets, which is discussed.

Restoration and Acquisition Opportunities

The main types of restoration activities that can benefit the Loxahatchee River and South Fork of the St. Lucie River are related to improving the water storage capabilities of wetlands within the river basin. Wetlands that are ditched or partially drained have a reduced hydroperiod. This negatively affects these rivers in four ways: 1) it causes unnatural surges of storm water to the river by water that can be, under natural conditions, stored in the wetland; 2) it reduces the amount of water that is eventually available to reach the river through ground water seepage; 3) it lowers the quality of the water flowing to the river by reducing the opportunities for water treatment that occur in natural wetland systems; and 4) it negatively affects the food web and habitat for fish and wildlife.

One area which warrants restoration is where the South Fork of the St. Lucie River system was connected to the Loxahatchee River system by at least two flow ways. These flow ways, which were generally aligned in a northwest to southeast direction,

converge into Kitching Creek, a northern tributary to the Loxahatchee River. These two natural flow ways are disrupted by a three mile long by one mile wide citrus grove and intersect the orange grove on its northern boundary and at its southwest corner. Storm water detention and management within the citrus grove can be modified to restore these hydrologic connections and improve river flows. A cooperative effort between the county, state and the local grower can be developed in which assistance and incentives can be provided to improve water management and restore the hydrology.

During the field work for the project, the water flows from the wetlands on the west side of Pal-Mar may be blocked by SR 711. It is recommended that the county and SFWMD conduct an investigation to determine the need and potential benefits of improving the west to east hydrological connections across SR 711. This would improve the connectivity in hydrology for Pal-Mar and reduce ponding of water west of SR 711. In addition, the SFWMD should investigate the need and potential benefits of restoring natural drainage flows from Pal-Mar to Cypress Creek through its historic route.

The Loxahatchee River and the South Fork of the St. Lucie River can benefit by increasing surface water storage within each watershed. This can help compensate for the loss of storage associated with existing development. Ideally, water stored can be released to the river basins during the dry season or periods of drought to maintain minimum base flows of surface waters. The maintenance of base flows to each river system is of primary importance to protecting these river systems.

Additionally, efforts should be made in the future during the process of permit review to encourage enhancement and restoration of the low and medium quality wetlands, which have been impacted by agricultural or urban development. Based on the current landscape position, many of these low and medium quality wetlands can be upgraded to provide expanded functions through relatively simple restoration efforts, such as exotics removal or hydrological improvements. Efforts should continue to restore and minimize the secondary impacts caused by urban and agricultural development.

The Cypress Creek area stands out as one major area containing high quality wetlands within the Project Area and is currently being considered for public acquisition. This area is located along the Martin and Palm Beach County line. About two square miles of this area occurs in Palm Beach County and two or three square miles are located in Martin County. This area is important because it has a direct drainage connection to the Northwest Fork of the Loxahatchee River through Cypress Creek. This area is interspersed with numerous marshes, cypress swamps, and wet prairies. The WRAP field assessment reveals that the hydrology of many of these wetlands is impacted by ditches associated with agricultural operations. The protection and restoration of the wetlands in the Cypress Creek Area can be extremely beneficial in improving the supply of fresh water to the Northwest Fork of the Loxahatchee River. These actions can assist in reducing salt water intrusion up the river, which is a threat especially during periods of drought. Other benefits include flood water attenuation, the protection of fish and wildlife

habitat, and enhancement of water quality. Palm Beach County and Martin County should coordinate activities to protect and restore the Cypress Creek Area.

There are presently several large areas of high quality wetlands in the Project Area that are being purchased or are purchased through the Save Our Rivers, Conservation and Recreational Lands, or Martin County Environmentally Sensitive Lands Acquisition Program. These areas include Pal-Mar, the Atlantic Ridge Ecosystem and the South Fork St. Lucie River. Martin County and the SFWMD have recently acquired major portions of both the Pal-Mar and the Atlantic Coastal Ridge Ecosystem. Portions of the South Fork of the St. Lucie River have also been acquired but additional areas should be considered to further enhance protection of the wetlands comprising the headwaters of this riverine system.

Review of the composite data overlays indicates that section 25 located north of Bridge Road (CR 708) and east of I-95 can be a beneficial and strategic location for a water storage area. This location coincides with the approximate location of the drainage divide between the South Fork of the St. Lucie River and Kitchen Creek. The pattern of hydric soils and wetlands in the adjacent sections suggest this area likely supported wetlands prior to their displacement by agriculture. This is one of the few locations where surface storage would not potentially displace other valuable wetlands. The SFWMD and county should evaluate the potential for acquisition of this land as water storage area.

Proposed Wetland Protection Polices

The Martin County Comprehensive Plan currently does not support mitigation programs as an alternative for wetland protection (see Federal, State and Martin County Wetland Policies section below). Public projects in Martin County, such as road and bridge construction, often result in the loss of wetlands through filling within the right-of-way. Martin County should consider designating the Loxahatchee River Basin Planning Project Area as a potential mitigation area for these public projects. Any mitigation requirements can be used to improve and restore wetland hydrology and habitat within this basin.

Martin County has strong local wetland protection policies and has recently adopted strong development regulations to enhance wetland protection. However, both Martin and Palm Beach Counties should consider adopting polices that emphasize coordination to jointly promote the protection and restoration of the Cypress Creek Area and Pal-Mar. Both of these areas are located partially within each county.

Another new policy Martin County should consider is to require that the water storage functions of wetlands are not lost when exemptions from protection measures are allowed. Replacement storage volumes should be required whenever exemptions are granted for development that may reduce natural wetland storage. The protection of

water storage functions of wetlands is one of the most important actions needed to ensure that hydrologic flows to the Loxahatchee River are adequately maintained.

Both the remote and field assessments utilized surrounding land use and related variables assessing the adjacent buffers in evaluating the functional status of wetlands. Especially in the field surveys, the extent and condition of adjacent uplands is a significant factor in determining site specific wetland function. Accordingly, the importance of the preservation and enhancement of larger buffer areas around wetlands should be recognized. This is especially important for those wetlands that are to be incorporated within development sites. State and federal agencies as well as local governments should strengthen their wetland buffer requirements.

Additionally, efforts should be made in the future during the process of review to enhance and restore the low and medium quality wetlands, which have been impacted by agricultural or urban development. Based on the current landscape position, many of the low and medium quality wetlands can be upgraded to provide expanded functions through relatively simple restoration efforts, such as exotics removal or hydrological improvements. Efforts should continue to restore and minimize the secondary impacts caused by urban and agricultural development.

Finally, another policy that should be considered by Martin and Palm Beach Counties is to provide incentives for private property owners to remove invasive exotic vegetation from their properties, such as reduction in taxes. State and federal agencies should assist the local governments to develop acceptable incentives that will promote the removal of invasive exotic vegetation on private properties.

INTRODUCTION

Background

The Loxahatchee River is one of the most regionally significant natural resources in southeastern Florida. The watershed of the river covers an area of approximately 210 square miles that encompasses sections of southern Martin and northern Palm Beach Counties. A portion of the river, the Northwest Fork, is designated as a National Wild and Scenic River because of its outstanding natural qualities. The Loxahatchee River is the only federally designated river in Florida (National Park Service, 1984; DEP and SFWMD, 1997).

Historically, the drainage basin of the Northwest Fork of the Loxahatchee River was comprised primarily of natural systems, including pine flatwoods interspersed with cypress sloughs, hardwood swamps, marshes and wet prairies. At present, portions of the drainage basin have been drained or redirected to discharge into other water bodies. Furthermore, much of the developed land within the remaining basin has a drainage system designed to lower the water table and remove storm water at a faster rate than under natural conditions. These changes to the drainage patterns have resulted in several problems, including excessively high flows in the river following rainfall events, and reduced base flows during the dry season. Reduced flows have allowed tidal movement of saltwater to extend up the river channel, which has altered aquatic ecosystems and caused a change in the vegetation along the river banks.

Protection and restoration of the Loxahatchee River can be accomplished by correcting drainage problems, providing additional water storage, and protecting and conserving existing wetland systems that store water and contribute to the base flow of the river. To assist in these efforts, the Loxahatchee River Basin Wetland Planning Project was initiated in 1994 by the U.S. Environmental Protection Agency (EPA) in response to requests and support of private citizens, state agencies, and local government officials. The Martin County government was chosen to conduct the portion of the project in Martin County. At the request of Palm Beach County and EPA, the Treasure Coast Regional Planning Council (TCRPC) was selected to conduct the Palm Beach County portion of the project. The two project teams worked together as much as possible to coordinate the approach and methodologies used in the project. This report describes the results and analysis of the Martin County portion of the Project Area.

Purpose and Goals of the Project

The purpose of the Loxahatchee River Basin Wetland Planning Project is to identify wetlands in the Loxahatchee River Basin and provide information about the functions and values of these wetlands for planning purposes. The goals of the project are:

1. To provide information that would assist in protecting the quality and quantity of water entering the Loxahatchee River.

2. To identify, classify, and evaluate the ecological functions and values of wetlands in the Project Area.

3. To provide a relative ranking of the quality of wetlands in the Project Area based on an assessment of wetland functions.

4. To promote the protection of high quality wetlands and to identify appropriate locations for wetland restoration and mitigation.

5. To provide information useful to the U.S. Army Corps of Engineers (COE), South Florida Water Management District (SFWMD), Florida Department of Environmental Protection (DEP) and local governments in their review of dredge and fill applications and development plans.

6. To promote consistency in regulatory determinations from involved agencies.

7. To provide a document useful to private citizens, land owners, planners, developers, and agencies in promoting good planning and permitting decisions and directing development to appropriate areas.

At both the national and state level, significant loss of wetland acreage have occurred by direct impacts since the 1950's (Tiner and Finn, 1986; Tiner *et al.*, 1994; National Research Council, 1995). As a national trend more than half of the wetlands that exist in what is now the lower 48 states have been converted to other uses. Estimated annual losses of wetlands between 1955 to 1975 total 458,000 acres per year. The rate of wetland losses has declined somewhat between 1975 and 1985, ranging from 120,000 to 290,000 acres per year (Dahl, *et. al.*, 1991). A similar pattern can be documented in Florida. From the 1950's to 1970's wetlands have been destroyed at an average annual rate of 72,000 acres per year (Frayer and Hefner, 1991). This rate of wetland destruction has slowed to an estimated 26,030 acres per year between the years of 1975 and 1985.

Section 230.80 of EPA's 404(b)(1) guidelines (40 CFR 230) allowed EPA, under the Clean Water Act Section 404 permitting authority, to identify sites that were suitable or unsuitable to receive dredged fill material. The results of such an advanced identification (ADID) program were advisory, not regulatory. Though this planning effort in Martin County was initiated under the auspices of a traditional ADID, the project team decided in early planning stages that the designations of suitable and unsuitable, with respect to wetland impacts, would not be used in this document. In the initial planning stage, it was the general consensus among the local project sponsors and the COE that these designations, with their regulatory implications, were not desirable. Instead, designations of areas of high, medium, and low quality wetlands would be presented. An additional second level functional assessment based on field visits was used to provide greater details about individual wetlands. This project was designed as a guidance tool rather than a basis for federal wetland regulatory decisions.

Jurisdictional Definition of a Wetland

In simple terms, a wetland is an area that has hydric soils, hydrophytic vegetation, and ground that is saturated with water for a portion of the year. However, because of the gradation in hydric soils, density of hydrophytic vegetation, and conditions in which saturation is detectable, identifying wetlands can be complicated in some situations. In Florida, wetlands are protected under an umbrella of federal, state, and local wetland protection provisions.

The federal definition of wetlands is described in the 1987 COE Delineation Manual (Environmental Laboratory, 1987). This document presents approaches and methods for identifying and delineating wetlands for the purposes of Section 404 of the Clean Water Act. It is designed to assist users in making wetland boundary determinations. The COE and EPA define Wetlands as:

> "*Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.*"

The 1993 Florida legislature mandated in subsection 373.421(1), Florida Statutes (FS), that the Environmental Regulatory Commission must adopt a unified statewide methodology for delineating the landward extent of wetlands and surface waters other than wetlands. The legislature developed a new statewide wetland definition for this methodology in January 1994, which is contained in Chapter 62-340, Florida Administrative Code (FAC). The legislature ratified Chapter 62-340, FAC, in Section 1 of Chapter 94-122, Laws of Florida, which was codified as section 373.4211, FS. These rules and methodologies became binding on all state agencies, including the Florida Department of Environmental Protection (DEP), the Water Management Districts, local governments, and any other Florida governmental entities on July 1, 1994. According to the State of Florida, wetlands are those areas defined in subsection 62-340.200(19), FAC as follows:

> ``*those areas that are inundated or saturated by surface water or ground water at a frequency and a duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Soils present in wetlands generally are classified as hydric or alluvial, or possess characteristics that are associated with reducing soil conditions. The prevalent vegetation in wetlands generally consists of facultative or obligate hydrophytic macrophytes that are typically adapted to areas having soil conditions described above. These species, due to morphological, physiological, or reproductive adaptations, have the ability to grow, reproduce, or persist in aquatic environments or anaerobic soil conditions. Florida wetlands generally include swamps, marshes, bayheads, bogs, cypress domes and strands, sloughs, wet prairies, riverine swamps and marshes, mangrove swamps and other similar areas. Florida wetlands generally do not include longleaf or slash pine flatwoods with an understory dominated by saw palmetto.*"

Final wetland delineations and jurisdictional determinations are dependent on the site specific conditions at the time of permit application as determined in the field by the appropriate regulatory agency. The Loxahatchee River Basin Wetland Planning Project is a planning tool and is not a final regulatory action or interpretation of land development regulations.

Wetlands Defined in Natural Community Inventories

A number of different plant community types have traditionally been classified as wetlands. Two of the more accepted plant community classification systems applicable to plant communities present within the Project Area are the Florida Natural Areas Inventory (FNAI and DNR, 1990) and the State of Florida Department of Transportation's (DOT) Florida Land Use Cover and Classification System (FLUCCS). Table 1 presents the definitions of wetlands and uplands as applied to these respective classification systems. Due to the generally flat topography of south Florida, the transition from uplands to wetlands can be subtle and varies depending on seasonal and interannual variations in hydrology. A brief description of these communities is included as APPENDIX 1 and APPENDIX 2.

Values and Functions of Wetlands

Wetland values are a measure of the importance of the wetland as a natural resource, as a benefit to ecosystem management and as a benefit to the public interest or importance to society. Many wetlands have been altered in their hydrology, water quality or vegetative composition through direct and indirect influences by man. The result of such negative alterations generally lowers habitat value to fish and wildlife, which cumulatively results in the degradation of the ecosystem, lowering the value and benefit to the public. A reduction in the function of a wetland (i.e. transfer of energy from one trophic level to the next) will ultimately lead to a reduction in its value or importance to society. Because wetlands are valued to various degrees by society, there is no precise, or general relationship between wetland functions and the value of wetlands to society. Wetland values are difficult to determine objectively and often change over time due to changing perceptions by society even when the wetland functions are constant. Values may consist of benefits to threatened or endangered species, the preservation of scarce habitats, contributions to a regional watershed plan, or even the provision of goods and services, such as timber and hunting.

Table 1. Classification of wetland and upland vegetation community types as defined in FNAI and FLUCCS systems (see APPENDICES 1 and 2 for further descriptions).

Community Type	FNAI Classification	FLUCCS Classification
Uplands	Mesic flatwoods, scrubby flatwoods, scrub, sand hill, xeric hammock, dry prairie and prairie hammock.	Pine flatwoods, hardwood-conifer mix, xeric oak, sand pine, pine-mesic oak, longleaf pine-xeric oak and tropical hardwoods.
Wetlands	Wet flatwoods, depression marsh, wet prairie, flatwoods/prairie lake, baygall, floodplain forest, slough, strand swamp, hydric hammock, swale, freshwater tidal swamp and blackwater stream.	Lakes, stream and lake swamp, slough waters, inland ponds and sloughs, mixed wetland hardwoods, bay swamps, cypress, cypress-pine-cabbage palm, wetland forested mixed, freshwater marsh, and wet prairie.

Wetland functions are the actions that are naturally performed by wetlands (Brinson 1993). Wetland functions are a result of the interactions between the physical components of wetlands such as soil, water, detritus, plants and animals with the geological, chemical and biological processes (Greeson *et. al.*, 1978) that occur in the wetland. Wetlands, which have had their functions reduced, will many times provide lower habitat value to fish and wildlife and decrease the overall values of the larger aggregate ecosystem by the accumulation of secondary impacts. The accumulation of secondary impacts on ecosystems will result in decreased benefits to the public interest (see Table 2).

Most functions fall into three broad categories: hydrologic, biogeochemical, and maintenance of habitat and food webs (Table 2). Individual wetlands function in part through interaction with adjacent portions of the landscape and with other wetlands. The connections between individual wetlands, aquatic systems, and terrestrial systems are critical to the support of many organisms.

Stronger federal permitting standards have been promulgated to protect the more significant wetland resources. The Section 404 permitting regulations (33 CFR, Section 320.4 (b)(2)) require that the permitting process identify functions that are performed by "important" wetlands that benefit the public interest. Traditionally, wetlands evaluated under the Section 404 permit process are assumed to perform functions that result in some

Table 2. Summary of wetland functions (adapted from R.D. Smith, *et al.*, 1995).

Functions Related to Hydrologic Processes	**Benefits, Products, and Services Resulting from the Wetland Function**
Short-term Storage of Surface Water: the temporary storage of surface water for short periods.	Onsite: replenish soil moisture, import/export materials, conduit for organisms. Offsite: reduce downstream peak discharge and volume and help maintain and improve water quality.
Long-term Storage of surface Water: the temporary storage of surface water for long periods.	Onsite: provide habitat and maintain physical and biogeochemical processes. Offsite: reduce dissolved solid and particulate loading and help maintain and improve surface water quality.
Storage of Subsurface Water.	Onsite: maintain biogeochemical processes. Offsite: recharge surficial aquifers and maintain baseflow and seasonal flow in streams.
Moderation of Groundwater Flow or Groundwater Discharge.	Onsite: maintain habitat. Offsite: maintain groundwater storage, baseflow, seasonal flows, and surface water temperatures.
Dissipation of Energy: the reduction of energy in moving water at the land/water interface.	Onsite: contribute to nutrient capital of ecosystem. Offsite: reduced downstream particulate loading helps to maintain or improve surface water quality..
Functions Related to Biogeochemical Processes	**Benefits, Products, and Services Resulting from the Wetland Function**
Cycling of Nutrients: the conversion of elements from one form to another through abiotic and biotic processes.	Onsite: contributes to nutrient capital of ecosystem. Offsite: reduced downstream particulate loading helps to maintain or improve surface water quality.
Removal of Elements and Compounds: the removal of nutrients, contaminants, or other elements and compounds on a short-term or long-term basis through burial, incorporation into biomass, or biochemical reactions.	Onsite: contributes to nutrients capital of ecosystem. Contaminants are removed or rendered innocuous. Offsite: reduced downstream loading helps to maintain or improve surface water quality.
Retention of Particulates: the retention of organic and inorganic particulates on a short-term or long-term basis through physical processes.	Onsite: contributes to nutrient capital of ecosystem. Offsite: reduced downstream particulate loading helps to maintain or improve surface water quality.
Export of Organic Carbon: the export of dissolved or particulate organic carbon.	Onsite: enhances decomposition and mobilization of metals. Offsite: supports aquatic food webs and downstream biogeochemical processes.
Functions Related to Habitat	**Benefits, Goods and Services Resulting from the Wetland Function**
Maintenance of Plant and Animal Communities: the maintenance of plant and animal community that is characteristic with respect to species composition, abundance, and age structure.	Onsite: maintain habitat for plants and animals (e.g., endangered species and critical habitats), for rest and agriculture products, and aesthetic, recreational, and educational opportunities. Offsite: maintain corridors between habitat islands and landscape/regional biodiversity.

direct or indirect value to the public interest (Smith, 1995). By and large these regulations, in the past, have succeeded in protecting the "biggest and best" of the remaining wetlands throughout the United States. However, through this process, impacts have often been allowed to smaller wetlands; those wetlands judged to have been already impacted by an

unrelated activity; and at times, even wetlands currently considered to be in pristine condition. The protection afforded to wetlands as a result of these allowable impacts requires compensation through wetland mitigation. The bulk of existing scientific data confirm that even small or impacted wetlands still provide valuable functions and that impacts to these wetlands should be minimized.

Use of This Planning Document

Although the Loxahatchee River Basin Wetlands Planning Study is federally funded as related to the Section 404 permitting process, it is not intended to delineate areas as being suitable or unsuitable for the placement of fill in wetlands. The functional assessment is designed to serve as a guidance tool for wetland protection and regulation of activities that may impact wetlands, either directly or indirectly.

Accordingly, the functional wetland assessment and boundaries shown on the enclosed maps are only approximate and intended for advisory purposes and have no effect on local, state, or federal laws. However, the classification maps and information on wetland quality should be used by federal, state, and local planning and regulatory agencies when making resource protection, development, and permit decisions. Moreover, this document should allow greater coordination among agencies and greater consistency in regulatory determinations. The project results should also be used by individual landowners to help avoid impacting wetlands when planning new development and useful for creating site development alternatives. This will save time and expenses in the permitting process.

The functional assessment also gives land use planners and government regulators a data base for land use decisions. The Project Area has many wetland systems still largely intact. The functional assessment provides useful information for landowners, and regulators to manage these remaining natural resources as a system. It is intended that the information provided will promote a more sustainable use of the land by indicating where reasonable development can be supported while minimizing the impacts to natural resources.

PROJECT AREA

Selection of the Project Area

The Martin County portion of the Project Area covers approximately 77,000 acres (Figure 1). It extends from U.S. Highway 1 in the east, to Cove Road in the north, to the Palm Beach County line in the south, and to a north-south line west of CR 711 in the west. The Palm Beach County portion of the Project Area includes about 65,000 acres. The northern boundary extends to the county line and matches the southern boundary of the Martin County portion of the project. The eastern boundary of the Project Area in Palm Beach County follows the Florida Turnpike. The Project Area extends south to Northlake Boulevard, and west to a north-south line that matches the western boundary of the Project Area in Martin County.

The Project Area chosen by the two project teams included the majority of wetlands within the Loxahatchee River watershed. A primary consideration in setting the study boundaries was to include areas with the highest potential for future development. A secondary consideration was to include areas where linkages between major wetland systems could be examined.

Basin Drainage Patterns

In Martin County, the center of the Project Area exhibits very shallow topographic relief except in the immediate vicinity of natural water courses or between the shallow interdunal swales and accretion ridges. Generally the water flow from the center of the Project Area either drains to the northwest to the South Fork of the St. Lucie River or to the southeast towards the Loxahatchee River (Figure 2). By comparing historical aerial photographs and topographic survey maps, it is apparent that at one time the South Fork of the St. Lucie River system was connected to the Loxahatchee River system by at least two flow ways which were generally aligned in a northwest to southeast direction and converged into Kitching Creek, which is a northern tributary to the Loxahatchee River. These two natural flow ways have both been disrupted by the presence of a three mile long by one mile wide citrus grove (Figure 2). These two flow ways intersect the orange grove on its northern boundary and at its southwest corner.

In the north half of the Project Area, the South Fork of the St. Lucie River flows north where it eventually converges with the St. Lucie Canal (C-44) and the North Fork of the St. Lucie River. At this point of convergence, the South Fork and the North Fork of the St. Lucie River become the larger St. Lucie River, which drains east into the Indian River Lagoon. The St. Lucie River and portions of its North and South Forks are also categorized as the St. Lucie Estuary, which results from the mixing of tidal waters through the St. Lucie Inlet from the Atlantic Ocean (Morris 1987). There are current efforts and considerable local support to have the South Fork of the St. Lucie River designated as an Outstanding Florida Water and as an Aquatic Preserve.

The North, Northwest, and Southwest Forks of the Loxahatchee River converge to form the mainstream of the Loxahatchee River, which generally flows east and, like the St. Lucie River, eventually flows into the Indian River Lagoon (Figure 2). The Loxahatchee River and portions of its contributing tributaries are also categorized as the Loxahatchee Estuary because of the tidal mixing through the Jupiter Inlet from the Atlantic Ocean (Law Environmental, 1991). Contributing tributaries of the Northwest Fork of the Loxahatchee include Kitching and Cypress Creeks. Portions of the northwest fork of the he Loxahatchee River are designated as an Outstanding Florida Waters, an Aquatic Preserve, and as a National Wild and Scenic River (National Park Service 1984).

A large undeveloped area known as Pal-Mar in the western portion of the Project Area historically drained eastward into Cypress Creek. However, much of the Pal-Mar basin currently lacks a positive outfall (Dames and Moore, 1989). A small area west of the river and north of Indiantown Road, including Oakwood Estates and a proposed residential development known as the Country Lakes of Jupiter, drains directly into the Northwest Fork. Immediately to the west, another small area of about two square miles drains north into Martin County and eventually flows through Cypress Creek to reach the Northwest Fork.

Major Wetland Systems in the Project Area

The largest concentrations of wetlands in the Project Area occur in locations that are primarily undeveloped or cleared of native vegetation. Several of these areas are publicly owned and are managed for recreation and the protection of natural resources. Many of the remaining undeveloped areas that are not already publicly owned are under consideration for public purchase through the Conservation and Recreational Lands (CARL) (DEP, 1997) and Save Our Rivers (SOR) (SFWMD, 1997) programs. The major wetland areas are shown in Figure 3 and described below.

Atlantic Coastal Ridge Ecosystem. This is an area of approximately 12,700 acres in eastern Martin County, located between I-95 and U.S. Highway 1. It has diverse and extensive upland and wetland systems, including wet flatwoods, marshes, forested sloughs, and coastal scrub. This area includes the headwaters of the South Fork of the St. Lucie River, North Fork of the Loxahatchee River, and Kitching Creek. Portions of the Atlantic Coastal Ridge Ecosystem are going through public purchase processes through the CARL and SOR programs. The natural resources on a portion of this area are described by TCRPC (1997) in an impact assessment of Seawind, a proposed Development of Regional Impact.

Cypress Creek Area. This is an area of about 4.5 square miles located north of Indiantown Road. A portion of this area lies within Martin County, and a portion within Palm Beach County. This forested area is interspersed with marshes, cypress swamps, and wet prairies. It forms the headwaters of Cypress Creek. This area has been approved as the Cypress Creek/Loxahatchee SOR project and an application for public purchase has been submitted to the CARL program.

Jonathan Dickinson State Park (JDSP). This state park is about 11,500 acres in southeastern Martin County. The south end of the park connects with the corridor acquired through the SOR program to protect the Loxahatchee River. The Pal-Mar CARL and SOR projects abut JDSP on its western boundary, potentially creating a greenway connecting to Corbett WMA (The Conservation Fund, 1997). The park surrounds Kitching Creek and portions of Cypress Creek, the Northwest Fork, and the North Fork of the Loxahatchee River. There are extensive wet pine flatwoods, marshes, wet prairies, and forested swamps throughout the park.

J. W. Corbett Wildlife Management Area (WMA). This 57,000-acre preserve area in northern Palm Beach County is owned and managed by the Fish and Wildlife Conservation Commission (FWC formerly the GFWFC). It is adjacent to the DuPuis Reserve, a 21,875-acre preserve area purchased through the SOR program in northwestern Palm Beach and southwestern Martin Counties (SFWMD, 1997). The natural communities include wet flatwoods, mesic flatwoods, wet prairies, marshes, cypress swamps, and some remnant portions of the northern reaches of the Everglades. The Pal-Mar CARL and SOR projects form a link between Corbett WMA and JDSP. Only the extreme eastern edge of Corbett WMA is within the Palm Beach County portion of the Project Area.

Loxahatchee River. This area includes a 1,926-acre preserve area surrounding the Loxahatchee River in northern Palm Beach and southern Martin Counties. It includes a mixture of habitats dominated by bottom land hardwoods and cypress swamps within the freshwater reaches of the river, which converge into a mangrove forest along the eastward tidal reaches of the river. Much of this property was purchased through the SOR program (SFWMD, 1997) and a portion was purchased by Palm Beach County. The property includes the historic flood plain of the Northwest Fork of the Loxahatchee River, which is designated as a National Wild and Scenic River (DEP and SFWMD 1997). This area is adjacent to the southern boundary of JDSP.

Pal-Mar. This area includes more than 37,000 acres in southern Martin and northern Palm Beach Counties. It is an extensive system of pine flatwoods, marshes and wet prairies that forms a linkage between Corbett WMA and JDSP. Much of this area will be purchased through the CARL and SOR programs. Only the eastern half of Pal-Mar is located within the Project Area.

South Fork of the St. Lucie River. This river system is located in the northwestern side of the Martin County portion of the Project Area. A preserve area of 184 acres surrounding the lower reaches of the river has been purchased through the SOR program (SFWMD, 1997). This area is adjacent to the Atlantic Coastal Ridge Ecosystem. The protection of natural connections between this area and JDSP have been discussed by the Conservation Fund (1997) and TCRPC (1997).

METHODS

Preliminary Considerations

Numerous wetland assessment procedures have been developed using a variety of approaches to determine wetland function (Adamus, 1992), but none have received wide spread use. This is because the methodologies may not always satisfy all of the ideal characteristics of a wetland assessment procedure, which include: 1) the ability to complete the approach in the time and with the resources available; 2) the ability to provide a standardized and repeatable assessment; 3) a level of technical accuracy and precision consistent with the time, resources, and information available; 4) the ability to assess a variety of wetland functions in a variety of wetland types; and 5) wide geographic applicability.

A new wetland assessment procedure that was considered for use in this project is known as the hydrogeomorphic methodology (HGM), which is being developed by the COE (Brinson 1993). This procedure is intended primarily for COE use and measures the ability of wetlands to perform specific functions (Smith *et al.*, 1995; Smith, 1995; Trott, 1997). This assessment procedure uses a hydrogeomorphic classification system to group wetlands based on geomorphic setting, water source, and hydrodynamics. HGM was not adopted for use in this project because the procedure was still under development at the time this project was initiated. In addition, it was noted that HGM was labor intensive, making it difficult to apply to many wetlands in the Project Area.

As an alternative, the project team applied a two fold wetland assessment approach. This involved: 1) a remote analysis based on the interpretation of digital satellite imagery and infrared aerial photographs; and 2) a field analysis using a functional assessment methodology developed by the SFWMD. The methodologies used in these approaches are described in the following sections of this report. Both approaches were applied by a team comprised of agencies cited in APPENDIX 5.

Data Sources

A variety of data types and sources were used in the project planning phase, field assessments and subsequent analysis of wetlands within the Project Area. These data sources provided a spatial and temporal context when assessing wetlands and valuable inferences as to possible contributing factors affecting wetland status. Additional descriptions of these data sources are provided in APPENDIX 3.

Topography. The topography of the Project Area can be examined on portions of eight U.S. Geological Survey (USGS) quadrangle maps: Rood, Palm City, Gomez, Jupiter, St. Lucie Inlet, Hobe Sound, Indian Town S.E., and West Palm Beach 2 N.E. These maps are produced at a scale of 1:24,000 and were last revised based on 1980 aerial photography. They show land use, land cover, roadways and topographic information. Many individual wetlands can be identified on these maps.

Soil Survey. The soil survey of Martin County was produced by the U.S. Department of Agriculture (McCullum and Cruz, 1981) and was based on major field work from 1968-1974. This document describes the soil types in Martin County and contains a series of maps at a scale of 1:20,000 that show soil types. The Project Area can be viewed in the original soil survey document on portions of 14 maps corresponding with sheet numbers 16-17, 24-26, 32-34, 40-42, and 47-49. The soils are mapped using 1970 aerial photography. The soil survey map shows the location of numerous wetlands. For this project, the soil series are simplified to highlight hydric soils (Figures 4 and 5) according to recommendations of the Natural Resources Conservation Service (pers. com., Ken Luidahl) and Carlisle(1995).

Land Cover. The GFWFC produced a statewide land cover map based on 1988 Landsat Thematic Mapper satellite imagery. The primary use of the GFWFC land cover maps was to identify natural communities for statewide planning efforts (Cox et al., 1994). The overall accuracy of the map is estimated at 80-90 percent. Numerous wetland communities are identifiable on this map. A 1:24,000 scale map was produced of the Project Area that shows the classified vegetative communities (Figure 6).

National Wetlands Inventory. The USFWS has prepared the National Wetlands Inventory (NWI), which is a series of maps that identifies and classifies wetlands. The NWI maps correspond with the USGS quadrangle maps, which are used as base maps for the NWI. The USFWS identified wetlands through the interpretation of 1984 aerial photography and classified wetlands according to the systems described by Cowardin *et al.*, (1979). Wetlands are identified on the maps using alphanumeric codes to indicate the type of wetland, dominant vegetation, and hydrological characteristics (Figure 7 and 8). See APPENDIX 4 for additional definitions of the corresponding codes assigned to the wetland classification.

Infrared Aerial Photography. More recent infrared aerial photographs of the Project Area were obtained from Photo Science, Inc. of Gaithersburg, Maryland. The photographs were taken between March 18, 1994 and February 2, 1995 as part of the National Aerial Photography Program (NAPP), which is a cooperative program between the USGS and participating states. Each photograph covers an area corresponding with a quarter of the USGS quadrangle map. Nine photographs were specially ordered for this project. Details concerning these photographs are provided in the next section of this report. These photographs were used extensively as a basis for comparison and evaluation of Project Area wetlands in conjunction with ground monitored sites (Figures 9 and 10).

Satellite Imagery. Martin County contracted with Environmental Systems Research Institute, Inc. (ESRI), to provide a wetland and land use characteristics analysis map using Landsat Thematic Mapping (TM) and SPOT satellite technology. The imagery data were analyzed and classified using Earth Resources Data Analysis System (ERDAS) software and converted to a GIS layer coverage using ARC/INFO GRID software. Landsat TM imagery data was obtained for July 1996 and the corresponding SPOT imagery collected in October 1996. TM bands 3, 4, 5 and 6 were used to classify land cover features based on twenty training sites. (See APPENDIX 3,

Selected Data Sources for an explanation of the satellite imagery data.) Prior to classification, the 10 meter (m) SPOT data was digitally merged with the TM bands to incorporate the higher resolution imagery as part of the classification scheme. A combined total of nine different land use and vegetation cover classes were extracted with an overall accuracy of 85 percent when compared with the independent ground truth data. Three wetland vegetation cover classes were identified and denoted as freshwater forested, brackish water forested and freshwater non-forested (Figures 11 and 12). GIS data layers representing the wetlands present in this 1996 time period were then compiled from these wetland classes for the Project Area.

Composite Data Overlays and Analysis

The TM data was employed as a major component of the wetland planning project. This TM mapping process provided information on vegetation type and soil moisture relative to the date of the imagery acquisition and other temporal data formats. The TM data was subsequently incorporated into map overlays of the hydric soils from the soil survey and the NWI data. This product was then used as a planning tool to aid in the delineation of wetlands and assess the overall spatial pattern of wetland distribution. This product was a useful guide to locating wetlands, but field delineation according to the appropriate jurisdictional definition determined the final location and extent of wetlands.

Remote Analysis

The first level of analysis of wetlands in the Project Area was through the interpretation of aerial photography. This type of analysis had the advantage that it could be applied equally to all wetlands within the entire Project Area. This was important because of the large size of the Project Area and because the project team did not have access to all properties containing wetlands. A disadvantage to this type of analysis was that certain details such as determining the exact vegetation composition in a particular wetland was not possible without a field inspection.

The most recent color infrared aerial photographs were obtained for this analysis through the USGS NAPP. The aerial photographs were taken between March 18, 1994 and February 2, 1995. The full image of each aerial photograph covered an area of approximately 25 square miles. We obtained 40 inch x 40 inch enlargements of each photograph to analyze wetlands in the entire Project Area. The photographs were mounted, covered with clear acetate, and displayed adjacent to one another for purposes of conducting this analysis.

The project team worked together to evaluate each photograph. Photographic interpretation of adjacent land cover, drainage networks, and wetland water levels formed the basis of this remote analysis methodology, which was designed specifically for this project. Various land cover boundaries, drainage features and interpretations of water storage depth were delineated on acetate overlays of the aerial photographs.

The potential influence of these factors on wetland functions within the Project Area was scored according to a qualitative ranking based on the presence and proximity of stress indicators as summarized in Table 3. The interpretation of a specific indicator and its potential impact as a stressor affecting wetland functions was based on the collective professional judgement of the team.

Table 3. Category type and rank score assigned to generalized indicators of stressors on wetland functions based on their presence and/or close proximity to wetlands.

	Stress Indicator Rank Score and Attribute		
Stress Type	**1**	**2**	**3**
Land Cover Impact	Urban	Agricultural	Natural
Drainage Impact	Major	Intermediate	Minor
Water Storage	Low	Intermediate	High

A composite score was calculated from the sum of these classification rankings to yield an overall estimate of the wetland functional impact attributed to these potential stressors. Zones having a total score of 3-4 were characterized as areas of relatively low quality (function) wetlands; 5-7 as areas of medium quality wetlands; and 8-9 as areas of high quality wetlands. The following discussion explains how these features relate to wetland functions, and how they were scored in the analysis.

Land Cover. This feature relates to the surrounding land use and condition of the land as a potential influence on wetland function. Wetlands adjacent to natural communities provide better wildlife habitat than wetlands adjacent to cleared or urban areas. Adjacent habitat is important for those species requiring a diversity of habitats in their life cycle and for those species preferring large expanses of similar habitat. Biodiversity within a wetland can be a product of the extent of surrounding natural areas. Nearby development may result in habitat fragmentation and serve as a barrier to wildlife movements. The land cover feature also is an indicator of factors affecting water quality. The surrounding land use is an indicator of the types of nutrients and other elements present in storm water runoff or seepage entering a wetland. The presence and character of a natural or partially natural upland buffer can play a large part in filtration and attenuation of pollutants before they can enter a wetland. A natural buffer may also provide valuable nutrients and detrital material to the wetland for healthy primary production in the food chain.

The land cover within a specified buffer zone near each wetland was classified as either urban, agricultural, or natural according to the predominate land use. Wetlands impacted by urban land uses such as residential/golf course, commercial, industrial, or institutional uses present within the zone received a category score of 1. Wetlands with buffer zones impacted by agriculture uses such as cleared pasture, row crops, groves,

or other agricultural land uses received a score of 2. Wetlands where buffer zones were adjacent to natural communities received a category score of 3.

Drainage Network. This feature is related to stressors on wetland functions attributed to alteration of groundwater and surface water hydrology. In general, wetlands adjacent to or intersected by ditches or drainage canals exhibit impaired functionality due to alterations in hydrology relative to those wetlands where a drainage system is not present. Typically, wetland hydroperiod and pattern of hydrology is altered by ditches and canals. Depending on the extent of ditching, a variety of wetland functions may be affected, including the structure of plant communities, wildlife utilization, and water storage functions. Stormwater retention time for water is reduced by drainage, thereby reducing the cycling of nutrients. A wetland receiving water from a ditch is also subject to an increase in sediment and pollutant load. In addition, the diversion of water that would otherwise flow through a wetland could result in significant loss of natural pollutant attenuation, thereby raising the potential of water quality degradation elsewhere in the drainage basin.

Drainage network impacts were ranked in each zone as major, intermediate, or minor with a corresponding score of 1, 2, or 3 (Table 4). The major classification was applied to zones having a series of rows or a grid pattern of ditches or roadside swales present. Most individual wetlands within this zone were intersected by one or more ditches. The intermediate classification was applied to zones where several ditches or roadside swales may have been present, but a repeating pattern of drainage ditches was not present. Some of the individual wetlands in this zone were intersected by a ditch or roadside swale. The minor classification was applied to zones having few ditches present and where most individual wetlands were not intersected by a ditch.

Wetland Water Level. This feature was directly related to the signature of water depth and storage capacity within individual wetlands. At the time the aerial photographs were taken, wetland water levels within the Project Area were relatively high. Most of the marshes and wet prairies in undeveloped portions of the Project Area were filled with water and were identified by a characteristic dark color on the infrared aerial photographs due to the light absorption quality of water. Wetlands of a similar type, but with greatly reduced water levels due to drainage activities, typically appeared much lighter in hue. Lower water levels were an indicator of reduced hydrology function compared to similar wetland types having deeper water depths and hence, potentially more seasonally stable hydroperiod. A reduction in depth, duration, frequency of wetland inundation could manifest itself in an increase of exotic, nuisance, or inappropriate plant species, as well as a decrease in distribution and abundance of aquatic invertebrates and vertebrates. Organic decomposition rates, nutrient cycling pathways, and primary and secondary production could be significantly disrupted. In some instances, reduced water levels could sever wetland ecosystem connectivity, isolating wetlands that were historically interconnected.

A light classification was applied to zones in which most individual wetlands appeared lighter in color than undisturbed wetlands of a similar type, indicating a reduced water level. The NWI Wetland Classification was used to assist in identifying wetlands of a

similar type. The intermediate classification was applied to zones where only some of the wetlands appeared lighter in color than undisturbed wetlands of a similar type, indicating a partially reduced water level. The high classification was applied to zones where most individual wetlands within the zone appeared dark in color or otherwise natural in appearance, typical of similar wetlands known to be relatively undisturbed. Light wetland color was assigned a score of 1, intermediate a score of 2, and dark a score of 3. This color-based variable was not as sensitive to forested wetlands, including wet pine flatwoods, in terms of quality evaluation.

Field Analysis

A second level of wetland analysis in the Project Area was conducted through a field inspection. Additional details about the wildlife utilization, vegetation, hydrology, and water quality was needed to ground truth the aerial photography interpretation. After considering several methodologies the project team selected the Wetland Rapid Assessment Procedure (WRAP) developed by the SFWMD (Miller and Gunsalus, 1997). This procedure was selected for several reasons. It was regionally tailored for freshwater wetlands in southern Florida. Its variable selection and associated descriptor were sensitive to conditions in the Project Area. It incorporated use of easily obtainable existing data, effectively addressed ecological and anthropogenic factors in wetland function and could be done within 1-2 hours of field time. Furthermore, the developers of WRAP had performed statistical analyses demonstrating that results were highly repeatable. Most of the variation in WRAP scores were attributable to wetland differences and not the result of variations in the way wetlands were scored by the individuals conducting the assessment (Miller and Gunsalus, 1997).

The WRAP was applied to 46 wetlands (39 site locations) in the Martin County portion of the Project Area from June 19, 1997 to October 21, 1997 (Figure 13). These study sites were selected based on their high potential for development and to reflect a representative sampling of the remotely classified high, medium, or low quality wetlands.

Authors of the WRAP technique accompanied the project team in the field on several occasions and provided assistance to ensure that the WRAP analysis was conducted properly. Prior to visiting a wetland, field personnel examined available maps and aerial photographs to determine adjacent land uses to assist in evaluating the potential wetland impacts. The project team also examined other data such as soil survey maps and National Wetland Inventory (NWI) maps. Each wetland was visited by 3-10 members of the project team. The amount of time spent in each wetland varied, depending on the size of the wetland. Generally, the team members would divide into small groups and spread out, walking a minimum of 50 percent of the wetland perimeter. In some situations where the wetland was extremely large, inspection of 100 percent of the wetland perimeter was not possible. In these circumstances, the WRAP analysis was only applied to that portion of the wetland visited by the project team.

From field observations, each of the wetlands was scored based on the evaluation of seven variables, including: 1) wildlife utilization; 2) wetland overstory/shrub canopy; 3) wetland vegetative ground cover; 4) adjacent buffer; 5) exotic and nuisance plants; 6) wetland hydrology; and 7) water quality inputs and treatment systems (Table 4). Team members separately evaluated each wetland for the above variables. After examining each wetland, the project team members gathered together at the edge of the wetland and formulated a consensus opinion about what score should be assigned for each variable. The determination of scores followed the guidelines detailed in Miller and Gunsalus (1997). All scores were assigned in half point intervals. For example, a wetland received a score of 2.5 for wildlife utilization if the team members judged the wetland to have above moderate, but less than strong evidence of wildlife utilization. An overall score was calculated by summing the values of the seven variables and dividing the total by 21, the highest possible score if all of the variables received a score of 3. In cases where a variable such as the wetland overstory/shrub canopy was determined to be not applicable, then the total was divided by the revised maximum possible points. This procedure yielded an overall WRAP score ranging from 0 to 1 for each wetland.

The following sections provide an outline of the scoring procedure for each variable. A more detailed description of these variables and examples of characteristics to be considered in assigning scores is provided in Miller and Gunsalus (1997).

Wildlife Utilization. The wildlife utilization variable evaluates observations and signs (i.e. scat, tracks, etc.) of wildlife use, primarily by wetland dependent species. In addition, it also addresses potential wildlife use through the presence or absence of wildlife food sources, nesting areas, roosting areas, den trees and protective cover. If the wetland exhibits no evidence of wildlife utilization it receives a score of 0; minimal evidence of wildlife utilization, a score of 1; moderate evidence of wildlife utilization, a score of 2; and strong evidence of wildlife utilization, a score of 3.

Wetland Overstory/Shrub Canopy of Desirable Species. The wetland overstory/shrub canopy variable evaluates the presence, health and appropriateness of the wetland's shrub and overstory canopy. The functional assessment of the canopy strata is objectively evaluated based on food, cover, nesting potential, and appropriateness of the vegetative community. The canopy strata is evaluated based on the habitat type. This variable may not be applicable to freshwater marsh and wet prairie habitats where overstory/shrub canopy are typically not present. Undesirable plant species include exotic and nuisance plant species. If the wetland has no desirable wetland overstory/shrub canopy trees present it receives a score of 0; if it has few of these types of canopy trees present, a score of 1; a moderate amount of desirable wetland overstory/shrub canopy trees present, a score of 2; and an abundant amount of desirable canopy trees present, a score of 3. This variable is not applied when the wetland has less than 20 percent coverage by canopy/shrub species.

Table 4. Category type and rank score assigned to generalized indicators of stressors on wetland variables based on their presence and/or close proximity to wetlands.

	Rank Score of Attribute			
Variables	**0**	**1**	**2**	**3**
Wildlife Utilization	none	minimal	moderate	strong
Vegetative Overstory/ Shrub Canopy	none	few desirable	moderate	abundant
Vegetative Ground Cover	none (<25%)	minimal (~50%)	moderate (~75%)	abundant (>90%)
Adjacent Buffer	none	width <30 ft few undesirable species present	width >30<300 ft mostly desirable species	width >300 ft mostly desirable species
Exotic/Nuisance Plants	abundant (>75%)	strong (~50%)	moderate (<25%)	none (<10%)
Wetland Hydrology	severely altered	inadequate	adequate with external affects	adequate no external affects
	Land Use Input Rank Score and Attribute			
	1	**1.5**	**2**	**3**
Water Quality Input*	highway/ improved pasture	single family residence/ golf course	low density residence/ unimproved pasture	recreation/ open space
	Water Quality Treatment Rank Score and Attribute			
Water Quality Treatment*	**0** none	**1** grass swales only or dry retention only (combination grass swale with dry retention = 2)	**2.5** separation berms; wet detention with swales; wet and dry detention	**3** natural undeveloped

* The scores from the land use input category and the treatment categories were averaged to provide one final score for the water quality inputs and treatment category.

Wetland Vegetative Ground Cover. The vegetative ground cover variable evaluates the presence, abundance, appropriateness and condition of vegetative ground cover within the wetland. Undesirable plant species include exotic and nuisance plant species. If the wetland has no desirable vegetative ground cover present (i.e., greater than 75 percent of undesirable vegetation), it receives a score of 0; minimal desirable

vegetative ground cover present (i.e., approximately 50 percent undesirable vegetation), a score of 1; a moderate amount of desirable vegetative ground cover present (i.e., less than 25 percent undesirable vegetation), a score of 2; and abundant desirable vegetative ground cover present (less than 10 percent nuisance and inappropriate plant species), a score of 3.

Adjacent Upland/Wetland Buffer. This variable evaluates the area adjacent to the subject wetland and the landscape setting of the wetland. This variable is evaluated based on the adjacent buffer size and the ecological attributes (i.e. cover, food source and roosting areas for wildlife) that this area is providing in association with the wetland that is being assessed. If the wetland has no adjacent upland/wetland buffer, it receives a score of 0; adjacent upland/wetland buffer averages 30 feet or less containing desirable or undesirable plant species, a score of 1; adjacent upland/wetland buffer averages greater than 30 feet but less than 300 feet containing predominantly desirable plant species, a score of 2; adjacent upland/wetland buffer averages greater than 300 feet containing predominantly desirable plant species, a score of 3.

Field Indicators of Wetland Hydrology. This variable evaluates the hydrologic regime based on observed field indicators for the subject wetland. The evaluation considers hydroperiod duration and magnitude. It is generally interpreted by using vegetative indicators and other signs of altered hydrology such as the encroachment of upland and transitional plant species into the wetland. In addition, hydrologic indicators such as lichen lines, algal mats, adventitious roots and basal scarring are also utilized. If the hydrologic regime of the wetland has become severely altered with strong evidence of succession to transitional, upland, or open water plant communities it receives a score of 0; the hydrologic regime is inadequate to maintain a viable wetland, a score of 1; the hydrologic regime is adequate to maintain a viable wetland system, but external features may affect wetland hydrology, a score of 2; and the hydrologic regime is adequate to maintain a viable wetland system, a score of 3.

Water Quality Inputs and Treatment. The water quality variable evaluates the water quality runoff into the subject wetland from adjacent land uses. This variable evaluates the percent and type of surrounding land uses as well as any pretreatment of surface waters prior to the discharge into wetlands. Fifty percent of this score is based on the land use category, and 50 percent is based on the treatment category. Scores for land use types encountered in this project are as follows: recreation/open space receives a score of 3; unimproved pasture, a score of 2; low density residential, a score of 2; single family residential, a score of 1.5; golf courses, a score of 1.5; highway, a score of 1; and improved pasture, a score of 1. The scores for the treatment category include the following: natural undeveloped area, a score of 3; berms which prevent runoff from entering a wetland, a score of 2.5; wet detention with swales, a score of 2.5; wet detention with dry retention, a score of 2.5; combination grass swale with dry retention, a score of 2; grass swales only, a score of 1; dry retention only, a score of 1; and no treatment, a score of 0. The scores from the land use category and the treatment categories are averaged to provide one final score for the water quality inputs and treatment category.

RESULTS AND DISCUSSION

Wetland Landscape Setting

Physiographic Features. The Project Area includes several unique physiographic features which frame and influence the Project Area wetlands. These features include the Atlantic Coastal Ridge, the South Fork of the St. Lucie River, the Loxahatchee River and Jonathan Dickinson State Park (Figure 14). The Project Area also includes a series of geologic interdunal swales that are separated by parallel accretion ridges which are generally aligned in a north to south direction.

U.S. Highway 1 is generally positioned on top of the Atlantic Coastal Ridge which borders the eastern side of the Project Area. The Atlantic Coastal Ridge consists of dunes, beaches and bars which were formed by sands deposited through sedimentation and biogenesis in shallow seas, approximately 1.6 to 0.01 million years ago during the Pleistocene and Holocene Epochs (Fernald, 1989). The elevation of the ridge varies from approximately 25 feet to 85 feet Mean Sea Level (MSL). The soils supporting the ridge are nearly pure siliceous sand and these sands drain extremely well.

Jonathan Dickinson State Park includes over 10,000 acres of mainly pristine Florida Coastal habitat and is located in the southeast corner of the Project Area in Martin County.

Land Use. The land use to the north of the Project Area is urban as a result of the town of Port Salerno and the City of Stuart (Figure 15). Urban activity is also located on the eastern side of the Project Area as a result of U.S. Highway 1, which connects the towns of Hobe Sound and Tequesta. U.S. Highway 1 also supports urban development on the east side of the Project Area in the form of non-residential uses of strip development, and residential subdivisions, which are constructed east and west of U.S. Highway 1. This highway provides a major transportation conveyance link between north and south urbane components of this area.

The majority of the Project Area can be categorized as large private ranches adjacent to improved and semi improved agricultural uses. Cattle and citrus production comprise the majority of agricultural activity in the Project Area. Large tracts of land within the Project Area are still in a natural condition with the only man made impacts being the result of minor water control facilities.

The land use within the southern portion of the Project Area consists of low density residential development and semi improved pasture, unimproved pasture, and undeveloped natural vegetative communities (Figure 15). The land use on the western portion of the Project Area includes two major traffic facilities; I-95 and the Florida Turnpike. Other land uses on the western side of the Project Area are mainly rural in nature such as citrus groves, improved pasture, semi improved pasture, unimproved pasture, a few row crops and undeveloped natural vegetative communities. A portion of

the Project Area in Martin County also includes several sections of land that are part of the State of Florida Conservation and Recreational Lands (CARL) purchase program known as the Pal-Mar tract.

The center of the Project Area in Martin County is bisected into north and south parcels by a two lane road, which runs east to west and is known as Bridge Road (CR-708). Bridge Road currently provides access to some commercial and industrial zoned lands. It is anticipated that U.S. Highway 1, Cove and Bridge Roads will all provide future radiating corridor areas that will result in the highest probabilities for future wetland impacts from human activity.

General Topography. Many of the numerous depressions occupied by wetlands in the Project Area are visible on the USGS quadrangle topographic maps. However, because of the narrow range of topography in the Project Area, these maps are of limited value in evaluating wetlands. The relatively flat topography contributes to the poor drainage and widespread presence of wetlands in the Project Area.

The topography of the eastern portions of the Project Area varies in elevation from 25 to 85 feet MSL and can be categorized as ridge and swale. The most eastern portion of the Project Area follows along the Atlantic Coastal Ridge which runs the entire length of the Project Area (Figure 14). Proceeding west from the ridge, the land form drops in elevation into a series of lake swamp and flatwood ridges, which are the result of interdunal swales being separated by accumulation of sand most likely accreted in the Pleistocene and Holocene epochs.

Starting at the eastern edge of the Project Area, the first stream and lake swamp system includes the wetland system connecting Banner Lake through Hobe Sound Country Club and the wetland system of the Medalist Golf Club. The second ridge is vegetated with an extensive natural scrub community and varies in elevation from 25 to 30 feet MSL. The second ridge drops off to the west into a second stream and lake swamp system. Both of these stream and lake swamp systems appear to receive a significant amount of seepage flow from the western side of the Atlantic Coastal Ridge. These two stream and lake systems eventually converge within Jonathan Dickinson State Park and flow to the North Fork of the Loxahatchee River (Figure 14).

Further west, the topography rises gently to a third and wider scrub ridge with elevations generally from 18 to 25 feet MSL. The topography then drops gently to the west into a very broad and flat plain that is generally 14 to 16 feet MSL. This flat plain is vegetated with pine flatwoods. This plain extends west to the depressions, which link the South Fork of the St. Lucie River to the Northwest Fork of the Loxahatchee River. This pine palmetto flatwoods plain is honeycombed with cypress heads, wet prairies and fresh water depression marshes.

The scrub habitat on the eastern portion of the Project Area and located on the ridges is a very significant natural community, because of its status as a rare, unique and

endangered habitat. The ridges are roughly parallel to each other. These ridges exhibit a high quality xeric oak and pine mesic oak habitat (Figure 6).

Soils and Ground Cover Associations. Soil types and the related water bearing characteristics are closely linked to the vegetation plant communities found scattered throughout the Project Area. A generalized description of these associations is summarized below.

Ridge Associations: The Atlantic Coastal Ridge is comprised generally of Salerno, Jonathan and Hobe soils, which are characterized as nearly level to gently sloping, poorly drained, moderately drained, moderately well drained, and somewhat excessively drained soils that have a dark colored, weakly cemented, dominantly sandy subsoil below a depth of 50 inches. This ridge is dominated by a sand pine (*Pinus clausa*) overstory. The under story is dominated by myrtle oak (*Quercus myrtifolia*), sand live oak (*Quercus geminata*), and Chapman's oak (*Quercus chapmanii*). The ridge also supports Florida rosemary (*Ceratiola ericoides*) and some scrub hickory (*Carya floridana*). Some of the characteristic shrubs include fetterbush (*Lyonia lucida*), shiny blueberry (*Vaccinium myrsinites*), staggerbush (*Lyonia fruticosa*), saw palmetto (*Serona repens*), and pawpaw (*Asimina reticulata*). This is also the probable habitat for the four petaled pawpaw (*Asimina tetramera*) although no specific specimens were confirmed during the study.

The ground cover of the Atlantic Coastal Ridge generally includes: prickly pear cactus *(Opuntia humifusa)*, tread softly (*Cnidoscolus stimulosus*), wire weed (*Polygonella* sp.), pineweeds (*Lechea* sp.), large flowered rosemary (*Conradina grandiflora*), yellow buttons (*Balduina angustifolia*), panic grass (*Dicanthelium sabulorum*), penny royal (*Piloblephis rigida*), blazing star (*Liatris chapmanii*), milk pea (*Galactia volubilis*), blue eyed grass (*Sisyrinchium solstitiale*), corkscrew threeawn (*Artiostida gyrans*), and reindeer moss (*Cladina* sp.).

Portions of the secondary ridges located west of the Atlantic Coastal Ridge contain very good quality xeric oak habitat. The soils consist of St. Lucie sand and Satellite Variant sand. These ridges although not as high as the primary Atlantic Coastal Ridge, still support similar understory and ground cover and an overstory comprised of scrub hickory, myrtle oak, sand live oak and Chapman's oak.

Sloughs: The ridges are separated by open water areas, which are described as broad slough, lake swamps, and associated freshwater depression marshes. These open water areas are generally more uniform and well defined than the secondary ridges, which are interrupted with presence of freshwater depression marshes. The dominant species of these systems generally include: maidencane (*Panicum hemitomon*), St. John's wort (*Hypericum fasciculatum*), various rushes (*Juncus* sp.), chainfern (*Woodwardia virginica*), red root (*Lacnanthes caroliniana*), yellow eyed grass (*Xyris sp.*), bladderworts (*Utricularia* sp.), saw grass (*Cladium jamaicense*), willow (*Salix caroliniana*), pickerelweed (*Pontederia cordata*), arrowhead (*Sagittaria* sp.), primrose willow (*Ludwigia* sp.), fireflag (*Thalia geniculata*) and leather fern (*Blechnum serrulatum*).

Flatwoods: Pine mesic flatwoods and palmetto prairies occupy the higher elevation landforms that straddle open marshes. These forested areas are comprised of an overstory of slash pine (*Pinus elliottii*) and cabbage palms (*Sabal palmetto*), with an understory of saw palmetto, gallberry (*Ilex glabra*), fetterbush, St. Johns wort, wax myrtle, and dahoon holly (*Ilex cassine*). The ground cover includes: wire grass, brackenfern (*Pteridium aquilinum*), meadowbeauty (*Rhexia nuttallii*), yellow eyed grass, short spike bluestem (*Andropogon brachystachyus*), yellow star grass (*Hypoxis juncea*), leather fern, and joint grass (*Coelorachis tuberculosa*).

West of the ridge and depression system, the topography develops into flatwoods, which is characterized by a mosaic of freshwater depression marsh wetlands. These flatwoods extend to the western boundary of the Project Area and are interrupted only by the two sloughs, which historically connected the South Fork of the St. Lucie River to the Loxahatchee River.

The soils of this flatwoods area are comprised of Wabasso, Riviera and Oldsmar associated soils. These soils are nearly level, poorly drained soils; most are sandy to depths of 20 to 40 inches. However, some are sandy to a depth of more than 40 inches; most have a subsoil that is dark colored and sandy in the upper part and loamy in the lower part. The flatwoods are dominated with an overstory of slash pine with an occasional sabal palm. This typical Florida flatwoods system is characterized by a lower density of slash pine and saw palmetto and a higher density of herbaceous vegetation than the mesic flatwoods and palmetto prairies described above. The dominant shrub understory of this community includes: gallberry, tarflower (*Befaria racemosa*), and wax myrtle. The dominant herbaceous vegetation within this community includes: wire grass (*Aristida sp.*), bracken fern, meadowbeauty, yellow eyed grass, short spike bluestem, yellow star grass, and creeping bluestem (*Schizachyrium stoloniferum*).

Depression Marshes: The vegetation of freshwater depression marsh wetlands, which form a mosaic within the pine palmetto flatwoods, are generally dominated by: maidencane, rushes (*Scirpus sp.*), broom sedge (*Andropogon* sp.), wax myrtle, marsh pink (*Sabatia sp.*), beak rushes (*Rhynchospora* sp.), sedges (*Carex* sp.), bog buttons (*Lachnocaulon anceps*), meadowbeauty (*Rhexia* sp.), cordgrass (*Spartina bakeri*), hedge hyssop (*Gratiola ramosa*), water hyssop (*Bacopa ssp.*), hat pins (*Eriocaulon decangulare*), bracken fern, pink sundew (*Drosera capillaris*), St. Johns wort, yellow eyed grass, bladderwort (*Utricularia* sp.), pickerelweed, arrowhead, primrose willow and buttonbush (*Cephalanthus occidentalis*).

Mixed Hardwood Forests: Portions of the broad sloughs, stream and lake swamp systems also exhibit areas of mixed wetland hardwoods. Generally where the mixed wetland hardwoods exist, they can be considered as good quality forested wetlands. These areas consist of cypress, (*Taxodium* sp.), red maple (*Acer rubrum*), red bay (*Persea borbinia*), cabbage palm, pop ash (*Fraxinus caroliniana*), wax myrtle, hackberry (*Celtis laevigata*), willow, loblolly bay (*Gordonia lasianthus*), swamp bay (*Persea palustris*), sweet bay (*Magnolia virginiana*), dahoon holly, laurel oak (*Quercus laurifolia*), and water hickory (*Carya aquatica*).

Comparison of Remote and Field Assessments for Wetlands

Appendix 5 includes a summary sheet and other information for each of the wetlands in which WRAP was conducted (Figure 16). Overall WRAP scores of the wetlands examined in the Project Area had a mean of 0.72 with a range of 0.39 to 1.0. One wetland received a score of 1.0, indicating maximum function and minimal disturbance. This wetland was located in Jonathan Dickinson State Park. The site with the lowest score of 0.39, indicating low wetland functions, was located within a rural ranchette subdivision located in the south central Project Area. This site was identified as a wetland on the NWI maps and appeared to have been excavated. Inspection of the soil survey photograph indicated that a natural wetland formerly occupied this site.

Remote analysis using the infrared aerial photographs resulted in the identification of areas of high, medium and low quality wetlands (Figures 17 and 18). The NWI wetland boundaries were used as the reference to display these areas in the GIS database. The analysis of the data for wetlands in the Project Area indicated that 72 percent were classified as high quality wetlands, 21 percent were classified as medium quality wetlands, and three percent were classified as low quality wetlands.

The largest areas of high quality wetlands occur in predominately undeveloped regions of the Project Area, such as Jonathan Dickinson State Park, The Atlantic Coastal Ridge Ecosystem, Pal-Mar, the South Fork of the St. Lucie River and the Northwest and North Forks of the Loxahatchee River. Generally, these high quality systems have not been directly altered in their hydrology by surface drainage ditches that are prominent throughout most of the study area. Although numerous drainage ditches have been previously constructed within the Pal-Mar wetlands region, there have been little affect on the surrounding wetlands due to a lack of positive discharge for these drainage features.

The largest areas of medium quality wetlands occurred along the north and northwest portions of the Project Area. These wetlands have been impacted by urbanization and development of subdivisions, semi-improved and improved pasture south of Cove Road, and agricultural development both north and south of CR 708. The next largest area of medium quality wetlands occurred in the south central portion of the Project Area, also impacted by urbanization, development of subdivisions, and semi-improved and improved pasture. These wetlands are impacted by dredging and filling or related land disturbances prior to State and County wetland protection provisions implemented in 1977 and 1982. Secondary impacts, such as indirect alterations in hydrology and water quality from projects developed since 1982 may have also contributed to the loss of quality in these wetlands.

The predominant areas of low quality wetlands included improved pasture, vegetable farmed areas, and citrus agricultural development areas located adjacent to I-95 and north of CR 708. These wetland areas have largely been altered in hydrology by extensive drainage activities in and around these wetlands. Natural buffer areas around these wetlands were often minimal or included highly disturbed areas from past or present agricultural activities.

In general, the WRAP scores are consistent with and verified the results of the remote analysis (Table 5). The locations identified as areas of high quality wetlands typically have a higher WRAP mean score of 0.81, with a range of 0.48 to 1.0 for wetland functionality. The mean WRAP score within areas remotely designated as medium quality wetland is 0.67 with a range of 0.39 to 0.85 for wetland functionality. The mean WRAP score within areas designated remotely as low quality wetlands is 0.56, with a range of 0.50 to 0.61 for wetland functionality. On some sites, the WRAP scores show a high degree of variability. Usually, the wetlands having low WRAP scores in areas of otherwise high quality wetlands are impacted by a road, ditch, or nearby canal. Low WRAP scores are useful for identifying wetlands which are most in need of restoration. The major locations in the Project Area that are identified as potential restoration areas are discussed later.

Table 5. Summary of the wetland quality analysis based on remote and field assessments (n = number sample sites comprising the mean score).

	Remote Quality Assessment Category		
	High	**Medium**	**Low**
Number of Wetlands	1,944	1,057	250
Total Acres	15,733.8	4,475.0	615.2
Percent of Project Area	72%	21%	3%
Corresponding WRAP Score for Remote Categories			
WRAP Score Range	0.48 - 1.0	0.39 - 0.85	0.50 - 0.61
WRAP Score Mean (n)	0.81 (20)	0.67 (24)	0.56 (2)

In two instances, wetland areas which received lower WRAP functioning scores actually received medium and high remote designations. The first area was the most southerly portion of the South Fork of the St. Lucie River (vicinity of Bridge Road), which intersects an orange grove. This area received a WRAP score of 0.48 (WRAP site 13; see Figure 13) for existing functionality because of the hydrology and subcanopy vegetational impacts to this area as a result of the existence of the grove. In another example, a wetland area, which is part of Roebuck Creek located off of SR-76, received a WRAP score of 0.45 for existing wetland functionality. This area was heavily impacted by adjacent urban development resulting in alterations to the wetland hydrology, which was accompanied by exotic plant and nuisance plant species infestation. However, like the previous example, the hardwood canopy, which defines this area and the potential for this area to be restored, resulted in a medium rating.

Statistical comparison of the WRAP scores with the remote assessment of wetland functions was not appropriate because the wetlands used in the field analyses were not chosen randomly. While the opportunity to conduct site visits was restricted to accessibility, the project team determined that greater benefits for the project could be achieved by conducting WRAP evaluations in selected areas. Within these areas, wetlands were chosen that appeared to be typical of other wetlands in the area. Also, when there was an opportunity, wetlands exemplifying the extremes in wetland condition (e.g., pristine compared to highly impacted) were selected.

Wetland Quality of Major Locations in the Project Area

The following section describes the major wetland locations within the Project Area and summarizes the WRAP score results for selected sites together with the remote aerial photo assessment of the surrounding wetland quality. Table 6 summarizes the quality designation and associated WRAP score assigned to the site locations where the WRAP assessment was conducted. Refer to Figure 13 for the site locations of the

WRAP assessments. Figures 17 and 18 depict the wetland quality based on the remote analysis.

Poinciana Gardens Area (WRAP Sites 1-3).

This area is located just west of Highway US-1 and includes sections 8 and 9 (Figure 13). The surrounding land use includes medium density residential development (Poinciana Gardens, see Figure 17) adjacent to undeveloped land parcels. The uplands community is predominantly pine flatwoods/palmetto mixture. WRAP sites 1-3 were selected in this area due to the high potential for future development. Highway US-1 is located just east of these study areas. WRAP scores for these wetlands are highly variable (ranging from 0.58 to 0.90) depending on the proximity to US-1 and alterations in hydrology due to local road drainage. Exotics such as melaleuca (*Melaleuca quinquenervia*) and downy rose myrtle (*Rhodomyrtus tomentosus*) are invading the adjoining wetlands along US-1.

The remote analysis concludes that wetland quality increased with increasing distance from US-1 (Figure 17). Larger depressional wetlands are located further west of the coastal ridge and appear in good condition. Correction of drainage impacts and control of exotics can improve wetland quality for those wetlands located along US-1.

Hobe Golf Club/Eaglewood & East Bridge Road (WRAP Sites 4 & 30).

These wetland sites are a contiguous area of undeveloped land (site 4 - section 29) and a location adjacent to Bridge road near the fringe of the Hobe Golf Club (site 30 -- section 29). Site 4 is a scrub-shrub wetland dominated with red bay, sweet bay, red maple and dahoon holly. Remote analysis of the surrounding wetlands indicates this region contains large depressional wetlands of very high quality. The surrounding land use is open native habitat. Bridge Road is the only major influence on the wetland hydrology and may be contributing to some greater than expected ponding along those wetlands adjoining the road. The WRAP score for this site is 0.74.

Site 30 is Banner Lake located just south of the Hobe Golf Club and north of the Eaglewood residential development (Figures 13 and 17). This is the largest wetland evaluated using the WRAP assessment technique. The land use is low density residential in combination with a golf course. The littoral zone around the lake is heavily infested in places with torpedo grass (*Panicum repens*) and cattail (*Typha sp.*). It is not known if the lake receives direct runoff from the golf course. The WRAP evaluation results in a score of 0.70 indicating the wetland is moderate in quality. Remote analysis of wetlands contained within the golf club to the north and the Eaglewood development to the south are also ranked medium in quality due to the surrounding influence of these developments.

Table 6. Summary of WRAP scores for the 39 wetlands in the Project Area in Martin County.

Wetland No[1]	NWI[2]	Quality Design-ation[3]	Modifier[4]	WRAP Score[5]	Area (acres)	Location[6]
1	PEM1F	med	none	0.75	5.5	Poinciana Gardens Area
2	PEM1F	high	none	0.83	10.8	Poinciana Gardens Area
3	PEM1C	med	none	0.58	0.3	Poinciana Gardens Area
4	PSS3A	high	none	0.74	16.0	Bridge Road Sec. 29
5	PEM1F	med	none	0.82	7.6	Ranch Colony
6	PEM1F	med	none	0.39	4.0	Ranch Colony
7	PEM1C	med	none	0.72	0.9	Ranch Colony
8	PEM1F	high	none	0.94	7.5	Seabranch Road
9	PEM1C	med	none	0.75	2.4	Seabranch Road
11	N/A	high	none	0.8	2.5	Seabranch Road
12	PEM1Cd	high	ditch/drain	0.76	4.1	Seabranch Road
13	PFO2F	high	none	0.48	8.1	Seabranch Road
14	PEM1C	high	none	0.73	8.3	Ranchland
15	PFO6/EM1C	med	none	0.51	8.3	Shiloh Farms
16	PSS2F	high	none	0.76	0.8	Becker Groves
17	PEM1C	high	none	0.76	11.9	Pal-Mar
18	PEM1A	high	none	0.76	1.2	Pal-Mar
19	PEM1Cd	med	ditch/drain	0.60	0.3	The Preserves
20	PEM1Cd	med	ditch/drain	0.65	1.5	The Preserves
21	L2OWH	med	none	0.60	6.2	The Medalist
22	PEM1F	high	none	0.65	0.8	The Medalist
23	PEM1F	med	none	0.58		Seawind
24	PEM1F	med	none	0.85	0.2	Seawind
	PEM1F	med	none	0.85	0.3	
	PEM1F	med	none	0.85	1.7	
	PEM1Cd	med	ditch/drain	0.85	3.2	
	PEM1Cd	med	ditch/drain	0.85	4.1	Seawind
25	PEM1Fd	med	ditch/drain	0.57	2.2	Seawind
	PEM1Cd	med	ditch/drain	0.57	5.5	
	PEM1Fd	med	ditch/drain	0.57	9.6	
26	PEM1F	high	none	0.78	0.2	Seawind
27	PSS6C	high	none	0.70	6.3	Seawind
28	PEM1F	high	none	0.94	8.1	Seawind
29	PEM1F	high	none	0.92	7.2	Seawind
30	L2OWH	med	none	0.76	23.3	Banner Lake
31	PEM1F	med	none	0.53	0.4	Florida Club
	PEM1Cd	med	ditch/drain	0.53	2.3	Florida Club

Table 6. Continued.

Wetland No[1]	NWI[2]	Quality Design-ation[3]	Modifier[4]	WRAP Score[5]	Area (acres)	Location[6]
32	PEM1F	med	none	0.74	1.4	Florida club
	PEM1Cd	med	ditch/drain	0.74	3.7	Florida Club
33	PFO1/3A	med	none	0.45	1.3	Tropical Farms
34	PEM1C	high	none	0.85	0.4	McMillion Property
	PFO1/3C	high	none	0.85	12.5	McMillion Property
35	PFO6C	low	none	0.61	9.5	Bridge Meadow Farms
36	PEM1C	low	none	0.50	10.7	Bridge Meadow Farms
37	PEM1F	high	none	0.94	3.4	J.D. State Park
38	PEM1F	high	none	0.81	2.7	J.D. State Park
39	PEM1F	high	none	0.94	3.1	J.D. State Park
40	PEM1F	high	none	1.00	4.6	J.D. State Park

1 Wetland numbers correspond with locations shown in Figure 13.
2 NWI codes correspond to designations described in APPENDIX 4.
3 Quality designations based on results of the remote analysis shown in Figures 17 and 18.
4 Indicates if direct evidence of hydrologic modifications were present during field evaluation.
5 Details of the scoring of each wetland are provided in APPENDIX 5.
6 Locations correspond with general areas identified in Figures 17 and 18.

Ranch Colony/Shiloh Farms (WRAP Sites 5 - 7 and 15; sections 22, 23, 25 and 27).

This region of the county includes numerous isolated wetlands that comprise the Pal-Mar/Cypress Creek drainage basins (Figures 13 and 18). WRAP sites were selected within a low density residential development that is otherwise surrounded by undeveloped open land and moderate agricultural development. Lot sizes within the development are large (>5.0 acres) and generally contain one or more wetlands. A common practice in the area is to construct ponds and raise elevations of the surrounding land with the fill. Land cover is predominately pine flatwoods/palmetto mixture. A surface drainage system exists throughout the development (roadside swales and ditches), which then drains to a primary drainage canal located along the north border of the development (Hobe St. Lucie Ditch). Many of the wetlands are interconnected through the internal surface drainage system. Accordingly, WRAP scores are highly variable and range from low (0.39) to medium quality (0.82). Other impacts include filling and sloping of the surrounding land surfaces to direct surface drainage into the wetlands resulting in erosion and transport of sediments into the wetlands.

The remote assessment ranks these and the adjoining wetlands throughout this residential area as medium in quality (sections 22, 23, 28 and 27; see Figure 18). Additional wetlands located in adjacent sections 14, 15, 28 and the lower half of 30 are also ranked medium in quality due to alterations in hydrology associated with the drainage and agricultural impacts from cattle grazing, other pasture improvements or cultivation of row crops. These latter wetlands can be improved in quality through better agricultural practices (e.g. best management practices) and plugging interconnecting ditches that drain some of these wetlands.

Seabranch Road Area (WRAP Sites 8 - 12; 19 - 20; see sections 1, 6, 12 and 7) .

Land use in this region of the Project Area includes residential planned unit developments on the north side of Seabranch Road (Summerfield Golf & Country Club, The Preserves and Double Tree, Figures 13 and 17) and a combination of undeveloped and agricultural land to the southwest. Land cover is predominately pine flatwoods with palmetto. WRAP scores for sites 9,19 and 20 located within the developments are relatively consistent, ranging from 0.75 to 0.62 and 0.65, respectively. These scores are indicative of medium quality wetlands with sites exhibiting a range of impacts including evidence of nutrient eutrophication and alterations in hydrology (ponding of water due to runoff from surrounding developed areas). Remote analyses of these and other wetlands within the project developments also ranks them medium in quality due to lack of adequate upland buffers from the surrounding developed areas.

WRAP sites south and outside the developed areas score higher ranging from 0.76 to 0.94 indicating these are high quality wetlands. However, even these wetlands exhibit some evidence of an alteration in hydrology (i.e. presence of young pines within or near the wetland) and disturbance from off-road vehicle use. Despite evidence of past agricultural use and related drainage attempts, the remote analysis indicates adjacent wetlands are high in quality. Numerous high quality, depressional wetlands are present to the southeast within the Atlantic Coastal Ridge Ecosystem parcel (Figure 13).

Pal-Mar (WRAP Sites 17 and 18).

As indicated earlier, this portion of the Project Area has an extensive mosaic of depressional wetlands (Figures 13 and 18). Drainage is primarily through groundwater seepage to the east and constitutes an important headwater area for the Loxahatchee River and its tributary, Cypress Creek. Natural communities dominate the landscape and include pine flatwoods, wet flat woods, mashes, swamps and wet prairies. Only two WRAP sites were selected in this region of Martin County for field evaluation. A larger number of these wetlands are evaluated on the West Palm Beach County side of Pal-Mar.

The WRAP scores and remote analysis both indicate these wetlands are high in quality despite the presence of extensive canals in the immediate area. As noted earlier, there is no positive drainage for this canal system and hence there is little direct canal affect on the hydrology of these wetlands. Construction of SR 711 immediately east of the study sites appears to have altered the natural surface drainage by blocking the west to east flow. Installation of more culverts under the roadway can allow eastward movement of water following high rainfall events when surface storage is exceeded and overland sheetflow occurs. Exotics are present in the vicinity (Old World climbing fern, *Lygodium microphylium*, and Brazilian pepper) and can pose a threat to future functional values unless kept in check.

Medalist Golf Club (WRAP Sites 21 and 22; section 16).

This portion of the Project Area is typical of more recent developments that extend westward from the coastal ridge where previous development is concentrated. Land use is residential with a golf course surrounding many of the wetlands contained within the development. Two wetland sites are evaluated (Figures 13 and 17), both producing WRAP scores indicative of medium quality (0.60 and 0.65). Both sites contain evidence of nutrient eutrophication (e.g. simulation of plant growth) from the adjoining developed areas and alterations in hydrology (e.g. direct conveyance of upland runoff). As with other wetlands that are incorporated into this type of development, the remote analysis scores these sites and adjacent wetlands as medium in quality (Figure 17).

Seawinds/Atlantic Coastal Ridge Ecosystem (WRAP Sites 23-29; sections 34, 3 , 4 and 10).

Portions of this area were previously slated for development (Seawinds Development) but did not receive the necessary permitting from Martin County. Land use is a mixture of native open spaces and improved pasture for cattle grazing (Figure 17). Land cover is pine flatwoods and palmetto with wet prairies, depressional wetlands and sloughs. Drainage ditches associated with previous agricultural activities meander through several of the wetlands and upland areas (Figure 17). Upland areas include oak and cabbage palm hammocks. A total of seven WRAP sites are evaluated in this area due to the high potential for development (Figure 13). Scores are highly variable ranging from medium to high quality (scores ranged from 0.57 to 0.94). Several sites are heavily infested with exotics (melaleuca, Brazilian pepper and Old World climbing fern). Remote analysis of the adjacent wetlands on the property also scores medium in quality due to alterations in upland buffers, presence of drainage impacts and agricultural impacts. The presence of drainage canals in combination with water control structures alters the hydrology of the area. Restoration of the normal hydrology can improve conditions within the wetlands and help slow the spread of exotics.

Florida Club/Roebuck Creek (WRAP Sites 31 and 32; section 8).

These sites are located within the preservation areas of a golf course (Figures 13 and 17). Both sites are located in close proximity to the adjoining residential development. Exotics are present at both locations and each exhibit signs of an altered hydrology such as woody species encroachment (reduced hydroperiod) or unnatural ponding of water depth. Runoff is conveyed to one of the two sites after some treatment by retention. Remote assessment of the adjoining wetlands is consistent with a medium quality designation.

Tropical Farms/Bridge Meadow Farm (WRAP Sites 33, 35-36; sections 7 and 24).

Areas where relatively long term agricultural practices are being replaced with residential development due to increased land values include these WRAP sites. Much of this area, once cultivated in row crops or citrus at some period of time prior, is now in residential use. There are three WRAP sites (Figure 13), one adjacent to a residential

area within the Roebuck Creek drainage (site 33) and two sites (35 and 36) adjacent to agricultural fields (see Figure 17). The Tropical Farms site (site 33) is located within the floodplain of Roebuck Creek. This creek receives a significant contribution of runoff from the adjacent agricultural fields and residential developments before eventually spilling into the C-44 canal along the northwest border of the Project Area. The WRAP score for this site is 0.45 suggesting low functional quality. A number of exotic species are in the floodplain.

Sites 35 and 36 are a cypress dome and marsh, respectively, located adjacent to abandon agricultural fields (row crops). Both wetland systems are hydrologically influenced by the agricultural drainage ditches constructed around these systems to convey water away from the area. WRAP scores for these sites are actually higher than site 33, scoring in a medium range at 0.61 and 0.50, respectively. The remote assessment, however, evaluated these sites at the low end of the scale compared to the medium evaluation given to site 33.

All three sites and other wetlands in this region can be improved through exotic management and hydrologic restoration. Nearly all of the wetlands in this region lack any buffer between the wetland and the adjoining upland land use practices that potentially can provide some mitigation of the water quality impacts.

Jonathan Dickinson State Park (WRAP Sites 37 - 40; sections 5, 9, 16, and 13).

Jonathan Dickson State Park contains the largest, contiguous tract of native habitat within the Project Area. Habitats include a wide variety from xeric scrub oak and pine, riverine cypress swamp, marshes, wet prairies and sloughs. Two major tributaries of the Loxahatchee river are included in the park, the North Fork Loxahatchee River and Kitching Creek. Both of these tributaries have wetland systems contributing to the headwaters of these natural drainage features. A portion of the water flowing into Kitching Creek includes runoff carried by the Jenkins Canal just to the north (section 32, Figure 18). This canal additionally conveys drainage from an old county landfill and runoff collected along portions of Bridge Road (CR 708). Flows from this canal are unregulated.

Although one of the four WRAP sites evaluated in the park is located near the Jenkins Canal (site 37, Figure 13), the evaluation score is high (0.94) indicating a high functional value. Other sites in the park also score high (0.81 - 1.0) reflecting the high quality status and comparative lack of perturbation in this protected portion of the Project Area. Accordingly, the remote analysis of park wetlands also score these wetlands as high in quality. The park and Pal-Mar contain the largest contiguous mosaics of high quality wetlands within the Project Area.

Other Areas.

Not all portions of the Project Area are equally represented in the WRAP assessments due to logistical constraints and access. Martin County contains significant areas where wetlands are concentrated within the landscape and road access is limited.

However, this lack of access also contributes to the general high quality of the wetlands in these areas. An example is the large aggregation of high quality wetlands in the Atlantic Coastal Ridge Ecosystem parcel north of Bridge Road and east of Highway US-1 (Figure 17). WRAP scores of similar wetlands and the remote analysis classify these wetlands as high in functional value. This is also true of the Pal-Mar wetlands in the southwest corner of the Project Area. Both regions of the Project Area have limited access and are relatively isolated from the secondary impacts of surrounding development.

A large concentration of medium quality wetlands are also associated with the fringe areas of citrus agriculture that diagonally crosses the Project Area around the I-95 and Florida Turnpike corridor. Accessibility to these wetlands is also limited due to a lack of roads or limited access through the citrus groves. Inspection of the aerial photographs of these areas suggest these systems are altered in hydrology compared to similar habitats. The corresponding remote evaluations classify these fringe wetlands as medium in quality. WRAP assessments can potentially alter this perception, particularly for those wetlands located some distance from the agricultural fields.

Wetland Data Themes and Composite Overlay Analysis

A variety of previously published data types (i.e. 1996 Satellite TM Data, GFWFC Land Cover Data, Hydric Soils Data, and NWI Data) are available describing wetland coverage in the Project Area. However, field assessments suggests these sources are not always reliable or accurate due to differences in spatial scale and time periods from which the data are derived.

GFWFC Land Cover. The GFWFC land cover maps (Figure 6) are useful for identifying major wetland systems in the Project Area and for statewide planning. However, this dated version of satellite imagery is not accurate enough for the detailed delineation of natural communities in the Project Area. The most obvious flaw in the land cover classification relates to the identification of dry prairie. According to the GFWFC land cover classification system, dry prairie is an upland community. A comparison of these areas with the NWI maps and verification through field inspections indicate much of the area classified as dry prairie by the GFWFC land cover map is actually wet flatwoods, which is a wetland community following the FNAI wetland classification system.

1996 TM Satellite. The 1996 TM classified wetlands data provide only three major classes of wetlands within the Project Area; forested fresh, forested brackish and non-forested wetlands (Figures 11 and 12). These classes account for 17,247 acres within the Project Area (Table 7). The major patterns of vegetation cover appear to agree with field observations and accurately depict forested wetlands associated with the river channels. Numerous small wetlands, however, are identified in the landscape as isolated features. These wetland features are at least 0.5 acres and larger in size since this area minimum is used as a filter to remove noise from the classified imagery. Based on the confusion matrix (a statistical measure of the correctly and incorrectly

classified pixels in the digital image) from the classified imagery, a portion of the TM imagery classified as smaller wetlands may actually be identified as upland forest.

National Wetlands Inventory. The most reliable data source depicting wetlands in the Project Area is the NWI wetland maps (Figures 7 and 8). Whenever wetlands are shown on the NWI maps, they are also found in the field. However, the NWI wetland boundaries underestimate wetland area as defined by present federal delineation guidelines (Rolband, 1995). Approximately 19,959 acres of NWI wetlands are contained within the Project Area (Table 7). Refer to Appendix 4 for a detailed explanation of the NWI classification system and an example of how to read the codes on the map. For additional details concerning the NWI classification, refer to the original NWI maps available from the USFWS and TCRPC. Also, SFWMD maintains an updated NWI data base in a digital format.

Wet pine flatwoods appear to be the most likely natural community excluded from the NWI delineations in southern Florida. This is due in part to characteristics manifested by a shorter hydroperiod as well as sometimes indistinct gradations to upland pine flatwoods. These are the areas most in need of inspections by the COE and SFWMD for onsite identification and delineation of wetlands.

Hydric Soils. Due to the reliance of federal, state and local regulations on saturated soils as an indicator of potential wetlands, the soils data for the Project Area are used as an initial screening tool to determine presence of wetlands. Analysis of the Martin County Soils map indicates hydric soils are prominent throughout the Project Area (Figures 4 and 5) and cover approximately 33,941 acres. From the overlays, 15,979 acres of NWI wetlands occur within the hydric soils series accounting for roughly 47 percent of the total acres of hydric soils (Table 7). Thus a significant proportion of the hydric soil acres do not contain NWI wetlands as might have been expected. It is worth noting that large portions of the Project Area having hydric soils but void of NWI wetlands, also contain extensive agricultural development and other land use changes, which may have eliminated wetlands. Differences in the minimum mapping size requirements between the NWI maps and soils series maps may also account for some of these discrepancies. Many of the hydric soils also contain nonhydric inclusions. Therefore, the soil survey alone was not always a reliable indicator of wetlands. Use of the soil survey in conjunction with the NWI data improved the identification of potential wetland sites. The original Martin County soil survey maps (McCullum and Cruz, 1981) should be consulted for a more detailed presentation of soil types.

Table 7. Summary data from composite overlay analysis of hydric soils, NWI wetlands and 1996 satellite classified wetlands.

Total Acres of Project Area Identified by Data Type		
NWI = 19,959	Hydric Soils (HS) = 33,941	TM = 17,247
Total Acres Overlapping in 2 but not 3 Data Types		
NWI + HS = 5,571	NWI + TM = 1,726	HS + TM = 2,299
Total Acres Overlapping in 3 of 3 Data Types		
NWI + HS + TM = 10,408		
Total Non-overlapping Acres Among Data Types		
HS Only = 15,663	NWI Only = 2,254	TM Only = 2,814
Total Combined Acres of Project Area Co-occurring in Data Overlays		
NWI + HS = 15,979	NWI + TM = 12,662	HS + TM = 13,222

Composite Overlays. Spatial overlays combining the hydric soils data, NWI wetlands data and the TM classified wetlands provide the most comprehensive identification of potential wetlands within the Project Area (Figures 19 and 20). A composite overlay of these data also reveal some interesting patterns and weaknesses in these different data sets.

The data in Figures 19 and 20 are coded to highlight the corresponding agreement between the various overlays of hydric soils, NWI and TM classified wetlands. The areas with the highest probability of containing wetlands are those where overlays of the NWI wetlands, the TM satellite data, and hydric soils coincide. Overlay of these three data layers account for approximately 10,408 acres of the Project Area (Table 7). Using the NWI data as a conservative estimator of the total wetland acres that can be expected in the Project Area, approximately 52 percent of the Project Area wetlands are identified in all three data overlays (Table 7). An additional 9,596 acres within the Project Area spatially correspond in combination with only two of three data overlays. Of these overlays, the paired combinations of hydric soils with NWI data account for 5,571 acres, increasing the cumulative number of acres where NWI wetlands coincide with hydric soils to 15,979 acres, or 80 percent within the Project Area.

There is also a reasonably high correspondence between the acres identified as wetlands using TM imagery and the NWI wetlands (Table 7). The corresponding TM and NWI wetland acreage total 12,662 within the Project Area. Approximately 2,814

acres are identified in the TM classified wetland data that do not correspond with any other data set (Table 7). These areas are predominately found along the peripheral edges where all three data sets suggest wetlands are most likely to be found. The apparent expanded buffers identified by the satellite data may be the expansion of the adjacent wetland communities or a high soil moisture signature attributed to an increased zone of water saturation around these wetland communities.

In summary, the combined overlays of the soil survey, recent infrared aerial photographs, Thematic Mapping, and the NWI maps provide the most useful tool for identifying wetlands in the Project Area. These results demonstrate that use of any single source of wetland indicator data may not provide a reliable estimate of the full extent of wetland coverage. A combination of data sources and field verification are required to fully determine wetland extent and functional status.

Wetland Areas Important for Protection

The South Fork of the St. Lucie River and the Loxahatchee River along with their associated tributaries are designated within the Martin County Comprehensive Growth Management Plan (MCCGMP) as Major Wetlands within Martin County. Additionally, the South Fork of the St. Lucie River, Loxahatchee River, Kitching Creek, and Cypress Creek, along with their headwaters, are designated within the MCCGMP as Wetland Areas of Special Concern. Also, contained within the study boundaries of the project are portions of the Pal-Mar and the Atlantic Ridge Ecosystem, which are ranked by the State of Florida's Conservation And Recreational Lands (CARL) committee as environmentally important areas worthy of preservation. Certainly, every effort should be made to publicly purchase as much of these areas as possible, to preserve in perpetuity, these environmentally significant areas. Protection also can be sought through implementation of local regulations to afford greater protection of these natural resources and wetlands of special concern.

The Cypress Creek area stands out as one major area containing high quality wetlands within the Project Area and is currently being considered for public acquisition. This area is located along the Martin and Palm Beach County line. About two square miles of this area occurs in Palm Beach County and two or three square miles are located in Martin County. This area is important because it has a direct drainage connection to the Northwest Fork of the Loxahatchee River through Cypress Creek. This area is interspersed with numerous marshes, cypress swamps, and wet prairies. The WRAP field assessment reveal that the hydrology of many of these wetlands is impacted by ditches associated with agricultural operations. The protection and restoration of the wetlands in the Cypress Creek Area can be extremely beneficial in improving the supply of fresh water to the Northwest Fork of the Loxahatchee River. These actions can assist in reducing salt water intrusion up the river, which is a threat especially during periods of drought. Other benefits include flood water attenuation, the protection of fish and wildlife habitat, and enhancement of water quality. Palm Beach County and Martin County should coordinate activities to protect and restore the Cypress Creek Area.

There are presently several large areas of high quality wetlands in the Project Area that are being purchased through the SOR, CARL, or Martin County Environmentally Sensitive Lands Acquisition Program. These areas include Pal-Mar, the Atlantic Ridge Ecosystem and the South Fork of the St. Lucie River (Figure 3). Martin County and the SFWMD have recently acquired major portions of both the Pal-Mar and the Atlantic Coastal Ridge Ecosystem. Portions of the South Fork of the St. Lucie River have also been acquired but additional areas should be considered to further enhance protection of the wetlands comprising the headwaters of this riverine system.

The governmental process is also in place whereby, the South Fork of the St. Lucie River and the Loxahatchee River, along with their associated tributaries, can be nominated for designation as Aquatic Preserves, or Outstanding Florida Waters (OFWs). These designations can provide additional protection provisions. Martin County should begin efforts to expand the Aquatic Preserve designation for these water bodies.

Wetland Areas Important for Restoration

The main types of restoration activities that can benefit the Loxahatchee River and South Fork of the St. Lucie River are related to improving the water storage capabilities of wetlands within the river basin. Wetlands that are ditched or partially drained have a reduced hydroperiod. This negatively affects these rivers in four ways: 1) it causes unnatural surges of storm water to the river by water that can be, under natural conditions, stored in the wetland; 2) it reduces the amount of water that is eventually available to reach the river through ground water seepage; 3) it lowers the quality of the water flowing to the river by reducing the opportunities for water treatment that occur in natural wetland systems; and 4) it negatively affects the food web and habitat for fish and wildlife.

One area which warrants restoration is where the South Fork of the St. Lucie River system was connected to the Loxahatchee River system by at least two flow ways. These flow ways, which are generally aligned in a northwest to southeast direction, converge into Kitching Creek, a northern tributary to the Loxahatchee River. These two natural flow ways are disrupted by a three mile long by one mile wide citrus grove and intersect the orange grove on its northern boundary and at its southwest corner. Storm water detention and management within the citrus grove can be modified to restore these hydrologic connections and improve river flows. A cooperative effort between the county, state and the local grower can be developed in which assistance and incentives can be provided to improve water management and restore the hydrology.

During the field work for the project, it was also noted that the water flows from the wetlands on the west side of Pal-Mar may be blocked by SR 711. It is recommended that the county and SFWMD conduct an investigation to determine the need and potential benefits of improving the west to east hydrological connections across SR 711. This would improve the connectivity in hydrology for Pal-Mar and reduce ponding

of water west of SR 711. In addition, the SFWMD should investigate the need and potential benefits of restoring natural drainage flows from Pal-Mar to Cypress Creek through its historic route.

The Loxahatchee River and the South Fork of the St. Lucie River can benefit by increasing surface water storage within each watershed. This can help compensate for the loss of storage associated with existing development. Ideally, water stored can be released to the river basins during the dry season or periods of drought to maintain minimum base flows of surface waters. The maintenance of base flows to the each river system is of primary importance to protecting these river systems (McPherson and Sabanskas, 1980).

Additionally, efforts should be made in the future during the process of permit review to encourage enhancement and restoration of the low and medium quality wetland, which have been impacted by agricultural or urban development. Based on the current landscape position, many of these low and medium quality wetlands can be upgraded to provide expanded functions through relatively simple restoration efforts, such as exotics removal or hydrological improvements. Efforts should continue to restore and minimize the secondary impacts caused by urban and agricultural development.

Key Areas in Need of a Mitigation Program

The Martin County Comprehensive Plan currently does not support mitigation programs as an alternative for wetland protection (see Federal, State and Martin County Wetland Policies section below). Public projects in Martin County, such as road and bridge construction, often results in the loss of wetlands through filling within the rights-of-way. Martin County should consider designating the Loxahatchee River Basin Planning Project Area as a potential mitigation area for these public projects. Any mitigation requirements can be used to improve and restore wetland hydrology and habitat within this basin.

Potential Sites for a Water Preserve Area

Future development within the basin will further increase pressures on groundwater resources and potentially conflict with the goal of increasing base flows to the Loxahatchee River. Increasing surface storage is one strategy that can potentially increase water supply for the Loxahatchee River and the South Fork of the St. Lucie River.

Review of the composite data overlays (Figures 19 and 20) indicates that section 25 located north of Bridge Road (CR 708) and east of I-95 can be a beneficial and strategic location for a water storage area. This location coincides with the approximate location of the drainage divide between the South Fork of the St. Lucie River and Kitching Creek. The pattern of hydric soils and wetlands in the adjacent sections suggests this area likely supported wetlands prior to their displacement by agriculture.

This is one of the few locations where surface storage would not potentially displace other valuable wetlands. The SFWMD and county should evaluate the potential for acquisition of this land as water storage area. This region is already under review by Martin County as part of an independent investigation of the Jenkins Canal/Kitching Creek drainage area. A water management plan is being prepared by the county's consultant, Earth Tech.

Threatened and Endangered Species

There are several state and federally listed plant and animal species whose known ranges fall within the Project Area (Tables 8 and 9). Several of these species require wetlands for survival throughout all or portions of their life cycle. Though others may not be considered wetland dependent or obligate in a strict sense, their recovery or even continued existence in the Project Area is associated with the presence and quality of wetland systems.

Of the animal species listed, only the scrub jay, gopher tortoise, and burrowing owl can be expected to survive independent of wetlands. In contrast, the wood stork and other colonial waterbirds nest and forage solely in wetland habitats. Sandhill cranes require wetlands for nesting. The snail kite forages in wet prairies and marshes, and bald eagles forage for fish in deeper wetlands. Bald eagles and red-cockaded woodpeckers often nest in wet pine flatwoods. The gopher frog is dependent on wetlands in early stages of its life cycle. A natural mosaic of uplands and wetlands provides habitat for a number of species, including the American alligator, eastern indigo snake, Florida pine snake, as well as a number of migratory species. Riverine systems are utilized by both the West Indian manatee and common snook.

One endangered species in particular, the snail kite, has a great potential to benefit from the protection of wetlands in the Project Area. The only food source for this species is the apple snail, which it typically captures at the surface of shallow, open wetlands. Within the Project Area, these wetlands occur mainly as isolated depression marshes interspersed throughout pine flatwoods. The protection of wetlands within the Project Area provides foraging habitat for kites, and provides travel routes to areas with higher water levels during periods of drought.

Similarly, the red-cockaded woodpecker is another endangered species in the Project Area that has a great potential to benefit from the protection of wet flatwoods. This species requires large stands of mature pine forest with an open understory. Each clan of woodpeckers may occupy a territory of several hundred acres. Commercial logging and urbanization have severely impacted the habitat of this species. Red-cockaded woodpeckers formerly occurred in JDSP and other locations within the Project Area in the late 1980s. The most important unprotected area for the red-cockaded woodpecker is Pal-Mar, which creates a corridor from Corbett WMA to JDSP. The protection of wet flatwoods connecting the existing major preserve areas is important for the continued existence of this species in the Project Area.

Table 8. Threatened and endangered animals in the Project Area. This list is a subset of the official species lists prepared by the Florida Game and Fresh Water Fish Commission (Wood 1996). The USFWS is the lead federal agency in administering the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*). A comprehensive listing of threatened and endangered species afforded protection in the United States can be found in 50 CFR 17.11. The GFWFC is the lead state agency in Florida responsible for the protection of species categorized in rules 39-27.003, 39-27.004 and 39-27.005, Florida Administrative Code. Species classified by the Florida Council on Rare and Endangered Plants and Animals are also included in this list. For additional information on listed animal species, refer to: Gilbert (1992) for fishes; Moler (1992) for amphibians and reptiles; Rodgers et al. (1996) for birds; Humphery (1992) for mammals; and Deyrup and Franz (1994) for invertebrates.

Scientific Name	Common Name	Designated Status[1] FCREPA[2]	GFWFC[3]	USFWS[4]
Fish				
Centropomus undecimalis	common snook		*SSC*	
Amphibians				
Rana capito aesopus	gopher frog	*T*	*SSC*	
Reptiles				
Alligator mississippiensis	American alligator	*SSC*	*SSC*	*T(S/A)*
Drymarchon corais couperi	eastern indigo snake	*SSC*	*T*	*T*
Gopherus polyphemus	gopher tortoise	*T*	*SSC*	
Pituophis melanoleucus	Florida pine snake		*SSC*	
Birds				
Ajaia ajaja	roseate spoonbill	*R*	*SSC*	
Aramus guarauna	limpkin	*SSC*	*SSC*	
Dendroica kirtlandii	Kirtland's warbler	*E*	*E*	*E*
Egretta caerulea	little blue heron	*SSC*	*SSC*	
Egretta thula	snowy egret	*SSC*	*SSC*	
Egretta tricolor	tricolored heron	*SSC*	*SSC*	
Eudocimus albus	white ibis	*SSC*	*SSC*	
Falco peregrinus tundrius	Arctic peregrine falcon	*E*	*E*	
Falco sparverius paulus	southeastern Am. kestrel	*T*	*T*	
Grus canadensis pratensis	Florida sandhill crane	*T*	*T*	
Haliaeetus leucocephalus	bald eagle	*T*	*T*	*T*
Mycteria americana	wood stork	*E*	*E*	*E*
Picoides borealis	red-cockaded woodpecker	*E*	*T*	*E*
Rostrhamus sociabilis	snail kite	*E*	*E*	*E*
Speotyto cunicularia floridana	Florida burrowing owl	*SSC*	*SSC*	
Sterna antillarum	Least tern	*T*	*T*	

Table 8. Continued.

Scientific Name	Common Name	Designated Status[1] FCREPA[2]	GFWFC[3]	USFWS[4]
Mammals				
Blarina carolinensis shermani	Sherman's short-tailed Shrew	*SU*	*SSC*	
Peromyscus floridanus	Florida mouse	*T*	*SSC*	
Sciurus niger shermani	Sherman's fox squirrel	*T*	*SSC*	
Trichechus manatus latirostris	West Indian manatee	*T*	*E*	*E*

[1] E = Endangered; R=Rare; T=Threatened; T(S/A)= Threatened/Similarity of Appearance; SSC = Species of Special Concern; SU=Status Undetermined
[2] Florida Committee on Rare and Endangered Plants and Animals
[3] Florida Game and Fresh Water Fish Commission
[4] United States Fish and Wildlife Service

Several listed plant species also are known to occur within wetlands in the Project Area. While the roots of most of these species grow within various types of wetlands, the *Tillandsia* species are bromeliads, which are epiphytes that grow attached to trees and shrubs within and outside of wetlands. The protection of wetland systems helps to ensure the continued survival of these species in the Project Area.

Table 9. Threatened and endangered plant species that occur in wetlands in the Project Area. The list is a subset of the official lists of species prepared by the Florida Game and Fresh Water Fish Commission (Wood 1996). Species classified by the Florida Council on Rare and Endangered Plants and Animals are also included in this list. Refer to Ward (1979) for more information on listed plant species.

Scientific Name	Common Name	Designated Status[1] FCREPA[2]	FDACS[3]
Acrostichum danaeifolium	giant leather fern		C
Bletia purpurea	pine pink		*T*
Calopogon barbatus	bearded grass pink		*T*
Calopogon multiflorus	many-flowered grass pink		*E*
Campyloneurum phyllitidus	long strap fern		*E*
Chrysophyllum oliviforme	satinleaf		*E*
Dennstaedita bipinnata	cuplet fern	*E*	*E*
Drosera intermedia	water sundew		*T*
Encyclia tampensis	butterfly orchid		*C*
Eulophia alta	wild coco		*T*
Hexalectris sp.	crested coralroot		*E*
Lilium catesbaei	Catesby's lily		*T*
Lycopodium cernuum	nodding club moss		*C*
Nemastylis floridana	celestial lilt	*T*	*E*
Nephrolepis biserrata	giant sword fern		*T*
Ophioglossum palmatum	hand adder's tongue fern	*E*	*E*
Osmunda cinnamomea	cinnamon Fern		*C*
Osmunda regalis	royal fern		*C*
Pecluma ptilodon	swamp plume polypody		*E*
Peperomia humilis	pepper (unnamed)		*E*
Pinguicula caerulea	blue-flowed butterwort		*T*
Platanthera nivea	snowy orchid		*T*
Pogonia ophioglossoides	rose pogonia		*T*
Spiranthes laciniata	lace-lip ladies' tresses		*T*
Spiranthes longilabris	long-lip ladies' tresses		*T*
Spiranthes vernalis	ladies' tresses		*T*
Stenorrhynchos lanceolata	leafless red beak orchid		*T*
Thelypteris serrata	dentate lattice vein fern		*E*
Tillandsia balbisiana	inflated wild pine		*T*
Tillandsia fasciculata	common wild pine		*T*
Tillandsia flexuosa	twisted air plant	*T*	*E*
Tillandsia utriculata	giant wild pine		*E*
Tillandsia valenzuelana	soft-leaved wild pine		*T*

[1] E=Endangered; R=Rare; T= Threatened; SSC=Species of Special Concern; C=Commercially Exploited [2] Florida Committee on Rare and Endangered Plants and Animals [3] Florida Department of Agriculture and Consumer Services.

Exotic Species

A major threat to wetland systems in the Project Area is the invasion of exotic pest vegetation. A list of invasive exotic plants that potentially occur in wetlands in the Project Area is provided in Table 10. Judging from the field evaluation of wetlands, the species having the largest impact on wetlands in the Project Area include Brazilian pepper, melaleuca, and Old World climbing fern. These species are widespread throughout the Project Area, as well as other parts of southern Florida. Brazilian pepper grows in the fringes of wetlands and can dominate the upland buffer. Melaleuca often grows into a forest that completely dominates a wetland. Old World climbing fern grows in forested wetlands and climbs to dominate the tree canopy. These species appear to be most prevalent in areas where the water table has been lowered and the natural communities have been disturbed. However, they occur throughout the Project Area, even in wetlands considered to be in close to pristine condition. Research efforts designed to limit the spread and remove invasive exotic species should be supported. The South Florida Water Management District and the Florida Department Environmental Protection have existing programs to control these species on public lands. The Martin County Parks and Recreation Department has initiated a similar control program for invasive exotic plants in County parks. It may be beneficial if local governments develop public programs and incentives for private land owners to eradicate exotic pest species on public and private lands.

Federal, State and Martin County Wetland Policies

Federal Regulations. The Federal Water Pollution Control Act (FWPCA), designated as 33 United States Code (USC) 1344, was a result of water pollution control statutes that were passed in the 1950s and 1960s. The FWPCA is more commonly known as the Clean Water Act (CWA). Major changes were made in the Clean Water Act in 1972 and 1977. Under Section 404 of the Clean Water Act, unless the activity is specifically exempted under section 404(f) of the Act, a land owner must receive a permit from the COE in cooperation with the EPA, before adding dredged or fill material into "waters of the United States," which includes wetlands and other special aquatic sites.

Federal Laws governing wetlands within the Project Area include: Section 10 of the Rivers and Harbors Act, which authorizes the placement of structures, dredging and filling in "navigable waters of the United States" and Section 404 of the Clean Water Act, which authorizes discharges of dredged or fill material in "waters of the United States". These Federal Statutes authorize the Secretary of the Army, acting through the Chief of Engineers, to issue permits, for the discharge of dredged or filled material into the "navigable waters or waters of the United States." This process includes a requirement for public notice and the opportunity for a public hearing. "Waters of the United States" includes wetlands and is defined in 33 Code of the Federal Regulations (CFR 328). The types of authorization include:

Table 10. Exotic plant species that occur or potentially occur in wetlands in the Project Area. This list is taken from the 1995 Florida Exotic Pest Plant Council's List of Florida's most Invasive Species. The Exotic Pest Plant Council is a national nonprofit organization founded in Florida in 1984 to take action against the invasion of exotic pest plants. Category I species include those that are invading and disrupting native plant communities in Florida. This definition does not rely on the economic severity of the problem and the geographic area covered, but the proven damage caused. Category II species are those that have shown a potential to invade and disrupt native plant communities. These species have a real potential to become category I ranked, but have not yet invaded natural Florida communities.

Category I

Acacia auriculiformis (earleaf acacia)
Ardisia crenata (coral ardisia)
Ardisia elliptica (=*A. humilis*)(shoebutton ardisia)
Bischofia javanica (Bischofia)
Brachiara mutica (Para grass)
Casuarina equisetifolia (=*C. litorea*)(Australian pine)
Casuarina glauca (suckering Australian pine)
Colocasia esculenta (taro)
Cupaniopsis anacardioides (carrotwood)
Eichhornia crassipes (water hyacinth)
Hydrilla verticillata (hydrilla)
Hygrophila polysperma (green hygro)
Hymenachne amplexicaulis (West Indian marsh grass)
Ipomoea aquatica (water spinach)
Lantana camara (lantana)
Lygodium microphyllum (Old World climbing fern)
Melaleuca quinquenervia (melaleuca, broad-leaf paper bark)
Mimosa pigra (catclaw mimosa)
Panicum repens (torpedo grass)
Pennisetum purpureum (napier grass)
Pistia stratiotes (water lettuce)
Psidium littorale (=P. cattleianum) (strawberry guava)
Rhodomyrtus tomentosus (downy rose myrtle)
Rhoeo spathacea (oyster plant)
Schinus terebinthifolius (Brazilian pepper)
Syzygium cumini (jam bolan, Java plum)

Category II

Myriophyllum spicatum (Eurasian water-milfoil)
Nephrolepis multiflora (Asian sword fern)
Passiflora foetida (stinking passion flower)
Rhynchelytrum repens (natal grass)
Sansevieria hyacinthoides (bowstring hemp)
Syngonium podophyllum (arrowhead vine)
Urena lobata (Caesar's weed)
Wedelia trilobata (wedelia)

No Permit Required (NPR):	Includes projects such as bridges without wetland filling, upland ditch maintenance, and structures in non-navigable waterbodies.
Nationwide Permit (NW):	Includes projects such as shoreline stabilization without wetland filling, minor road crossings.
General Permit (GP):	Includes projects such as single and multi-family piers, excavated boat slips, and maintenance dredging of residential canals.
Letter Of Permission (LOP):	Includes projects such as shoreline stabilization projects with less than 0.2 acres of wetlands being filled, small marinas less than 10 slips, and dredging projects which involve less than 10,000 cubic yards of material.
Individual Permit (IP):	Includes projects such as new road construction in wetlands of a major water body, and filling for residential or commercial development in wetlands of a major water body.

Decisions which are made according to Federal guidelines must meet a 21 item Public Interest Test. No permit will be granted for work in wetlands identified as important unless the benefits of the alteration outweigh the damage to the wetland resource and the proposed alteration is necessary to realize those benefits. All permits issued pursuant to Section 404 must comply with technical guidelines developed by the Environmental Protection Agency and state requirements. These guidelines require that the proposed wetland impact address alternatives, water quality considerations, significant degradation, and minimizing adverse impacts. Proposals affecting wetlands must also address requirements for mitigation and compensation.

State of Florida Regulations. In 1993, the State of Florida Legislature passed the Florida Environmental Reorganization Act, which directed the water management districts and the DEP to adopt rules incorporating the states dredge and fill provisions into the rules governing the management and storage of surface waters. The legislature stated that these rules shall seek to achieve a statewide, coordinated and consistent permitting process.

The SFWMD and DEP administer the state wetlands permitting process in both Martin and Palm Beach Counties. The legislation is contained in the Chapter 40E, FS and implemented through, what is termed, the Environmental Resource Permitting (ERP) process. The rules of this process incorporate a seven point public interest test. Short term and long term water quality considerations must be addressed to avoid the

violation of State water quality standards. The proposed activity must provide reasonable assurances that the regulated activity will not cause unacceptable secondary water resource impacts. In addition, applicants must provide reasonable assurances that the regulated activity will not cause unacceptable cumulative impacts on wetlands and other surface waters within the same drainage basin. Applicants must eliminate or reduce adverse impacts to wetlands by modifying the project, if practicable. The regulated activity must not impact wetlands and other surface waters so as to cause adverse impacts to the abundance, diversity and habitat of fish, wildlife and listed species.

Factors used to assess the impacts to wetland function as a result of the proposed activities include: condition, hydrologic connection, uniqueness, landscape setting, and fish and wildlife utilization. Applicants must provide reasonable assurance that the proposed activity will not change the hydroperiod of a wetland or other surface water so as to adversely affect wetland functions or adversely impact wetland function provided to fish and wildlife.

Mitigation can be approved only after all practicable modifications have been implemented to reduce or eliminate impacts to wetland and other surface functions. Mitigation must offset the adverse impacts caused by regulated activities. Mitigation consists of restoration, enhancement, creation or preservation of wetlands, other surface waters or uplands. Mitigation "out-of-kind" may be allowed if the impacts are offset and the applicant demonstrates that greater improvement of ecological value will result from the proposed activity. Mitigation "off-site" or mitigation banking may be acceptable if the impacts are offset and the applicant demonstrates that: 1) onsite mitigation is not expected to have comparable long term viability; and 2) off-site mitigation would provide greater improvement in ecological value than onsite mitigation.

Martin County. Wetland losses in the last century are extensive for Florida and for Martin County. Martin County requires that wetlands will not be altered except in very limited circumstances, which are detailed in the wetland policy (Martin County Growth Management Plan; MCCGMP) and land development regulations (Martin County Wetland Ordinance 548). The wetland policies of Martin County will continue to assure that natural wetlands are preserved and restored to the greatest extent possible and that there is no net loss of the spatial extent and the functions and values of natural wetlands. All wetlands in Martin County are protected.

Martin County requires mitigation for impacts, which are allowed under limited exemptions defined under the Comprehensive Plan and Wetland Ordinance 548. The county does not allow what is sometimes called "the mitigation alternative" where creation of new wetlands, enhancement of existing wetlands or contribution in dollars to mitigation banks is considered as justification for wetland alteration and destruction. New land development regulations allow reasonable use in which wetlands may be mitigated where use would otherwise be prohibited due to constraints imposed by wetland regulations. Exemptions from the regulations are granted for limited conditions. However, waiver of the regulations permitting wetland mitigation must be approved by

the Martin County Board of Commissioners following strict standards established under federal "taking" guidelines (Martin County Wetland Ordinance 548).

The only exemptions for altering wetlands in Martin County are:

(a) Riparian access
(b) Access to uplands
(c) Removal and management of exotic vegetation
(d) Reasonable use of residential lots of record
(e) Public utilities
(f) Elevated observation boardwalks and single family residential docks, multi-slip docks, boat ramps and commercial docks
(g) Public bridges

Even in those limited situations where avoidance of wetland impact is impossible, the applicant must show that the least damaging alternative has been chosen and the damage has been mitigated.

Wetlands serve many important hydrological and ecological values and functions. They act as groundwater recharge and filter areas for the shallow aquifer, which provides water both for individual homes and for central utilities in Martin County. They reduce the impact of flooding by acting as storage basins and temper the effect of climate extremes. They act as uniquely productive biological systems providing home and food for the majority of Florida's threatened and endangered species.

The wetland protection provided by the MCCGMP is almost exclusively through the preservation and enhancement of existing wetlands and implemented through local ordinances that require a Preserve Area Management Plan (PAMP). The PAMP is subject to the review and approval of Martin County Growth Management Department. No development approval will be issued until the PAMP is approved by the Martin County Growth Management Department and must contain a statement that indicates the County has authority to enforce all its provisions. The wetland areas on site must be maintained In accordance with the plan.

The PAMP must contain provisions to:

(a) remove and provide continued management of exotic vegetation and debris;

(b) revegetate the wetland area or the surrounding upland transition buffer with appropriate native plant material, if necessary;

(c) mitigate previous or potential drainage impacts, to the maximum extent technically feasible, in order to restore the natural hydroperiod;

(d) assure that the quality and quantity of natural drainage patterns, which provide inflow to the wetlands, are maintained by incorporating these areas into the project's surface water management plan;

(e) provide buffers of appropriate native vegetation adequate to assure continuance of the wetlands values and functions;

(f) provide for the protection of plant and animal species of regional concern in accordance with recommendations from applicable state and federal agencies; and

(g) provide any additional measures, deemed necessary, to protect and maintain the values and functions of the wetland area.

These PAMP provisions require that wetland systems in areas proposed for development also be restored and enhanced as part of the development order. Restoration and enhancement are required components of the development order and are not applied as mitigation credits for impacts to wetlands. These preserve area management provisions, have the effect to maximize the restoration and enhancement of existing medium and low quality wetlands to the extent technically feasible while eliminating direct negative impacts to wetlands by requiring protection through wetland preservation. This approach also works to minimize secondary wetland impacts, which are the inherent result of all development.

CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the major conclusions and recommendations contained in this report. Each item below is discussed in greater detail in the preceding body of text. The conclusions and recommendations are as follows:

1. The analyses of the data for wetlands in the Project Area indicate that 72 percent are classified as high quality wetlands, 21 percent as medium quality wetlands, and three percent as low quality wetlands.

2. The largest areas of high quality wetlands occur in Jonathan Dickinson State Park, The Atlantic Coastal Ridge Ecosystem, Pal-Mar, and in the vicinity of the Loxahatchee River and the South Fork of the St. Lucie River.

3. The largest areas of medium quality wetlands occur along the north and northwest quarters of the Project Area. These wetland are impacted as a result of: urbanization and development of subdivisions, semi-improved and improved pasture south of Cove Road, and agricultural development both north and south of CR 708. The next largest area of medium quality wetlands occurs in the south central portion of the Project Area. The impacts result from urbanization and development of subdivisions and from semi-improved and improved pasture. The alterations include direct impacts of wetlands, which were legally altered prior to State and County wetland protection provisions implemented in 1977 and 1982, and secondary impacts on wetlands from projects developed since 1982.

4. The main areas of low quality wetlands include improved pasture, farmed areas producing vegetable crops, and citrus agricultural development areas. These areas were legally altered prior to 1977 and located adjacent to I-95 and north of CR 708.

5. The WRAP scores provide a good indication of the relative functionality of representative wetlands in different parts of the Project Area. In addition, WRAP scores provide a good indication of the range of variation of wetland functions in selected areas.

6. In general, the WRAP scores are consistent with and verify the results of the remote analysis. The locations identified as areas of high quality wetlands typically have higher WRAP scores than the locations identified as areas of low quality wetlands. On some sites, the WRAP scores show a high degree of variability. Usually, the wetlands that have a low WRAP score in an area of high quality wetlands are impacted by a road, ditch, or nearby canal. Low WRAP scores are useful for identifying which wetlands are most in need of restoration.

7. The combined overlays of the soil survey, recent infrared aerial photographs, Thematic Mapping, and the NWI maps provide the most useful tool for identifying wetlands in the Project Area. These results demonstrate that use of any single source of wetland indicator data may not provide a reliable estimate of wetland coverage. A

combination of data sources and field verification are required to fully determine wetland extent and functional status.

8. Both the remote and the WRAP field assessments utilize surrounding land use and adjacent buffer variables in evaluating wetlands. The extent and condition of adjacent uplands is a significant factor in determining wetland function. Because of this, the importance of the preservation and enhancement of larger buffer areas around wetlands that are to be preserved should be encouraged. This is especially important for those wetlands that are to be incorporated within development sites. State and federal agencies as well as local governments should strengthen their wetland buffer requirements.

9. The Cypress Creek Area stands out as the one major area of high quality wetlands in the project area that is currently being considered for public acquisition. This area is located along the Martin and Palm Beach County line. About two square miles of this area occur in Palm Beach County and two to three square miles are located in Martin County. This area is important because it has a direct drainage connection to the Northwest Fork of the Loxahatchee River through Cypress Creek. This area is interspersed with numerous marshes, cypress swamps, and wet prairies. The WRAP field assessment reveals that the hydrology of many of these wetlands is impacted by ditches associated with agricultural operations. The protection and restoration of the wetlands in the Cypress Creek Area can be extremely beneficial in improving the supply of fresh water to the Northwest Fork of the Loxahatchee River. These actions would assist in reducing salt water intrusion up the river, which is a threat especially during periods of drought. Other benefits include flood water attenuation, the protection of fish and wildlife habitat, and enhancement of water quality. Palm Beach County and Martin County should coordinate activities to protect and restore the Cypress Creek Area.

10. There are several large areas of high quality wetlands in the Project Area that are presently being purchased or are purchased through the SOR, CARL, or other Martin County Land Acquisition programs. These areas include portions of the South Fork of the St. Lucie River, Pal-Mar and the Atlantic Ridge Coastal Ecosystem. Existing efforts to manage and protect these areas should continue.

11. The main types of restoration activities that can benefit the South Fork of the St. Lucie River and Loxahatchee River are related to improving the water storage capabilities of wetlands within the river basin. Wetlands that are ditched or partially drained have a reduced hydroperiod. This negatively affects these rivers four ways: 1) it causes unnatural surges of stormwater to the river by water that would have, under natural conditions, been stored in the wetland; 2) it reduces the amount of water that is eventually available to reach the river through ground water seepage; 3) it lowers the quality of the water flowing to the river by reducing the opportunities for water treatment that occur in natural wetland systems; and 4) it negatively affects the food web and habitat for fish and wildlife. Restoration efforts should be encouraged.

12. The Loxahatchee River also suffers from reduced hydrologic flows because connections from certain wetland systems have been diverted from the drainage basin.

One area which warrants restoration is where the South Fork of the St. Lucie River system was connected to the Loxahatchee River system by at least two flow ways. These flow ways, which were generally aligned in a northwest to southeast direction, converged into Kitching Creek, a northern tributary to the Loxahatchee River. These two natural flow ways have both been disrupted by the development of a three mile long by one mile wide citrus grove and intersect the orange grove on its northern boundary and at its southwest corner. Stormwater detention and management within the citrus grove can be modified to restore these hydrologic connections and improve river flows. A cooperative effort between the county, state and the local grower can be developed in which assistance and incentives will be provided to improve water management and restore the hydrology.

13. The individual or isolated wetlands within many of the residential and rural agricultural areas are in need of improvements to restore the hydroperiod to natural conditions. Canals and ditches are frequently located in or near many of these wetlands and as a result these wetlands have altered hydroperiods. Restoration of these wetlands should be a requirement of any activities in these residential or agricultural areas that require a permit modification or application for new land use.

14. Field observations suggest that the water flows from the wetlands on the west side of Pal-Mar may be partially blocked by SR 711. It is recommended that the county and SFWMD conduct an investigation to determine the need and potential benefits of improving the west to east hydrological connections for SR 711. This would improve the connectivity in hydrology for Pal-Mar and reduce ponding of water west of SR 711. In addition, the SFWMD should investigate the need and potential benefits of restoring natural drainage flows from Pal-Mar to Cypress Creek through its historic route.

15. Martin County should consider designating the Loxahatchee River Basin Planning Project Area as a potential mitigation area for public projects that result in wetland impacts or losses. Allowing mitigation of these impacts in the Loxahatchee River basin can generate additional resources to improve and restore wetland hydrology and habitat within this basin.

16. Review of the composite data overlays indicate that section 25 located north of Bridge Road (CR 708) and east of I-95 can be a beneficial and strategic location for a water storage area. This location coincides with the approximate location of the drainage divide between the South Fork of St. Lucie River and Kitching Creek. This is one of the few locations where surface storage would not potentially displace other valuable wetlands. The SFWMD and county should evaluate the potential for acquisition of this land as a WPA. This region is already under review by Martin County as part of an independent investigation of the Jenkins Canal/Kitching Creek drainage area. A water management plan is being prepared by the county's consultant, Earth Tech.

17. Martin County has strong wetland protection policies. Martin County and Palm Beach County should consider more direct coordination to jointly promote the

protection and restoration of the Cypress Creek area and Pal-Mar. Both of these areas are located partially within each county.

18. An additional new policy that should be considered by Martin County is to provide incentives, such as reduction in property taxes, to private property owners for removal of invasive exotic vegetation from their properties. State and federal agencies should assist the local governments to develop acceptable incentives that will promote the removal of invasive exotic vegetation on private property.

19. The protection of the ecological character of individual wetlands and wetland systems should remain a priority in Martin County. Maintenance or enhancement of water quality and water storage are essential to this objective. The protection of water storage functions of wetlands is one of the most important actions needed to assist in restoring more natural flows to the Loxahatchee River and South Fork of the St. Lucie River. In light of this, any mitigation that may be required under exemptions of Martin County's present wetland ordinance should require "in-kind" replacement storage in the same watershed as the impacted wetland site and compensate for the suite of functions lost, to the extent practicable.

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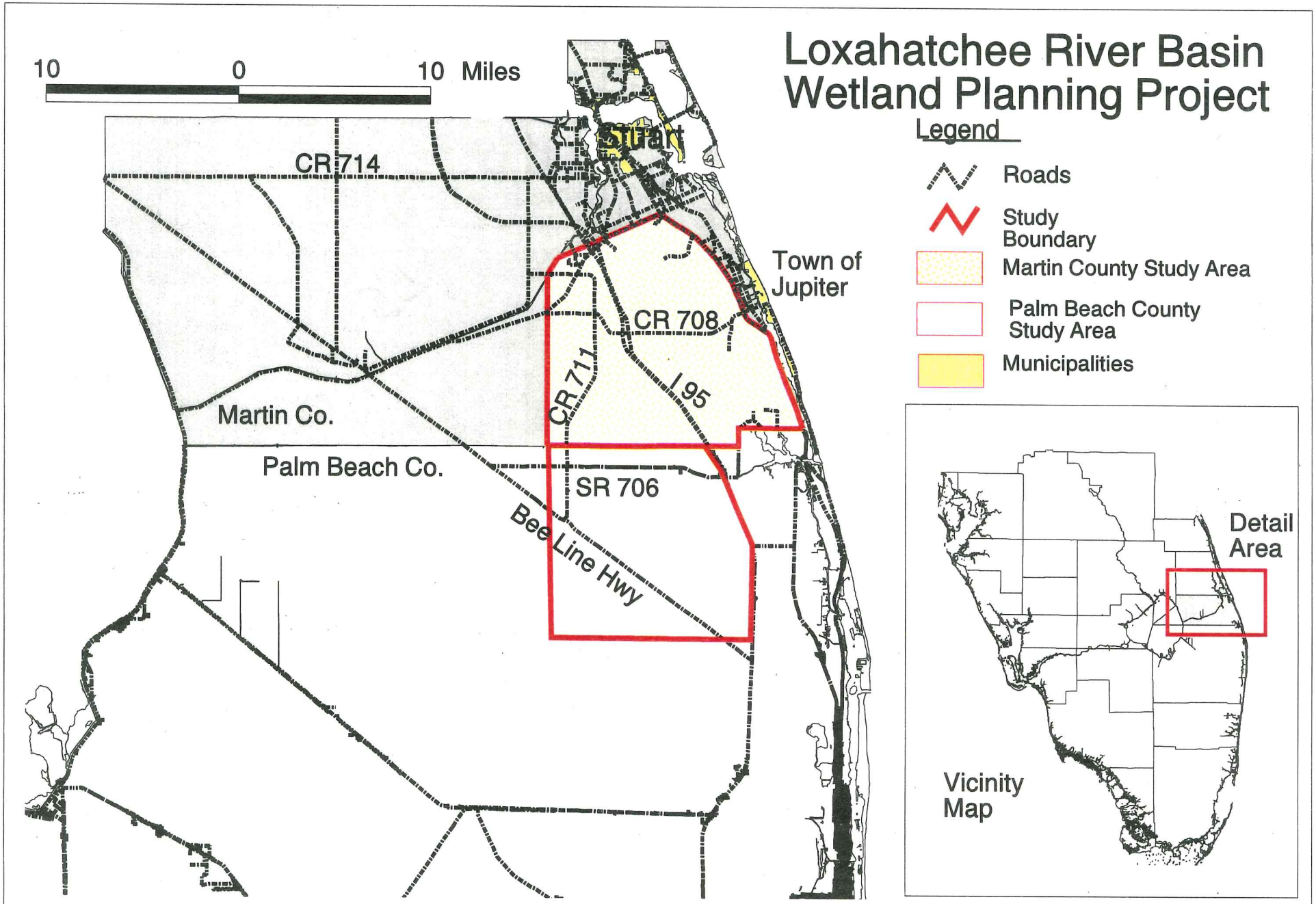


Figure 1. Study site and vicinity map showing the total project planning area and location map for the Martin County project area.

Martin County

Loxahatchee & S. Fork St. Lucie River Basins

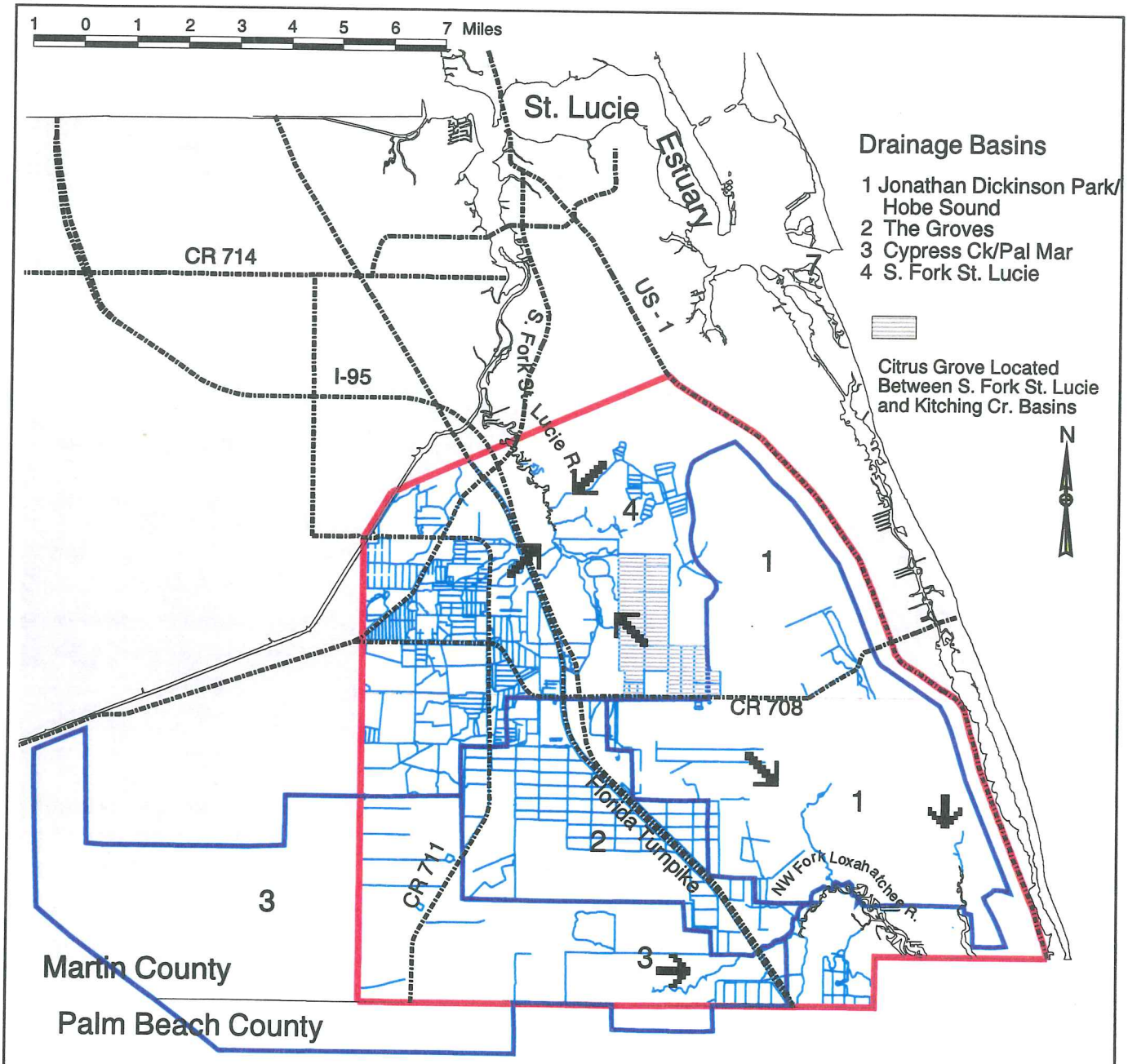


Figure 2. Loxahatchee River watershed and major drainage basins including portions of the S. Fork St. Lucie River sub-basin.

GMD
Environmental Division

Legend

- Loxahatchee R. Sub-basins
- Project Boundary
- Martin County Project Area
- County Background
- Major Drainage Features
- Roads

Martin County

Loxahatchee River Basin Wetland Planning Project

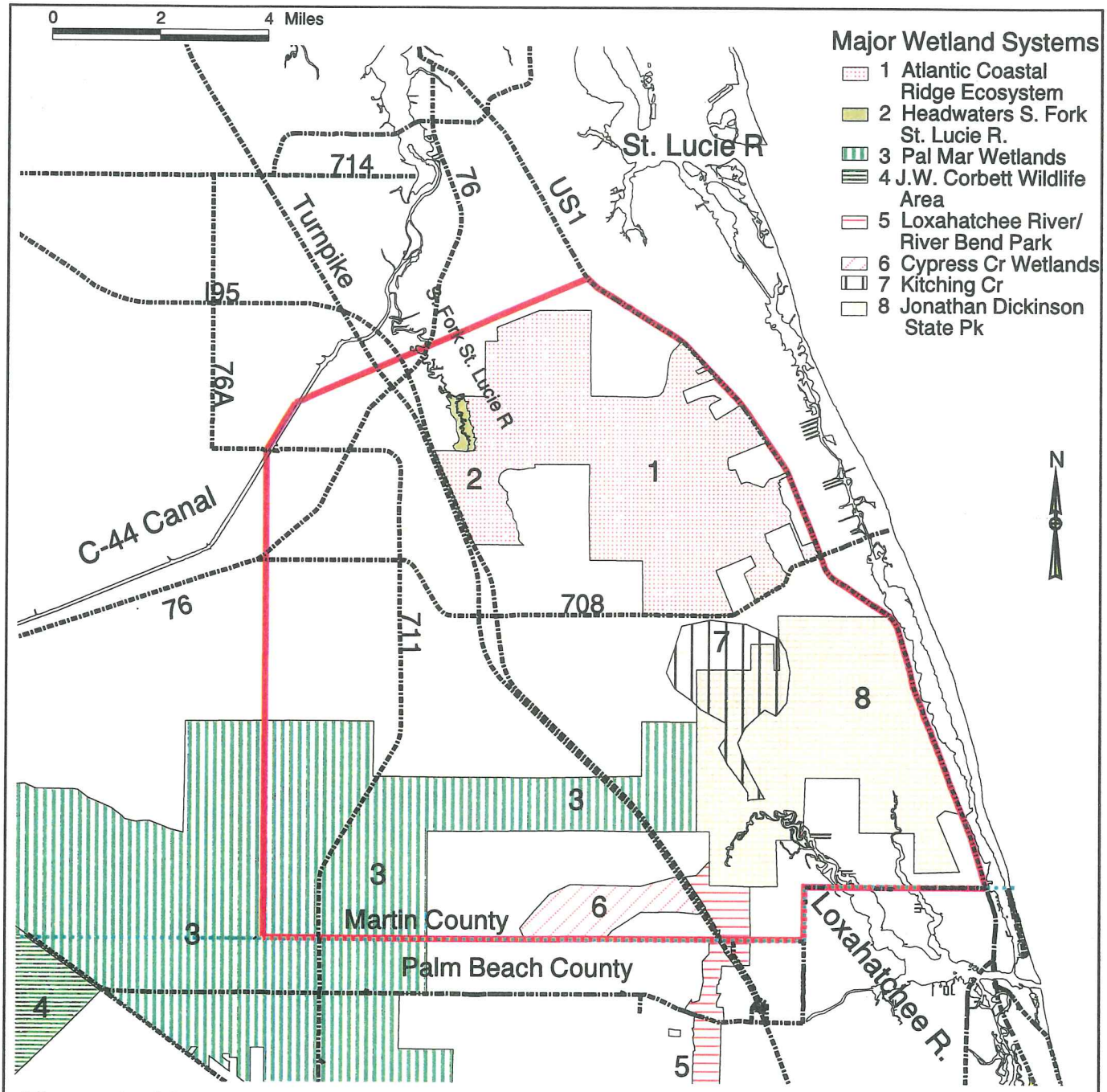


Figure 3. Major wetland systems associated with the Loxahatchee and S. Fork St. Lucie River Basins.

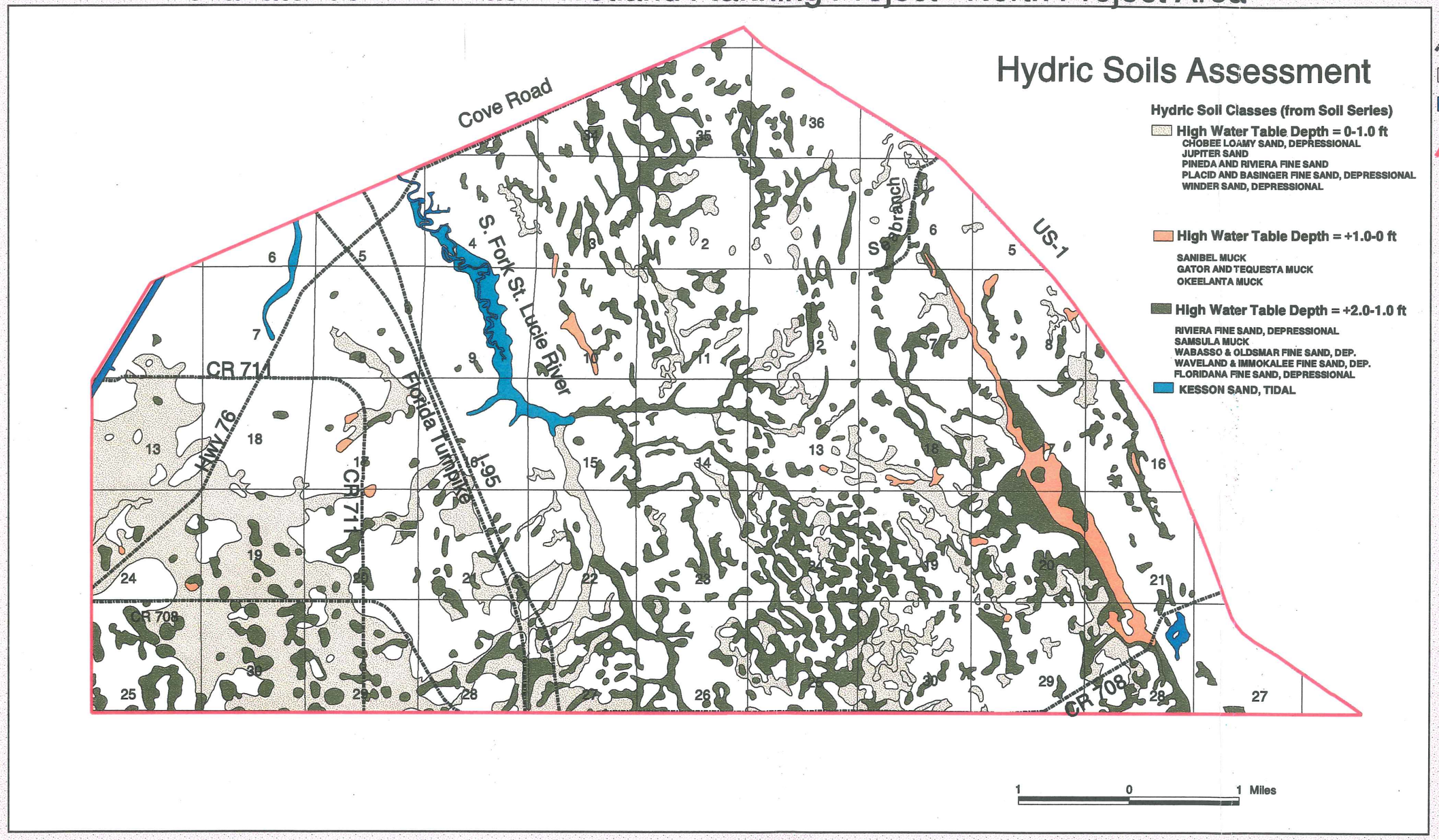
GMD
Environmental Division

Legend

- Martin County Project Area
- Project Boundary
- County Background
- County Line
- Roads

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - North Project Area



Legend

- Roads
- Section Lines
- Open Water
- Study Boundary

GMD

Environmental Division

N

Figure 4. Hydric soils analysis for the north project area. Soil types based on USDA Soil Survey (1981) and grouped according to typical high water table depths for hydric soils.

Figure 4

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - South Project Area

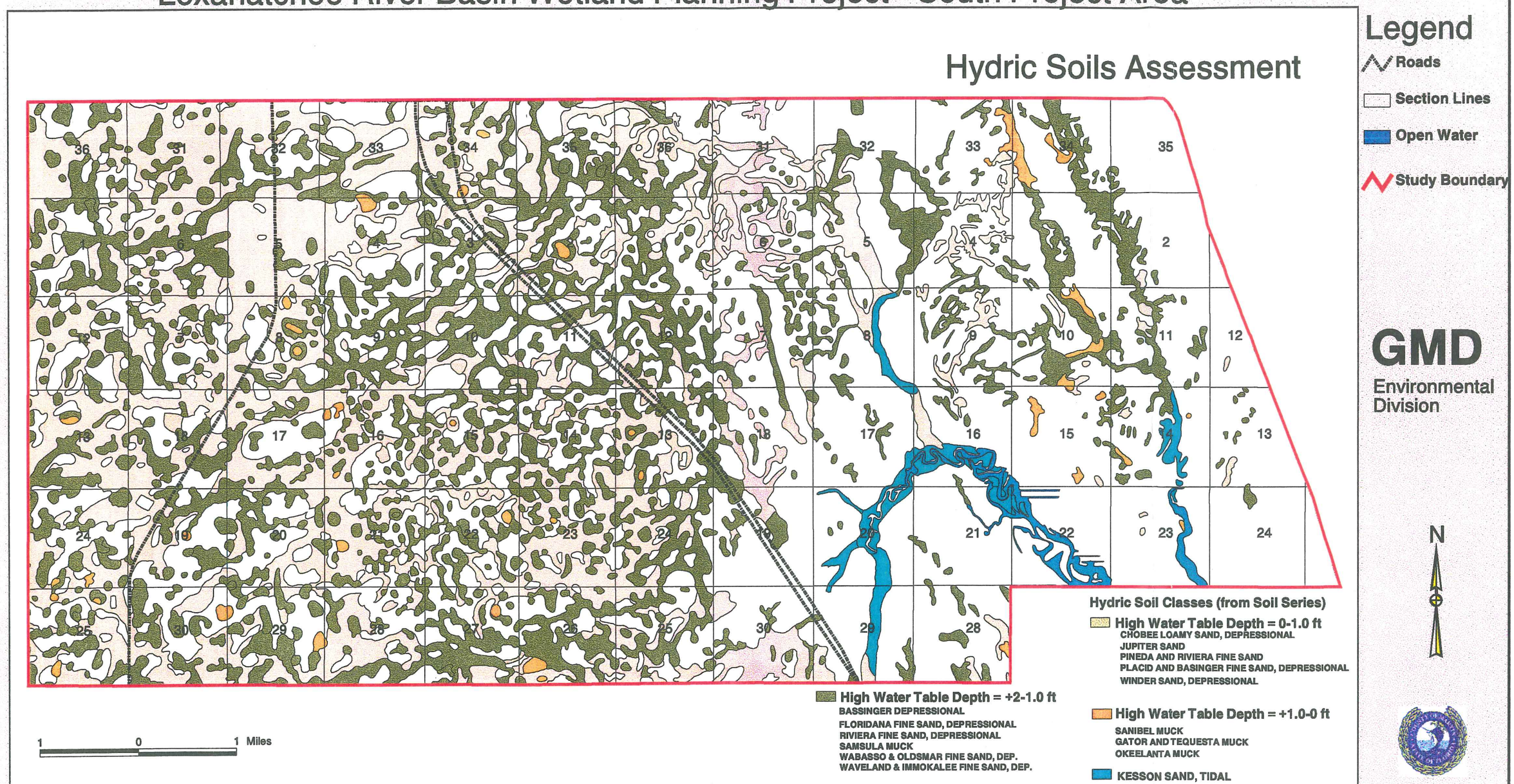
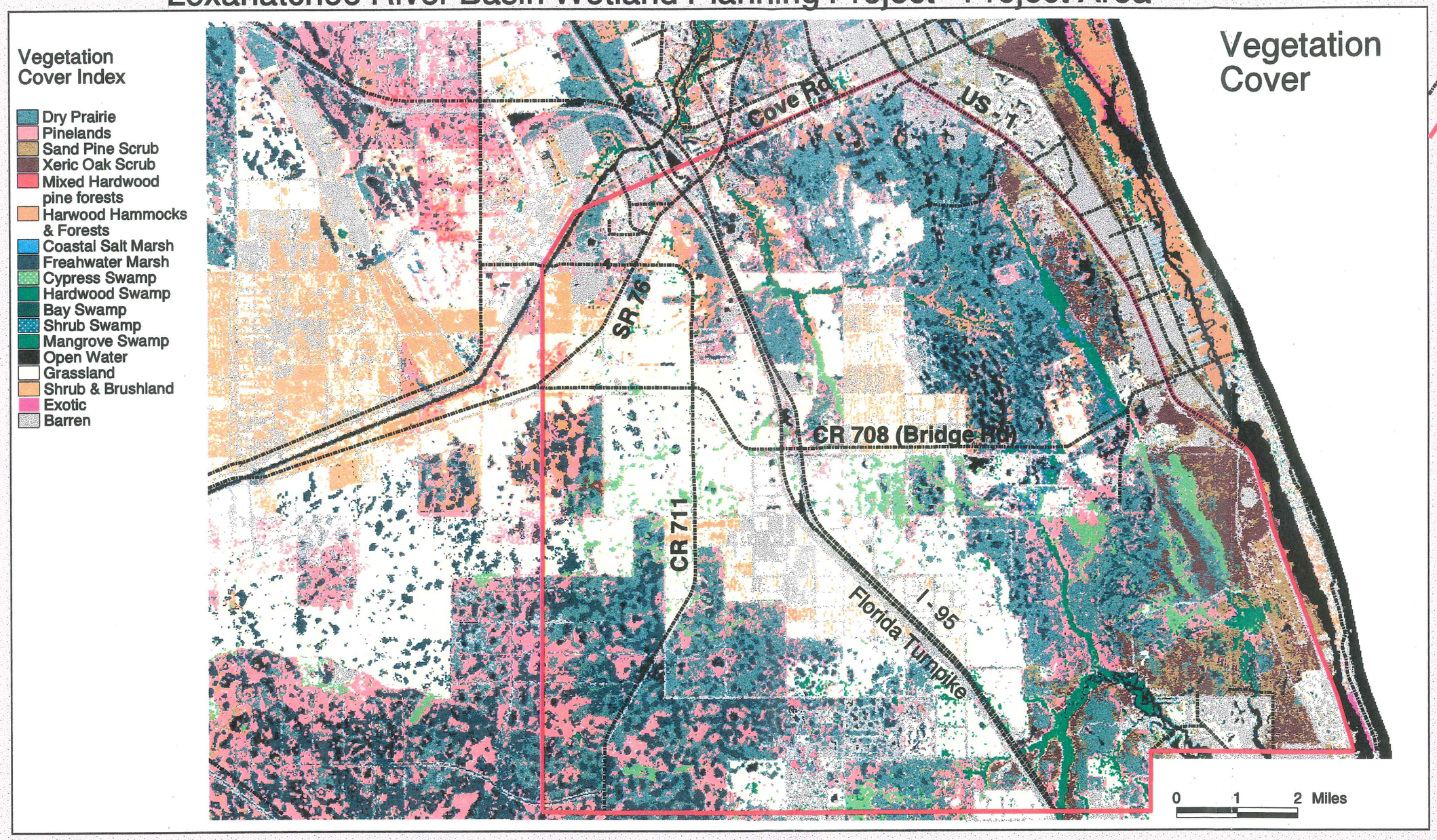


Figure 5. Hydric soils analysis for the south project area. Soil types based on USDA Soil Survey (1981) and grouped according to typical high water table depths for hydric soils.

Figure 5

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - Project Area



Legend

Roads

Study Boundary

GMD

Environmental Division

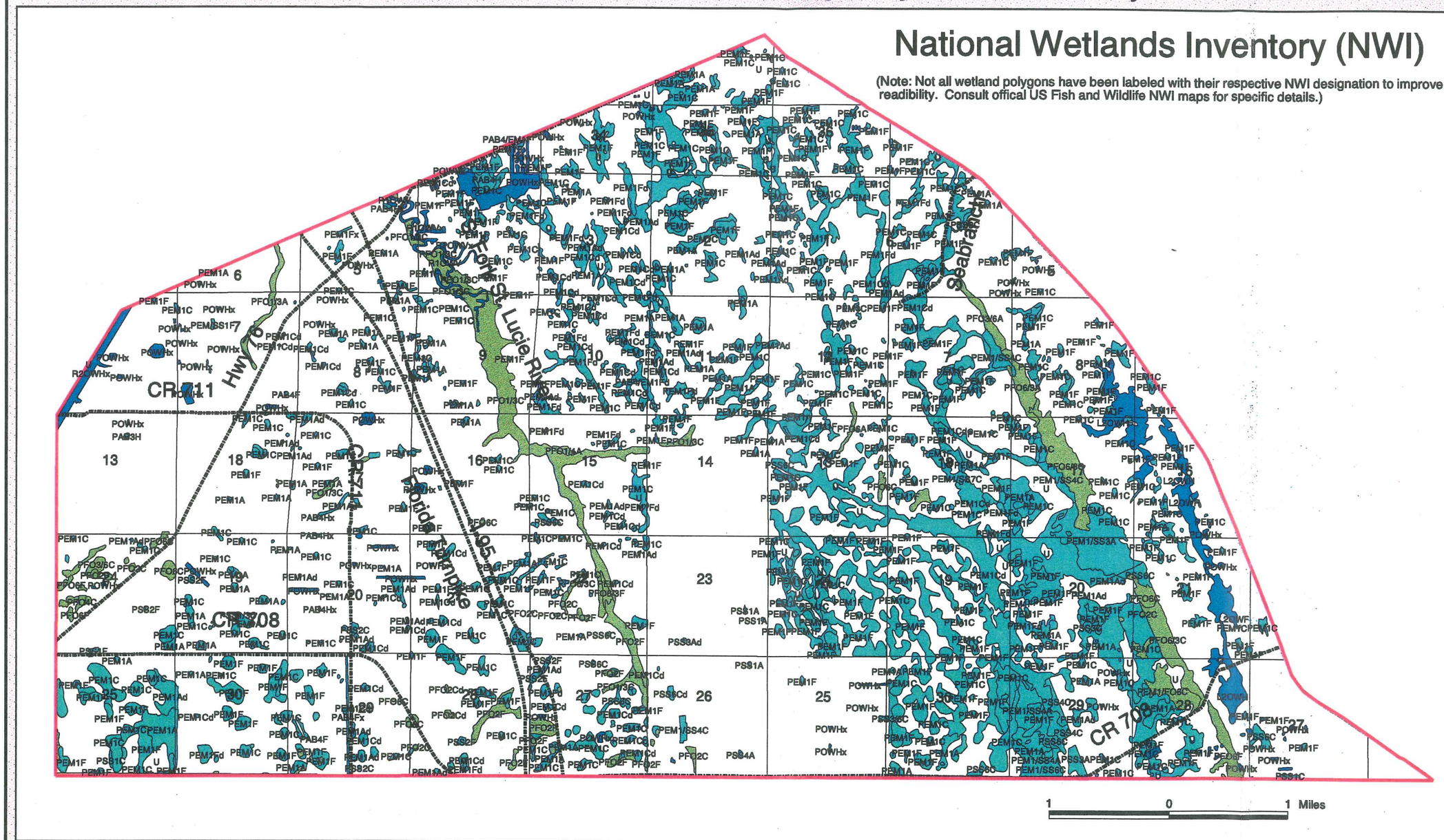
N

Figure 6. GFWFC land cover for Martin County and Loxahatchee River Basin project area.
Source data from GFWFC landsat TM data 1988 - 1989.

Figure 6

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - North Project Area



Legend

NWI Wetlands
- Estuarine Intertidal
- Palustrine Forested
- Palustrine Emergent
- Open Water

- Major Roads
- Section Lines
- Project Boundary

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Figure 7. National Wetlands Inventory of the north project area.

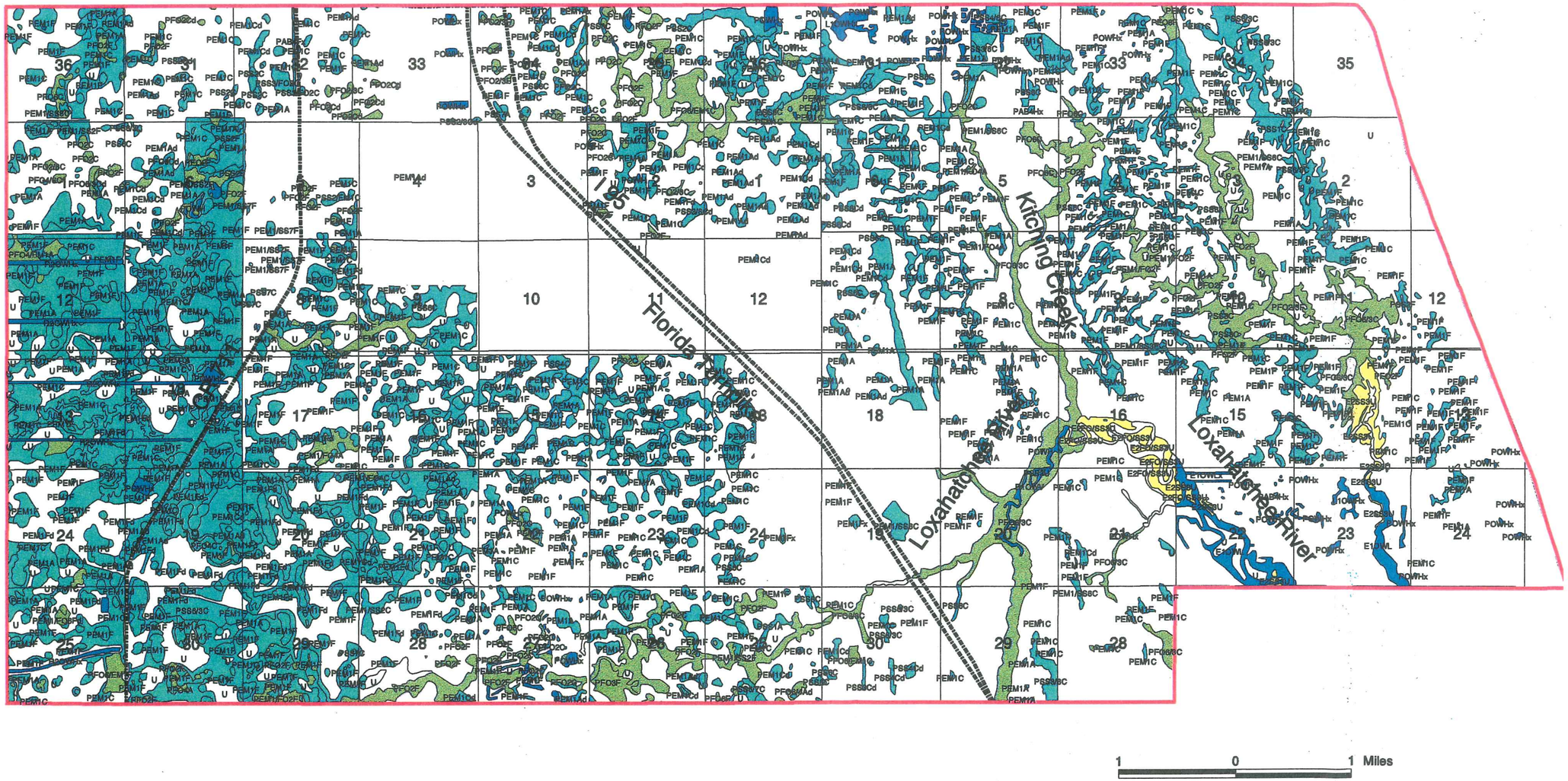
Figure 7

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - South Project Area

National Wetlands Inventory (NWI)

(Note: Not all wetland polygons have been labeled with their respective NWI designation to improve readibility. Consult offical US Fish and Wildlife NWI maps for specific details.)



Legend

NWI Wetlands
- Estuarine Intertidal
- Palustrine Forested
- Palustrine Emergent
- Open Water

- Major Roads
- Section Lines
- Project Boundary

GMD

Environmental Division

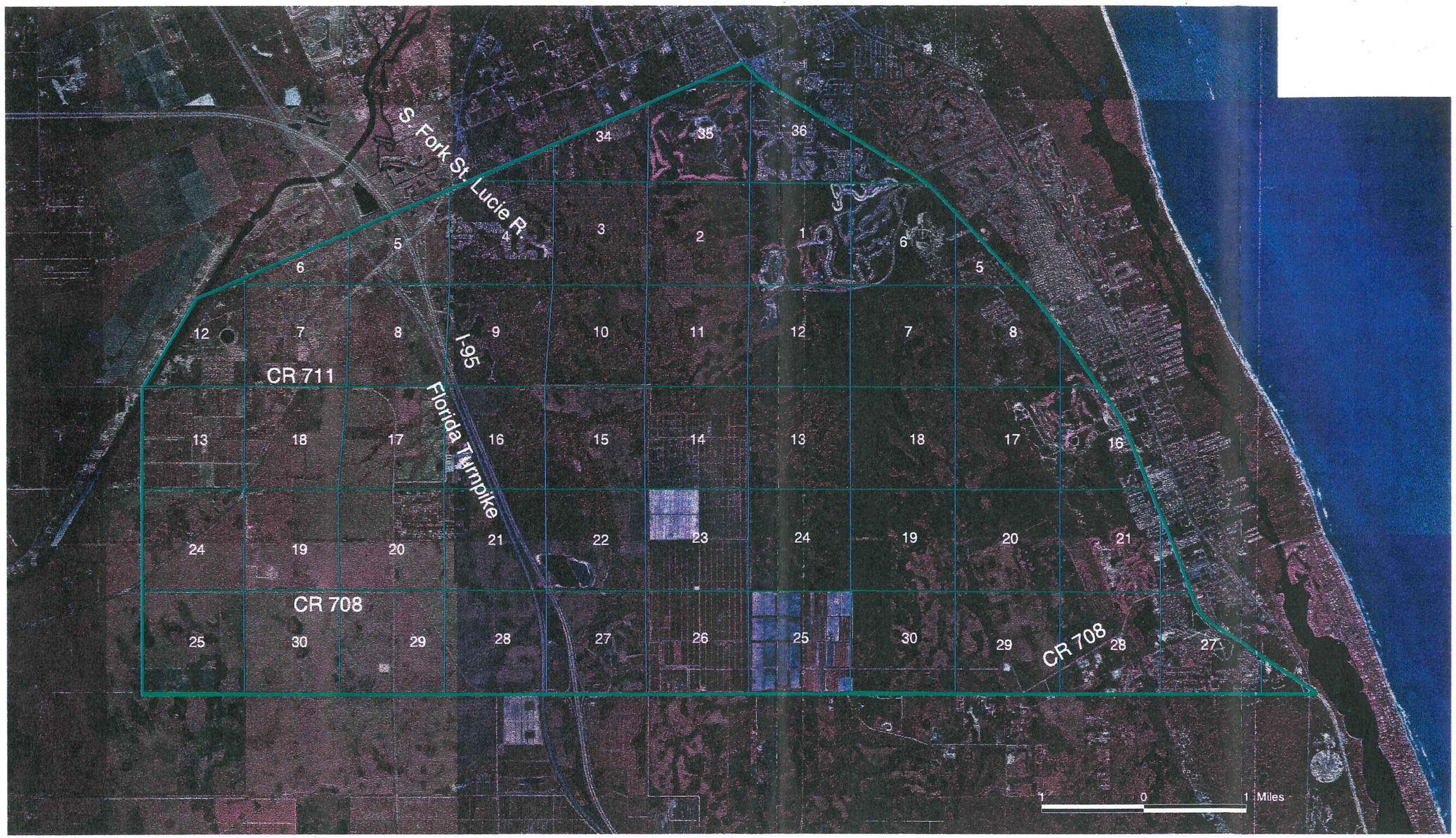
N

Figure 8. National Wetlands Inventory for the south project area.

Figure 8

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - North Project Area



Legend

Section Lines

North Study Boundary

GMD

Environmental Division

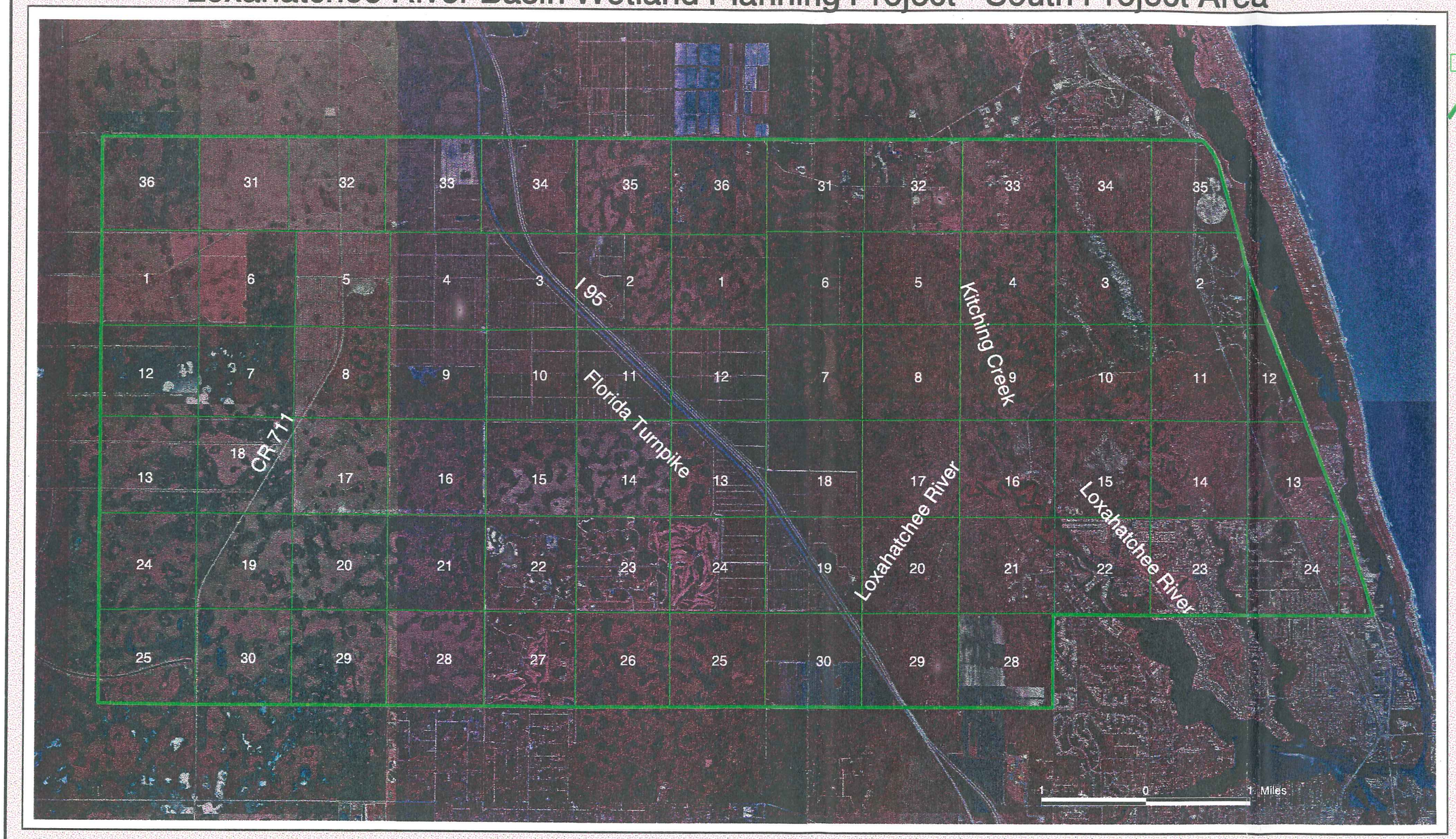
N

Figure 9. Composite color infrared photographs of the north project area showing mosiac of wetlands. Photos taken in spring 1995.

Figure 9

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - South Project Area



Legend

Section Lines

Study Boundary

GMD

Environmental Division

N

Figure 10. Composite color infrared photographs of the south project area showing the mosiac of wetlands. Photos taken in spring 1995.

Figure 10

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - North Project Area

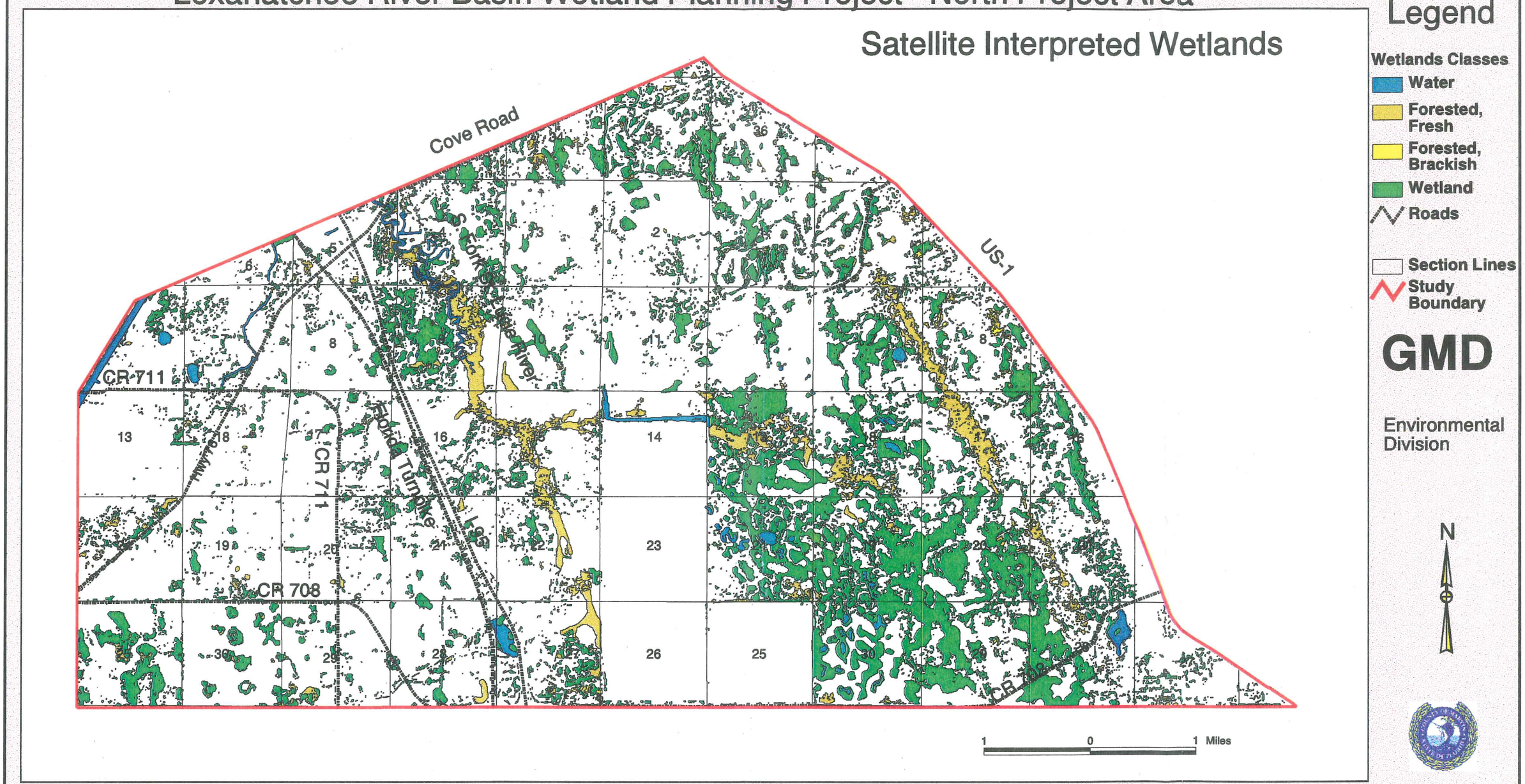


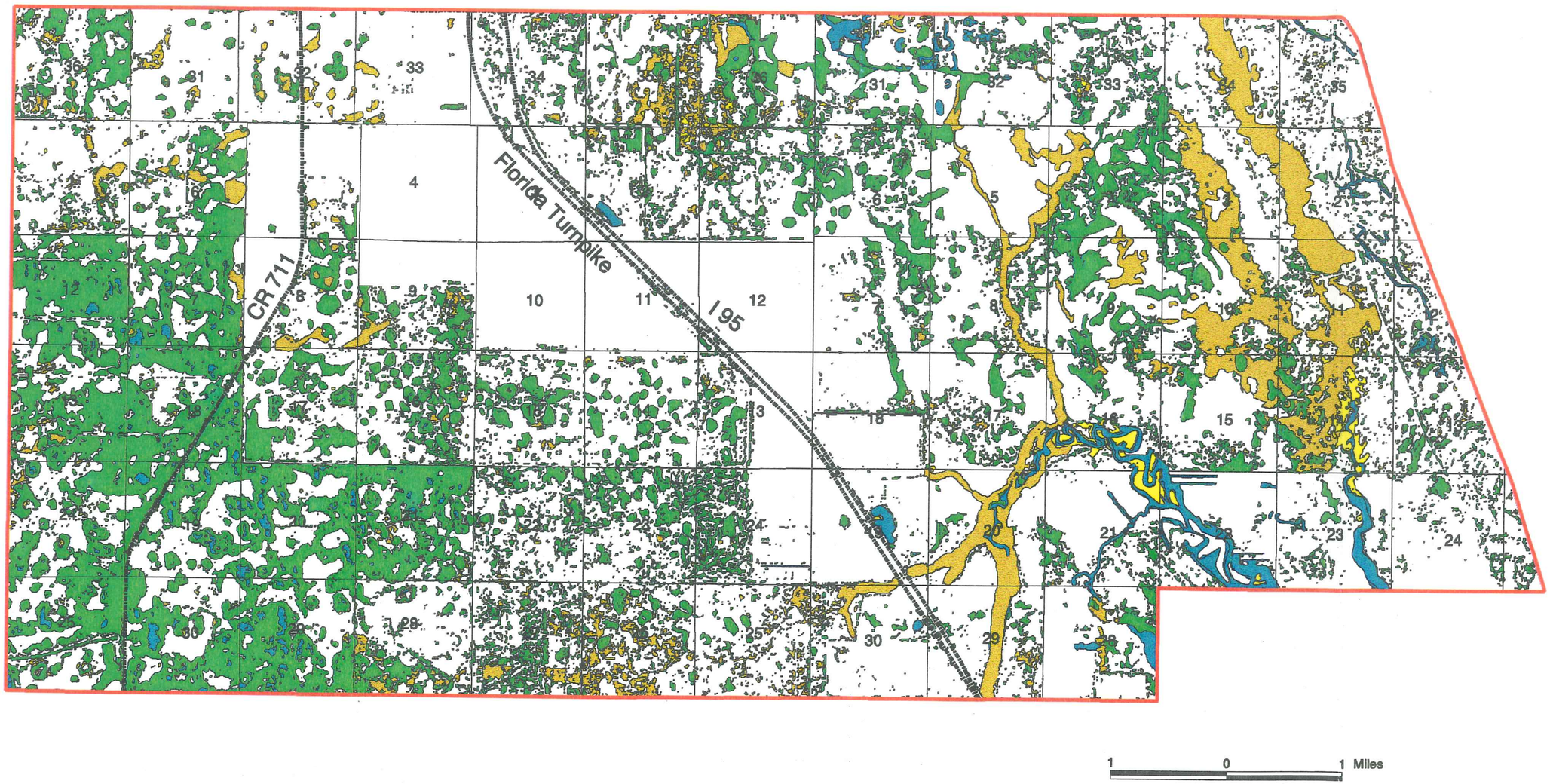
Figure 11. Satellite derived wetland features within the north project area. Source data from 1996 Landsat and SPOT satellite images classified to depict wetlands. Images were digitally merged prior to classification.

Figure 11

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - South Project Area

Satellite Interpreted Wetlands



Legend

Wetlands Classes

- Water
- Forested, Fresh
- Forested, Brackish
- Wetland
- Roads
- Section Lines
- Study Boundary

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Figure 12. Satellite derived wetlands features within the south project area. Source data from 1996 Landsat and SPOT satellite images classified to depict wetlands. Images were digitally merged prior to classification.

Figure 12

Martin County

Loxahatchee River Basin Wetland Planning Project

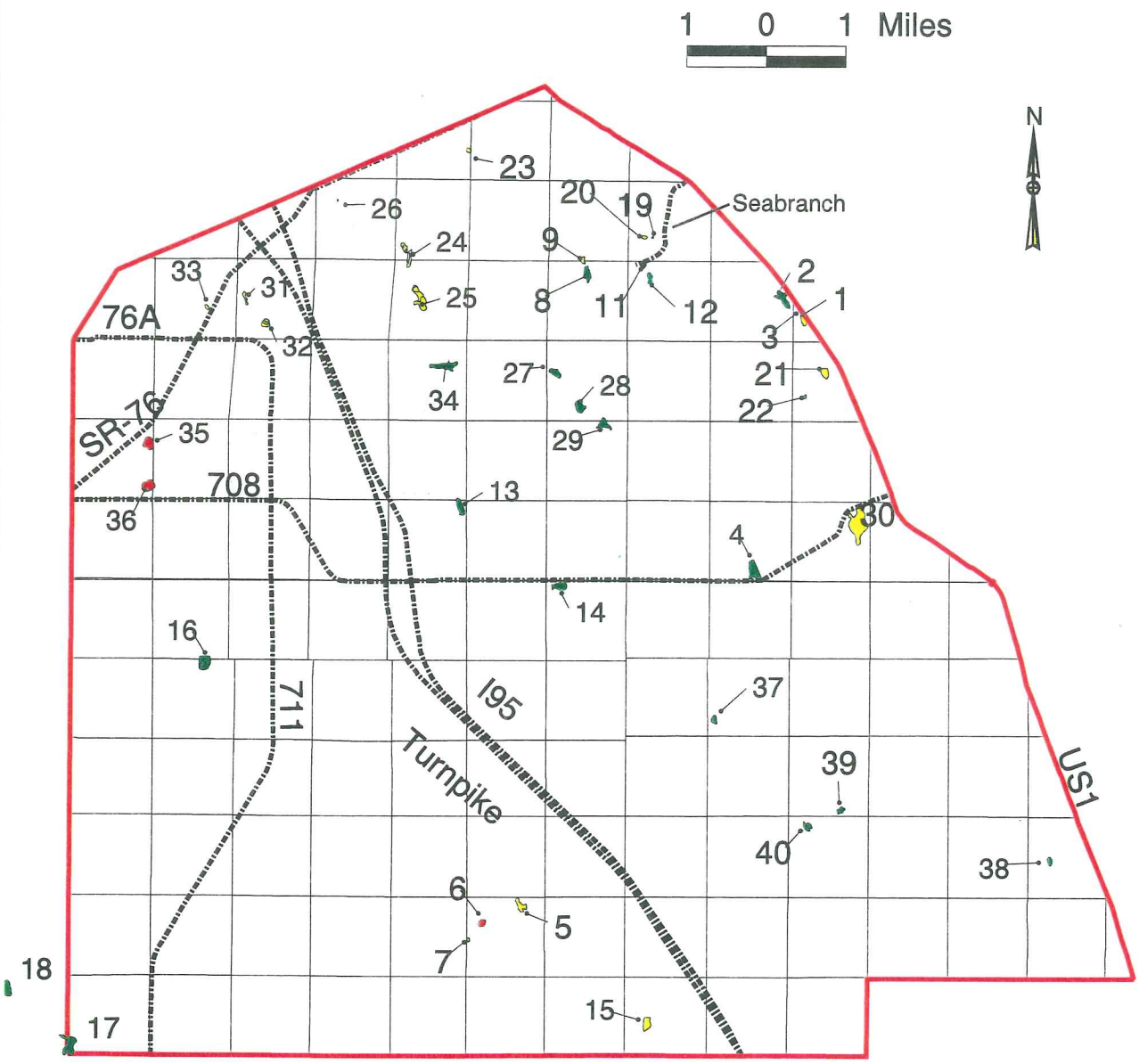

Figure 13. WRAP site locations within the project area and quality assessment based on remote analysis. (Note: WRAP site #18 is located just outside the project boundary.)

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Legend

Wetland Site Quality
- high
- med
- low

- Roads
- Section Lines
- Project Boundary

Martin County

Loxahatchee River Basin Wetland Planning Project

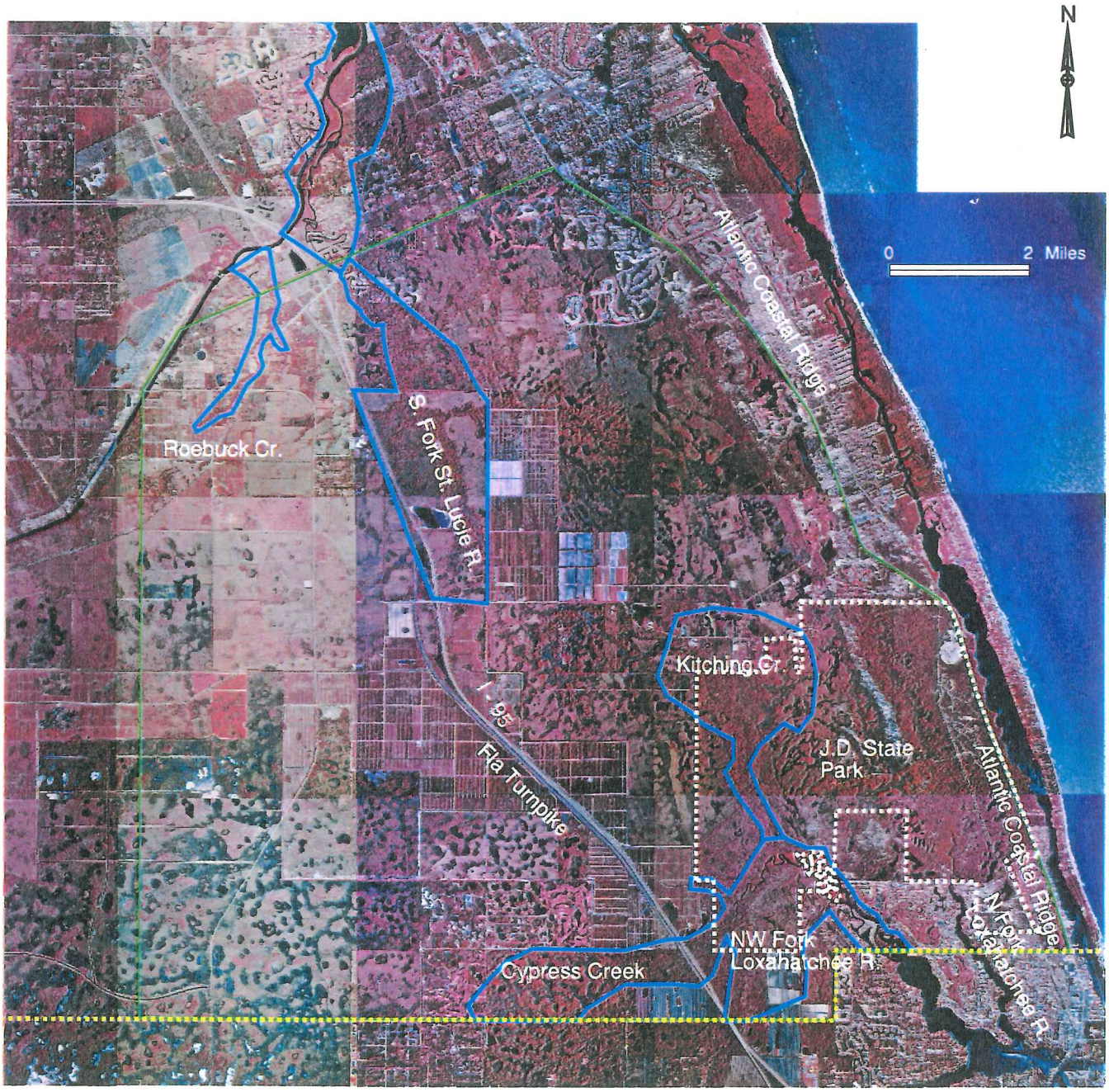

Figure 14. Major physiographic features in project area.

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Legend

- Study Boundary
- County Boundary
- State Park
- Stream/Creek Basin

Martin County

Loxahatchee River Basin Wetland Planning Project

Project Area Land Uses

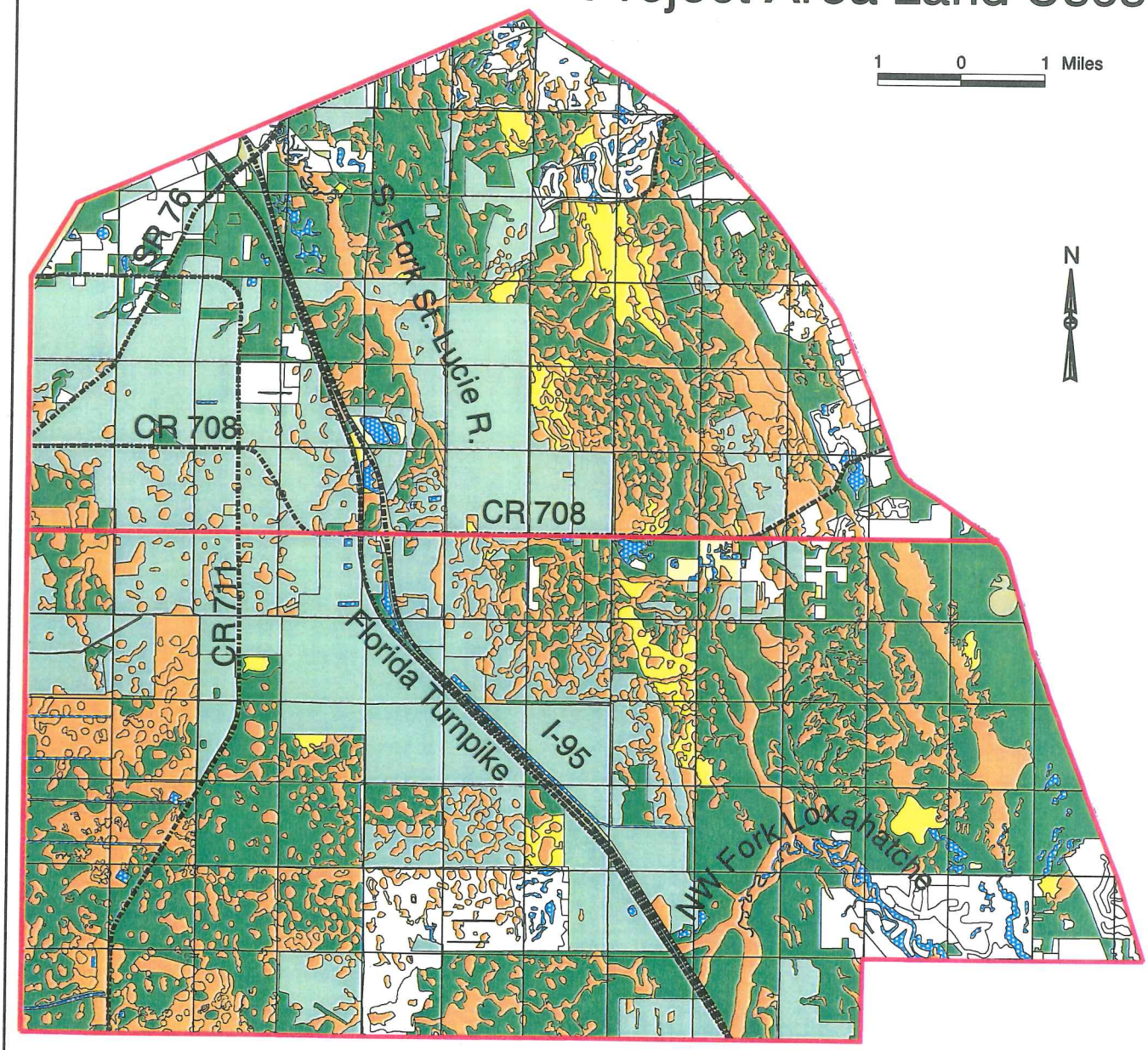

Figure 15. Land uses within the study area based on a 1995 evaluation. Land use designations based on the level 1 FLUCCS code.

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Legend

- Urban
- Ag
- Rangeland (Ag)
- Upland Forests
- Water
- Wetlands
- Barren Land
- Trans/Utilities

Major Roads
Section Lines

Martin County

Loxahatchee River Basin Wetland Planning Project

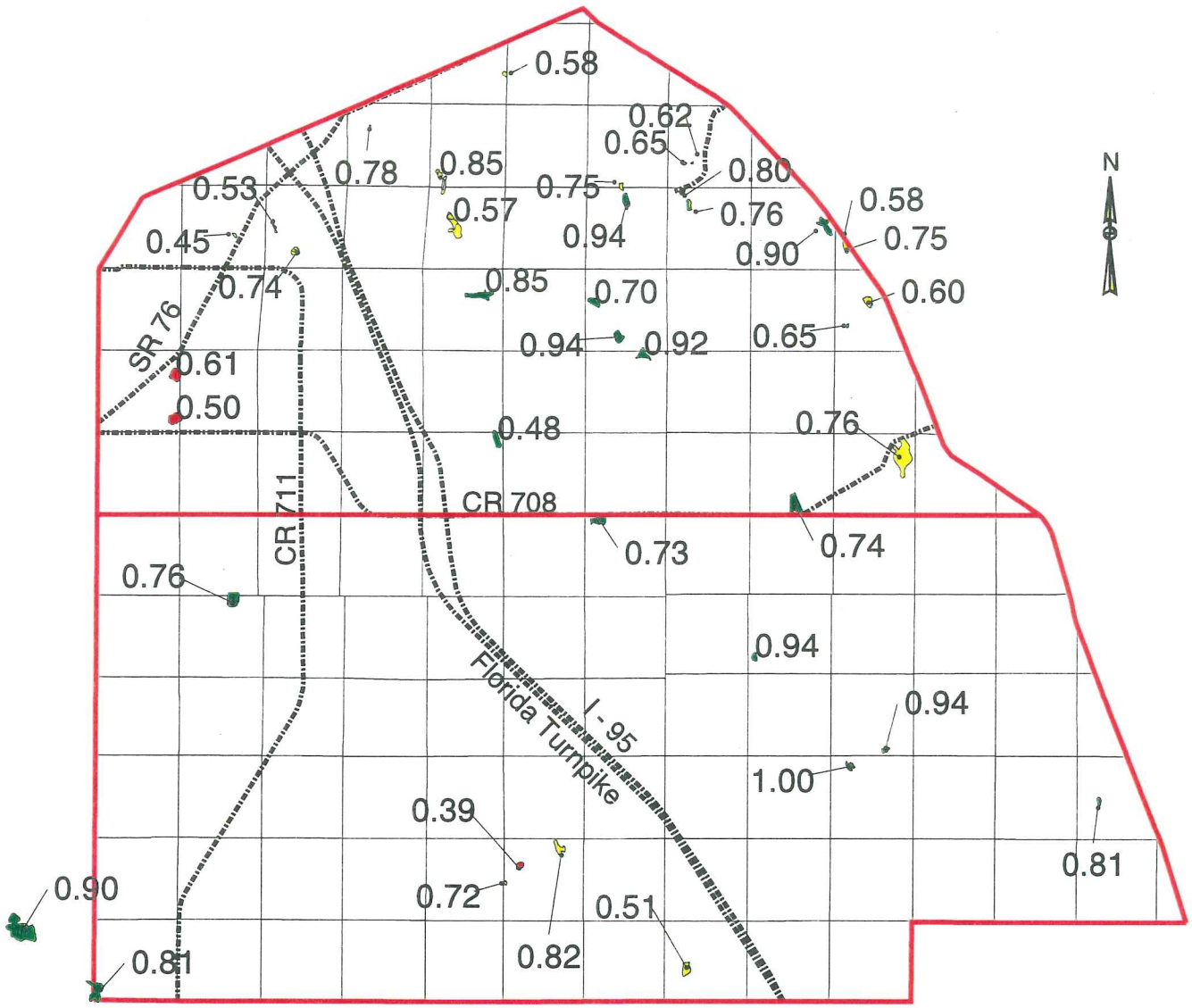

Figure 16. WRAP scores from wetland field evaluations within the project area. Quality rating based on remote analysis of aerial photographs.

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Legend
Wetland
Quality Rating
high
med
low

Study Boundary
Roads
Section Lines

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - North Project Area

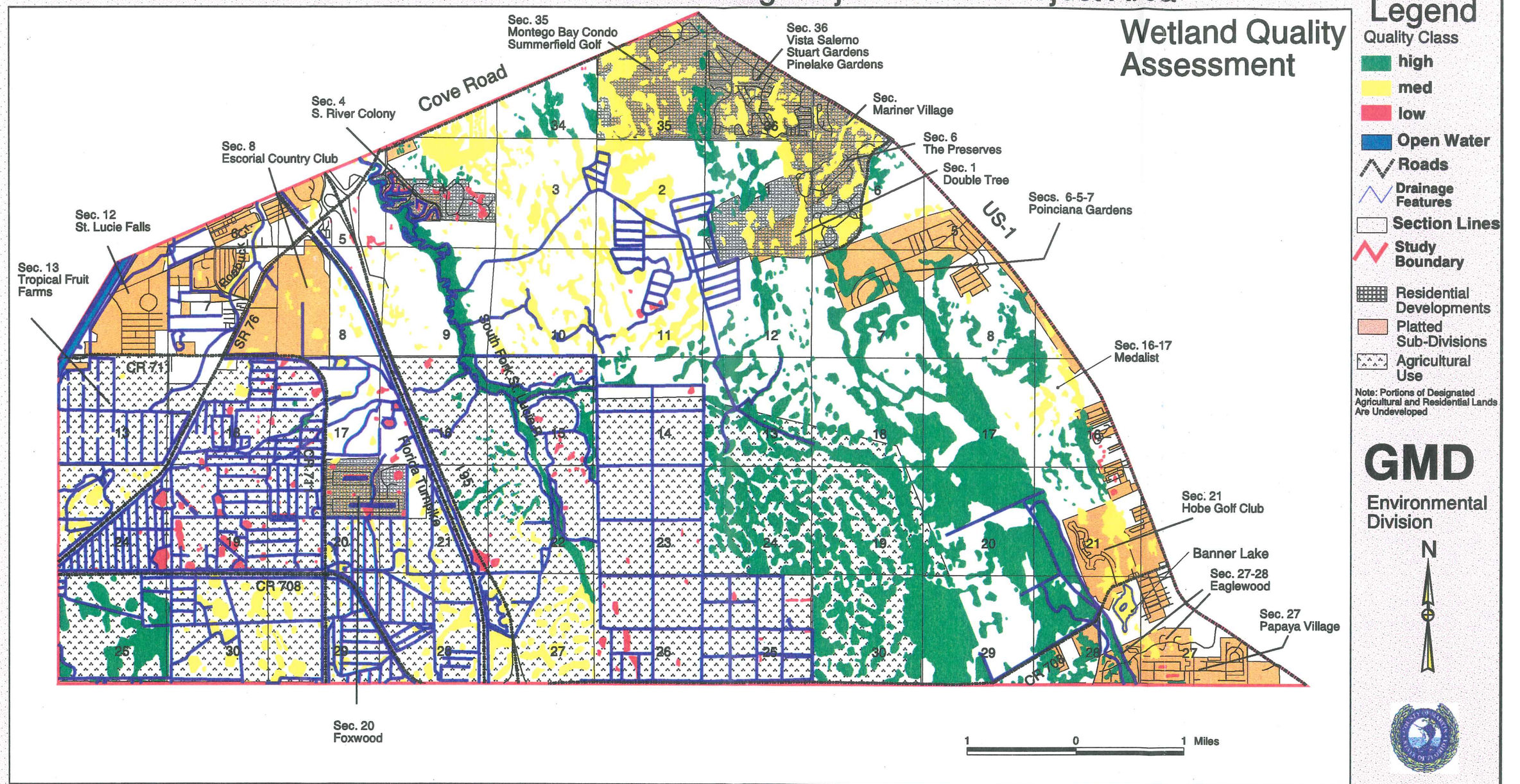


Figure 17. Wetland quality assessment for north project area based on aerial photo interpretation and WRAP analysis.

Figure 17

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - South Project Area

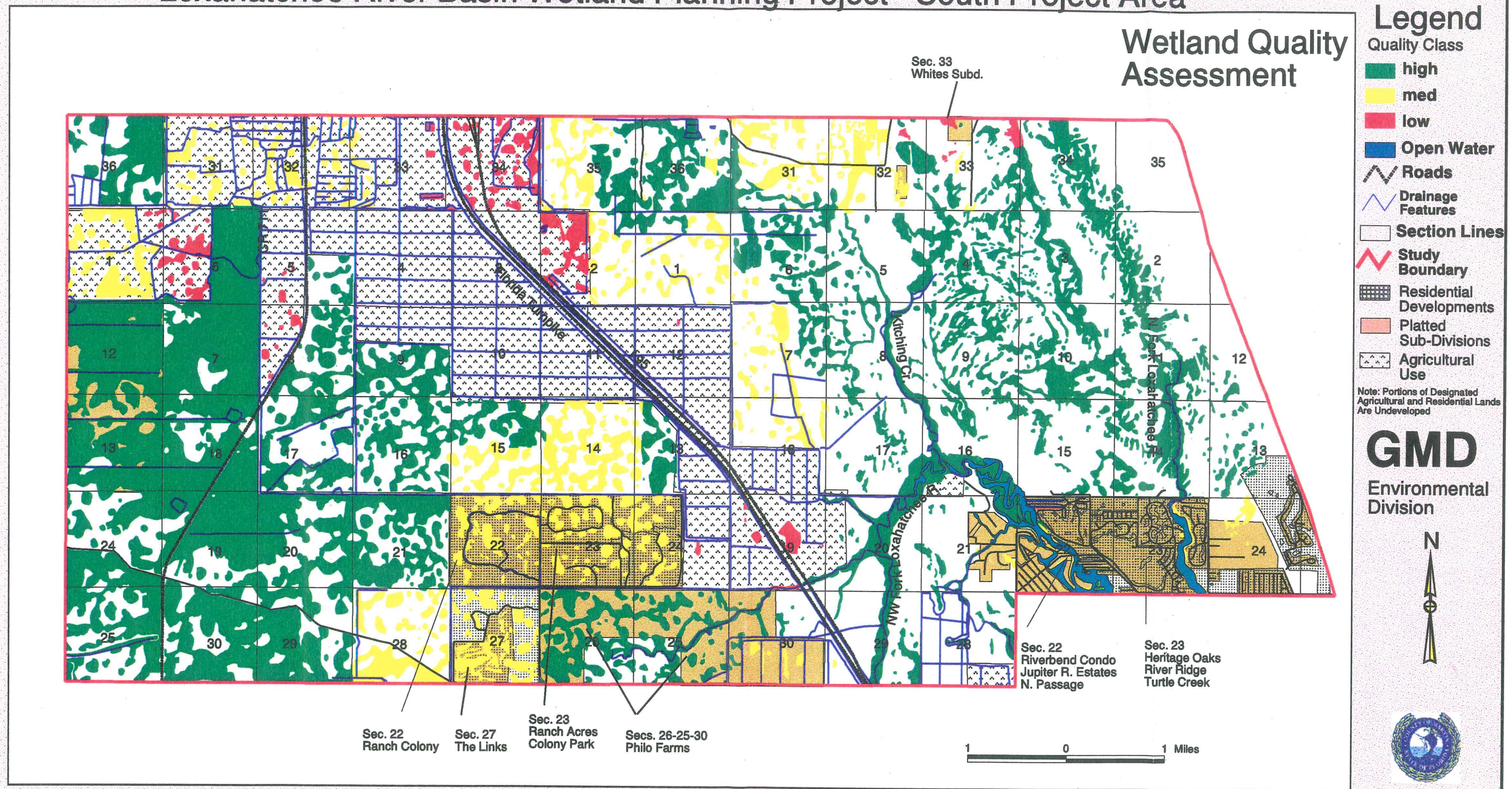


Figure 18. Wetland quality assessment for the south project area based on aerial photo interpretation and WRAP analysis.

Figure 18

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - North Project Area

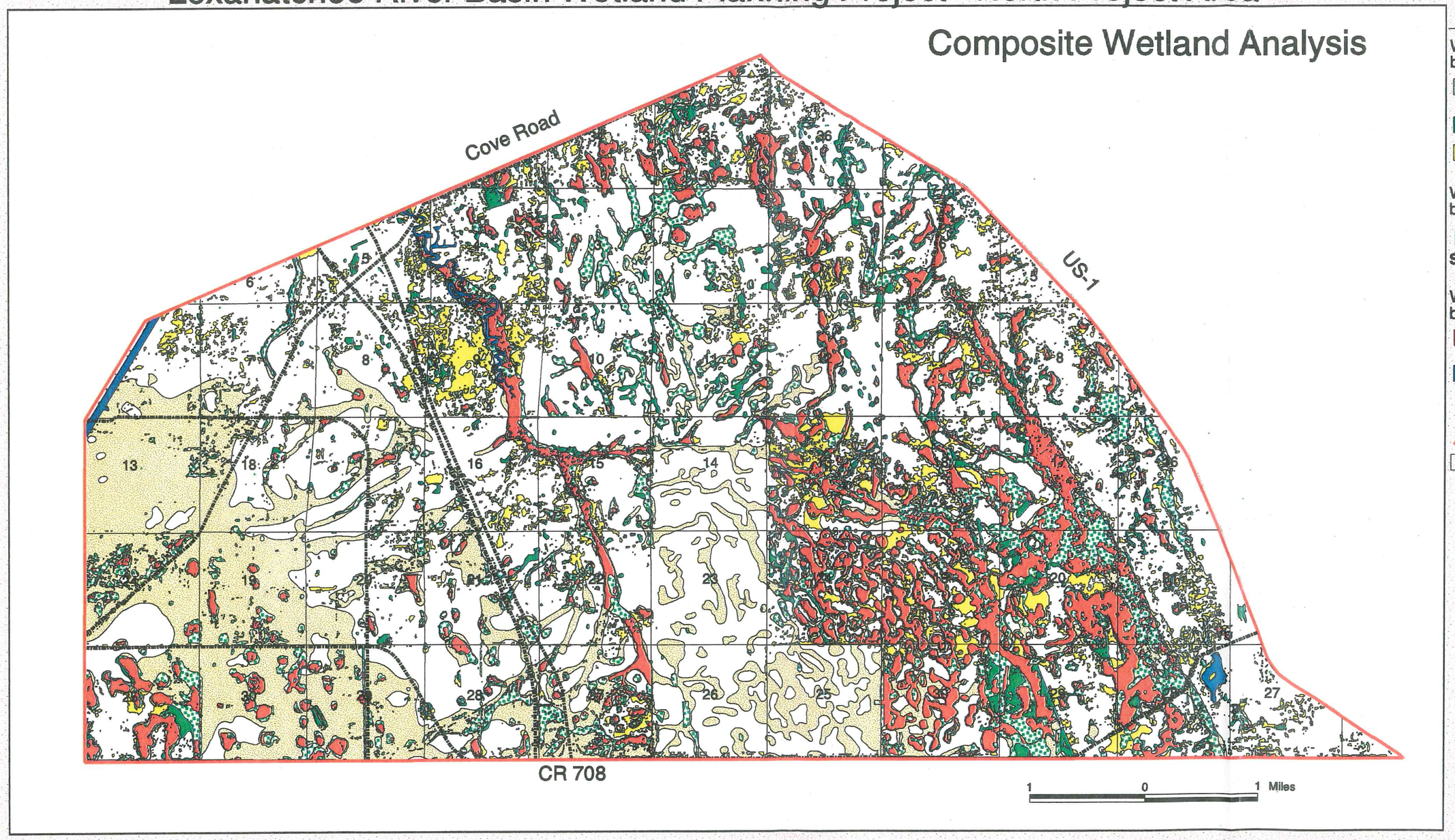


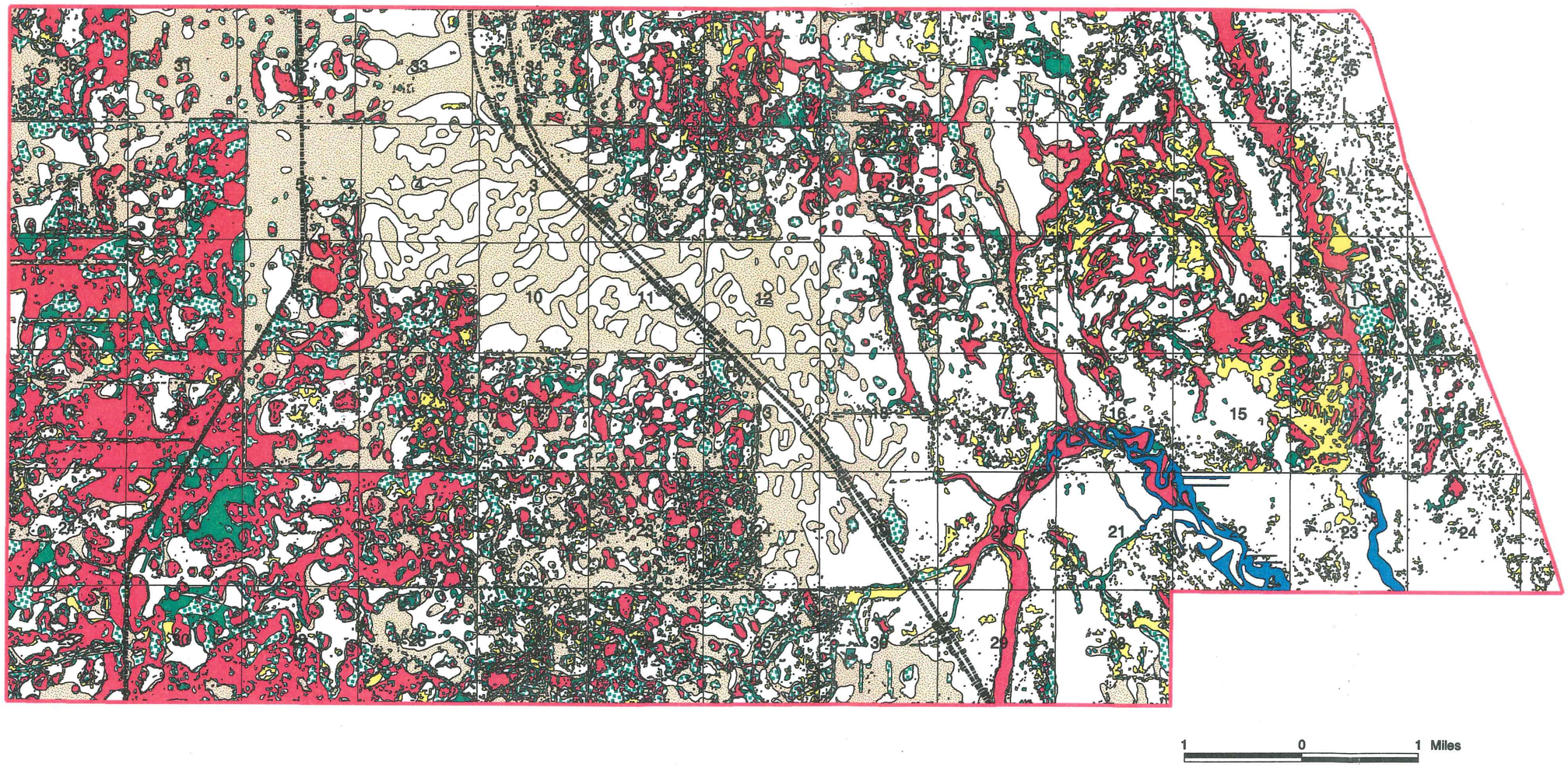
Figure 19. Composite wetland analysis for the north project area based on spatial data overlays. The map depicts wetlands that occur in only one spatial theme (such as hydric soils, or as TM classified wetlands, or in the NWI data) and as combinations of more than one data source. Spatial themes with more than one overlapping data source have an increased probability these features would be characterized as wetlands.

Figure 19

Martin County, Florida

Loxahatchee River Basin Wetland Planning Project - South Project Area

Composite Wetland Analysis



Legend

Wetlands Identified by 1 of 3 Parameters

- Hydric Soils Only
- NWI Only
- TM Only

Wetlands Identified by 2 of 3 Parameters

- Soil+NWI, or Soil+TM, or NWI+TM

Wetlands Identified by all 3 Parameters

- (S+NWI+TM)
- Open Water
- Roads
- Study Boundary
- Section Lines

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N

Figure 20. Composite wetland analysis for the south project area based on spatial data overlays. The map depicts wetlands that occur in only one spatial theme (such as hydric soils, or as TM classified wetlands, or in the NWI data) and as combinations of more than one data source. Spatial themes with more than one overlapping data source have an increased probability these features would be characterized as wetlands.

Figure 20

APPENDIX 1

FLORIDA NATURAL AREAS INVENTORY
(Brief Descriptions of Florida Natural Communities)

TERRESTRIAL-	Upland habitats dominated by plants which are not adapted to anaerobic soil conditions imposed by saturation or inundation for more than 10 percent of the growing season.
XERIC UPLANDS -	Very dry, deep, well drained hills of sand with xeric adapted vegetation.
Sandhill -	Upland with deep sand substrate; xeric; temperate; frequent fire (2-5 years); longleaf pine and/or turkey oak with wire grass understory.
Scrub -	Old dune with deep, fine sand substrate; xeric; temperate or subtropical; occasional or rare fire (20 - 80 years); sand pine and/or rosemary and cladonia.
Xeric Hammock -	Upland with deep sand substrate; xeric; temperate or subtropical; rare or no fire; live oak and/or laurel oak and/or other oaks, sparkleberry, saw palmetto.
MESIC FLATLANDS -	Flat, moderately well drained sandy substrates with a mixture of organic material, often with a hard pan.
Dry Prairie -	Flatland with sand substrate; mesic-xeric; subtropical or temperate; annual or frequent fire; wiregrass, saw palmetto, and mixed grasses and herbs.
Mesic Flatwoods -	Flatland with sand substrate; mesic; subtropical or temperate; frequent fire; slash pine and/or longleaf pine with saw palmetto, gallberry and/or wiregrass or cutthroat grass understory.
Prairie Hammock -	Flatland with sand/organic soil over marl or limestone substrate; mesic; subtropical; occasional or rare fire; live oak and/or cabbage palm.
Scrubby Flatwoods -	Flatland with sand substrate; xeric-mesic; subtropical or temperate; occasional fire; longleaf pine or slash pine with scrub oaks and wire grass understory.

PALUSTRINE - Wetlands dominated by plants adapted to anaerobic substrate conditions imposed by substrate saturation or inundation during 10 percent or more of the growing season. Includes nontidal wetlands; tidal wetlands with ocean derived salinities less than 0.5 parts per thousand and dominance by salt-intolerant species; small (less than 8 hectare), shallow (less than 2 meters deep at low water) water bodies without wave-formed or bedrock shoreline; and inland brackish or saline wetlands.

WET FLATLANDS - Flat, poorly drained sand, marl or limestone substrates.

Hydric Hammock - Lowland with sand/clay/organic soil, often over limestone; mesic-hydric; subtropical or temperate; rare or no fire; water oak, cabbage palm, red cedar, red maple, bays, hackberry, hornbeam, blackgum, needle palm, and mixed hardwoods.

Wet Flatwoods - Flatland with sand substrate; seasonally inundated; subtropical or temperate; frequent fire; vegetation characterized by slash pine or pond pine and/or cabbage palm with mixed grasses and herbs.

Wet Prairie - Flatland with sand substrate; seasonally inundated; subtropical or temperate; annual or frequent fire; maidencane, beakrush, spikerush, wiregrass, pitcher plants, St. John's wort, and mixed herbs.

SEEPAGE WETLANDS - Sloped or flat sands or peat with high moisture levels maintained by down-slope seepage; wetland and mesic woody and/or herbaceous vegetation.

Baygall - Wetland with peat substrate at base of slope; maintained by down-slope seepage, occasionally inundated; subtropical or temperate; rare or no fire; bays and/or dahoon holly and/or red maple and/or mixed hardwoods.

Seepage slope - Wetland on or at base of slope with organic/sand substrate; maintained by down-slope seepage, usually saturated but rarely inundated; subtropical or temperate; frequent or occasional fire; sphagnum moss, mixed grasses and herbs or mixed hydrophytic shrubs.

FLOODPLAIN WETLANDS -	Flat alluvial sand or peat substrates associated with flowing water courses and subjected to flooding but not permanent inundation; wetland or mesic woody and herbaceous vegetation.
Floodplain Forest -	Floodplain with alluvial substrate of sand, silt, clay or organic soil; seasonally inundated; temperate; rare or no fire; diamondleaf oak, overcup oak, water oak, swamp chestnut oak, blue palmetto, maidencane, and mixed hardwoods.
Freshwater Tidal - Swamp	Rivermouth wetland, organic soil with extensive root mat; inundated with freshwater in response to tidal cycles; rare or no fire; cypress, bays, cabbage palm, gums an/or cedars.
Slough -	Broad, shallow channel with peat over mineral substrate; seasonally inundated, flowing water; subtropical; occasional or rare fire; pop ash and/or pond apple or water lily.
Strand Swamp -	Broad shallow channel with peat over mineral substrate; seasonally inundated, flowing water; subtropical; occasional or rare fire; cypress and/or willow.
Swale -	Broad, shallow channel with sand/peat substrate; seasonally inundated, flowing water; subtropical or temperate; frequent or occasional fire; sawgrass, maidencane, pickerelweed, and/or mixed emergents.
BASIN WETLANDS -	Shallow, closed basin with outlet usually only in time of high water; peat or sand substrate, usually inundated; wetland woody and/or herbaceous vegetation.
Depression Marsh -	Small rounded depression in sand substrate with peat accumulating toward center; seasonally inundated, still water; subtropical or temperate; frequent or occasional fire; maidencane, fire flag, pickerelweed, and mixed emergents, may be in concentric bands.
Dome Swamp -	Rounded depression in sand/limestone substrate with peat accumulating toward center; seasonally inundated, still water; subtropical or temperate; occasional or rare fire; cypress, blackgum, or bays, often tallest in center.

LACUSTRINE -	Non-flowing wetlands of natural depressions lacking persistent emergent vegetation except around the perimeter.
Flatwoods/Prairie Lake	Generally shallow basin in flatlands with high water table; frequently with a broad littoral zone; still water or flow through; sand or peat substrate; variable water chemistry, but characteristically colored to clear, acidic to alkaline, soft to moderately hard water with moderate mineral content (sodium, chloride, sulfate); oligo-mesotrophic to eutrophic.
RIVERINE -	Natural, flowing waters from their source to the downstream limits of tidal influence and bounded by channel banks.
Blackwater Stream -	Perennial or intermittent/seasonal watercourse characterized by tea-colored water with a high content of particulate and dissolved organic matter derived from drainage through swamps and marshes; generally lacking an alluvial floodplain.

APPENDIX 2

FLORIDA LAND USE, COVER AND FORMS CLASSIFICATION SYSTEM (FLUCCS)
(Brief Descriptions of Florida Natural Communities)

UPLAND FORESTS - Those upland areas which support a tree canopy closure of 10 percent or more. The Upland Forest includes both the xeric (dry site) and mesic (moderately moist site) forest communities.

Upland Coniferous Forests - Any natural forest stand whose canopy is at least 66 percent dominated by coniferous species is classified as a Coniferous Forest. The similar morphology of the pine species occurring in Florida makes them difficult to distinguish from one another on aerial photographs.

Pine Flatwoods - These forests are quite common throughout much of northern and central Florida. Originally, longleaf pines were common on drier sites while slash pines, which are less fire-resistant, were confined to moist sites; wildfire being the contributing factor in this distribution. However, fire control and artificial reforestation have extended the range of slash pine into former longleaf sites. The pine flatwoods class is dominated by either slash pine, longleaf pine or both. The common flatwoods under story species include saw palmetto, wax myrtle, gallberry and a wide variety of herbs and brush.

Longleaf Pine - Xeric Oak - This forest type is dominated by longleaf pine trees and can be distinguished from longleaf dominated Pine Flatwoods by the presence of a midstory canopy of blue-jack oak, turkey oak, sand post oak and other dry-site tolerant oaks and hardwoods. This forest community is characteristic of the deep, infertile sand-soils of the sandhill provinces. The often poor and irregular stocking of this pine community, revealing its oak mid-story, is a distinguishing feature.

Sand Pine - This pine community grows on deep, infertile deposits of marine sands and clays. The Ocala variety of north central Florida grows in densely stocked, pure, even aged stands. A root disease complex gives many sand pine stands a disheveled appearance. Its dark crown coloration distinguishes it from other southern pines.

Pine - Mesic - Oak - On moister sites, slash longleaf and loblolly pine grow in strong association with a wide variety of mesic oaks and other hardwood species. Southern red oak, water oak, chestnut oak and laurel oak in addition to hickories, sweet gum and dogwood commonly grow along side these pine species under mesic conditions. Gallberry, wax myrtle and saw palmetto are among the common understory species.

Upland Hardwood Forest - This classification of upland forest lands has a crown canopy with at least a 66 percent dominance by hardwood tree species. This class, like the Upland Coniferous, is reserved for naturally generated stands.

Xeric Oak - This forest community is similar to and occupies the same sites as the Longleaf Pine - Xeric Oak community except that the pines, if present, are not the dominant species. In many cases, longleaf pine may have been present in significant numbers prior to harvesting but were never regenerated. Species common to this class include bluejack oak, turkey oak and sand post oak.

Oak - Pine- Hickory - This is a mixed forest community in which no single species is consistently dominant. However, this is a predominantly hard wood forest type in which various southern pines are major associate species. Major component species of this community may include southern red oak, post oak, chestnut oak, black oak, live oak, loblolly pine, shortleaf pine, slash pine, mockernut hickory and pignut hickory in addition to numerous minor associate species. Composition will vary.

Tropical Hardwoods - This forest cover type is also referred to as tropical hammock. The common components of this community typically include some combination of gumbo limbo, mastic, stoppers, wild lime, strangler fig, lancewood, poison wood, sea grape, marlberry and wild tamarind.

WATER - The delineation of water areas depends on the scale and resolution characteristics of the remote sensor imagery used for interpretation. One definition of water bodies, provided by the Bureau of Census, includes all areas within the land mass of United States that at predominantly or persistently water covered provided that, if linear, they are at least 1/8 mile (660 feet or 220 meters) wide or, if extended, cover at

least 40 acres (16 hectares). When defining water bodies at level III, linear water bodies less than 1/8 mile wide and extensive water bodies less than 40 acres in size are classified. In some instances water bodies of one acre will be identified and plotted.

Lakes - The lakes category includes extensive inland water bodies, excluding reservoirs. Islands within lakes that are too small to delineate will be included in the water area. The delineation of a lake will be based on the size of the water body at the time the remote sensor is acquired.

Lake - Lakes less than 10 acres (4 hectares) which are dominant features.

Slough Waters - Sloughs are channels of slow moving water in the coastal marshland. The term also refers to ``backwater sloughs", those narrow, often stagnant bodies of water found near inland rivers.

WETLANDS - Wetlands are those areas where the water table is at, near or above the land surface for a significant portion of most years. The hydrologic regime is such that aquatic or hydrophytic vegetation usually is established, although alluvial and tidal flats may be nonvegetated. Wetlands are frequently associated with topographic low lying areas.

Wetland Hardwood Forests - Wetland hard wood forests are those wetland areas which meet the crown closure requirements for forestland as outlined under the Upland Forest classification of minimum 10 percent closure. To be included in the Wetland Hardwood Forest category, the stand must be 66 percent or more dominated by wetland hardwood species, either salt or freshwater.

Bay Swamp - This category is composed of dominant trees such as loblolly bay, sweetbay, red bay, swamp bay, slash pine and loblolly pine. Large gallberry, fetterbush, wax myrtle and titi are included in the understory vegetation.

Stream and Lake Swamp - This community, often referred to as bottomland or stream hardwoods, is usually found on but not restricted to river,

creek and lake floodplain or over flow areas. It is a conglomeration of a wide variety of predominantly hardwood species of which some of the more common components include red maple, river birch, water oak, sweetgum, tupelos, water hickory, bays, water ash and buttonbush. Associated species include cypress, slash pine, loblolly pine and shortleaf pine.

Inland Ponds and Sloughs - These communities are associated with depressions and drainage areas that are not associated with streams or lakes. One or a combination of the following species will generally be predominant: pond cypress, swamp tupelo, water tupelo, titi or willows.

Mixed Wetland Hardwoods - This category is reserved for those wetland hardwood communities which are composed of a large variety of hardwood species tolerant of hydric conditions yet exhibit an ill defined mixture of species.

Wetland Coniferous Forest - Wetland Coniferous Forests are wetlands which meet the crown closure requirements for coniferous forest, and are the result of natural generation. These communities are commonly found in the interior wetlands in such places as river floodplains, bogs, bayheads and sloughs.

Cypress - This community is composed of pond cypress or bald cypress which is either pure or predominant. In the case of pond cypress, common associates are swamp tupelo, slash pine and black titi. In the case of bald cypress, common associates are water tupelo, swamp cottonwood, red maple, American elm, pumpkin ash, Carolina ash, over cup oak, and water hickory. Bald cypress may be associated with laurel oak, sweetgum, and sweetbay on less moist sites.

Cypress - Pine - Cabbage Palm - This community includes cypress, pine and/or cabbage palm in combinations in which none of the species achieves dominance. Although not strictly a wetlands community, it forms a transition between moist upland and hydric sites.

Wetland Forested Mixed - This category includes mixed wetland forest communities in which neither hardwoods or conifers achieve a 66 percent dominance of crown canopy composition.

Vegetated Non-Forested - Vegetated Non-Forested wetlands include marshes and seasonally flooded basins and meadows. These communities are usually confined to relatively level, low-lying areas. This category does not include areas which have a tree cover which meet the crown closure threshold for the forested categories. When the forest crown cover is less than the threshold for Wetland Forest or is non-woody, it will be included in this category. Sawgrass and cattail are the predominant species in freshwater marshes, while spartina and needlerush are the predominant species in the saltwater marsh communities.

Freshwater Marsh - The communities included in this category are characterized by having one or more of the following species dominate: sawgrass, cattail, arrowhead, maidencane, buttonbush, cordgrass, switchgrass, bulrush, needlerush, common reed, or arrowroot.

Wet Prairie - This classification is composed of dominantly grassy vegetation on wet soils and is usually distinguished from marshes by having less water and shorter herbage. These communities will be dominated by one or more of the following species: sawgrass, maidencane, cordgrasses, spike rushes, rushes, St. Johns wort, spiderlily, swamplily, yellow-eyed grass, or whitetop sedge.

APPENDIX 3

SELECTED DATA SOURCES

National Wetlands Inventory (NWI): The U.S. Fish and Wildlife Service NWI classification system (Cowardin *et. al.* 1979) is a hierarchical approach to describing wetland communities based on hydrologic, geomorphologic, chemical and biological factors. Dominant vegetative life forms and the composition of the unvegetated areas were expressed as a alphanumeric classification that a wetland receives. The system used a series of water regime modifiers that attempted to describe wetland hydrology in terms of flooding duration during the growing season.

The source material for the NWI data was a combination of color infrared and black and white aerial photography flown during the early 1970's and in 1984 -1985. The scales of these photo ranged from 1:40,000 to 1:80,000. The NWI coverage was originally based on a scale of 1:24,000 and was geo-referenced to the USGS 7.5 minute Quadrangle.

County Soil Survey: The various County Soil Surveys are a publication of the National Cooperative Soil Survey, which is a joint effort of the U.S. Department of Agriculture and other federal and state agencies including the Agricultural Experiment Stations and local agencies. Major field work for this soil survey was performed in the period 1974 -1978. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in these publications refer to conditions in the survey area in 1978. The soil data was a result of many hours in the field excavating holes and recording soil profiles. The soil coverage was originally based on a scale of 1:20,000. The areas shown on the soil maps are called map units. Detailed map units are made up of one type of soil. General map units are made up of two or more associations of soil types.

USGS Topographic Quadrangle: The U.S. Geologic Survey (USGS) produces two kinds of spacial information: digital line graph (DLG) data and digital elevation models (DEM). The DLG information contains characteristics such as land use, land cover, roadways, hydrology and property boundaries and converts the data into a vector format. The DEM information consists of a grid pattern of point elevations that are used to simulate the topography of an area. The elevation is characterized with the use of spot elevations and estimated lines of topography designated in 5.0 foot units of contour. This data is useful for generating three dimensional information including slope, aspect, volume and surface profiles. This data was originally based on a scale of 1:24,000 in 7.5 minute blocks of longitude and latitude.

Florida Game and Fresh Water Fish Commission (GFWFC) Land Cover Maps: Land Cover and Vegetation maps were created by the GFWFC using 1985 - 1989 Landsat Thematic Mapper imagery. Landsat Thematic Mapper (TM) data were collected using a predefined grid work of "pixels" (or picture elements). Each pixel was 30 meters square. Habitat classification was compared with aerial photography, experts, and scientific

literature to produce the maps. The overall accuracy of the maps is estimated at 80-90 percent. Unless otherwise indicated, statements in these publications refer to conditions in the survey area in 1989.

Florida Land Use Cover and Forms Classification System (FLUCCS): FLUCCS is a land use, vegetative cover and land form classification system arranged in hierarchical levels with each level containing land information of increasing specificity. The hierarchical levels are applied through a photointerpretive process of panoramic, natural color or false color infrared images and designate areas according to land use for disturbed areas and vegetational types for native upland and wetland communities. Color, shade, shape, imagery, multispectral and multitemporal characteristics are some of the features used to implement the land use and land cover classification system. In 1994 - 1996, the South Florida Water Management District established a contract to interpret 1994 -1995 USGS National Aerial Photographic Program (NAPP) aerial photography at a scale of 1:40,000 and classify the existing land use and land cover conditions of St. Lucie, Okeechobee and Martin Counties. Although this data has been made available for this Wetland Planning Project, it is acknowledged that the data has not been field verified and will be a dynamic tool that is corrected as actual field observations are made.

Thematic Mapping of Earth Resources Data Analysis System (ERDAS) Images: Martin County contracted with Environmental Systems Research Institute, Inc. (ESRI), to provide a wetland and land use characteristics analysis map using Thematic Mapping (TM) technology and Earth Resources Data Analysis System (ERDAS), Inc., classified images applied to the Martin County Project area using ARC/INFO GRID software.

The TM scanner is a multi spectral, seven band, infrared scanning system which records reflected and emitted electromagnetic energy from visible, reflective infrared, middle infrared, and thermal infrared regions of the spectrum. It is useful for the determination of vegetation type, vegetation health and soil moisture. Bands 1, 2, and 3 are in the visible portion of the spectrum and are useful in determining roadways, urban development boundaries between soil and vegetation, forest types, vegetational health, and differences between plant species. Bands 4, 5, and 7 are in the reflective infrared portion of the spectrum and can be used to determine vegetation biomass, soil moisture, crop identification, and these bands are used to emphasize soil, crop and water contrasts. Band 6 is useful for vegetation and crop stress, heat intensity and locating thermal pollution.

APPENDIX 4

NATIONAL WETLANDS INVENTORY (NWI) DESIGNATIONS

The estuarine, riverine, and lacustrine (estuaries, rivers, and lakes) habitats are well defined and small in quantity relative to the total Project Area. Additional descriptive information regarding these habitats can be found in the publication entitled "Classification of Wetlands and Deepwater Habitats of the United States" (Cowardin *et. al.* 1979).

E - Estuarine: Deepwater tidal habitats and adjacent tidal wetlands that are usually semiclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by fresh water runoff from the land.

R - Riverine: Includes all wetlands and deep water habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens; and (2) habitats with water containing ocean derived salts in excess of 0.5 parts per thousand.

L - Lacustrine: Wetlands and deepwater habitat with all the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees shrubs, persistent emergents, emergent mosses or lichens, with greater than 30 percent areal coverage; and (3) total area exceeds 20 acres.

The majority of the wetland habitat within the Project Area was comprised of palustrine (shallow, vegetated, nontidal) wetlands. The following descriptive text is a summary of general characteristics attributed to these palustrine wetlands. Additional descriptive information regarding this habitat can be found in the publication entitled "Classification of wetlands and deepwater habitats of the United States" (Cowardin *et. al.* 1979).

P - Palustrine: Shallow vegetated nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens.

EM - Emergent: Wetlands comprised of erect, rooted, herbaceous, hydrophytes, excluding mosses and lichens. This vegetation is present for most of the growing season in most years. These wetlands are usually dominated by perennial plants.

1-Persistent: Wetlands dominated by species that normally remain standing at least until the beginning of the next growing season.

2-Nonpersistent: Wetlands dominated by plants which fall to the surface of the substrate or below the surface of the water at the end of the growing season so that certain seasons of the year, there is no obvious sign of emergent vegetation.

SS - Scrub Shrub: Wetlands dominated by woody vegetation less than 20 feet tall. The species include true shrubs, young trees and trees or shrubs that are small or stunted because of environmental conditions.

1 - Broad Leaved Deciduous - woody angiosperm trees or shrubs with relatively wide, flat leaves that are shed during the cold or dry season; e.g., black ash (*Fraxinus nigra*).
2 - Needle Leaved Deciduous - woody gymnosperm trees or shrubs with needle-shaped or scale-like leaves that are shed during the cold or dry season; e.g., bald cypress (*Taxodium distichum*).
3 - Broad Leaved Evergreen - woody angiosperm trees or shrubs with relatively wide, flat leaves that generally remain green and are usually persistent for a year or more; e.g., red mangrove (*Rhizophora mangle*).
4 - Needle Leaved Evergreen
5 - Dead
6 - Deciduous
7 - Evergreen

FO - Forested: Wetlands characterized by woody vegetation that is 20 feet or taller.

1 - Broad Leaved Deciduous
2 - Needle Leaved Deciduous
3 - Broad Leaved Evergreen
4 - Needle Leaved Evergreen
5 - Dead
6 - Deciduous
7 - Evergreen

OW - Open Water: Open bodies of water with unknown bottom vegetation or substrate

Appendix 4

Water Regime Modifiers:

A - Temporarily Flooded
B - Saturated
C - Seasonally Flooded
D - Seasonally Flooded - Well Drained
E - Seasonally Flooded - Saturated
F - Semipermanent Flooded
G - Intermittently Exposed
H - Permanently Flooded
J - Intermittently Flooded
K - Artificially Flooded
W - Intermittently Flooded/Temporary
Y - Saturated/Semipermanent/Seasonal
Z - Intermittently Exposed/Permanent
U - Unknown

Special Modifiers:

d - Partially Ditched and Drained
f - Farmed
h - Diked/Impounded
r - Artificial substrate
s - Spoil
x - Excavated

APPENDIX 5

Wetland Evaluation Summary

This appendix includes a one page summary for each of the 39 wetlands evaluated (MC 10 not used) within the Martin County Project Area where WRAP was applied. Additional details were recorded in the original field notes. The wetland number on each page corresponds with the site location identified in Figure 13. Refer to the methods section of this report and Miller and Gunsalus (1997) for a detailed description of the field methodology and scoring procedures.

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure (WRAP)

Wetland Number: MC 1

Property: Immediately West of US-1 south of Cove Rd.

Date Of Site Visit: 6/19/97

Assessment Team Members Present: Gary Roderick, Martin Co.
Brad Rieck, USFWS
John Wrublik, USFWS

NWI Wetland Classification: PEM1F: palustrine, emergent, persistent, semi-permanently flooded.

FNAI Community Type: Depression marsh.

Soil Type: Waveland sand, depressional.

Land Use: Recreational/open space.

Wildlife Utilization: Score = 2.5; great egret, blue heron, gambusia and other small fish, crayfish, dragonflies, cricket and pig frog, turtle eggs, wildlife trails, proximity to road is detrimental.

Wetland Overstory/Shrub Canopy: N/A; downy rose myrtle and gallberry present but at less than 20% coverage.

Vegetative Ground Cover: Score: 2.0; gradations; beak-rush and yellow-eyed grass predominant along fringe with some dog fennel, maidencane, water lily, rooted algae, melaleuca seedlings.

Adjacent Upland/Wetland Buffer: Score = 2.0; 75% pine flatwoods, 25% highway.

Exotic and Nuisance Plant Species: Score = 2.0; melaleuca seedlings and saplings, downy rose myrtle.

Field Indicators of Wetland Hydrology: Score = 2.0; unnatural spikes of high water and impounding; 3-6 inches in depth.

Water Quality Inputs and Treatment: Score = 2.5; (LU 2.5, TC 2.5)

Overall Wrap Score: 2.5 + 2.0 + 2.5 + 2.0 + 2.0 + 2.5 divided by 18 = 0.75

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 2

Property: Immediately West of US-1 south of Cove Rd.

Date Of Site Visit: 6/19/97

Assessment Team Members Present:
Bev Barta, Martin Co.
Gary Roderick, Martin Co.
Brad Rieck, USFWS
John Wrublik, GFWFC
Tori Agramonte, COE
Doug Strom, DEP

NWI Wetland Classification: PEM1F: palustrine, emergent, persistent, semi-permanently flooded.

FNAI Community Type: Depression marsh.

Soil Type: Sanibel muck and placid sand.

Land Use: Recreational/open space.

Wildlife Utilization: Score = 3.0; crayfish, small fishes, potential for larger predators; wildlife trails present.

Wetland Overstory/Shrub Canopy: N/A

Vegetative Ground Cover: Score 2.5; abrupt transition from surrounding uplands due to unnatural water retention.

Adjacent Upland/Wetland Buffer: Score = 2.5; 90% pine/palmetto flatwoods, 10% highway.

Exotic and Nuisance Plant Species: Score = 3.0; none observed.

Field Indicators of Wetland Hydrology: Score = 2.5.

Water Quality Inputs and Treatment: Score = 2.75.

Overall Wrap Score: 3.0 + 2.5 + 2.5 + 3.0 + 2.5 + 2.75 divided by 18 = 0.90

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 3

Property: Immediately West of US-1 south of Cove Rd.

Date Of Site Visit: 6/19/97

Assessment Team Members Present:
Bev Barta, Martin Co.
Gary Roderick, Martin Co.
Brad Rieck, USFWS
John Wrublik, GFWFC
Tori Agramonte, COE
Doug Strom, DEP

NWI Wetland Classification: PEM1C: Palustrine, emergent, persistent, seasonally flooded.

FNAI Community Type: Wet prairie.

Soil Type: Not mapped.

Land Use: Recreational/open space.

Wildlife Utilization: Score = 1.5; whirlygig beetles, waterbeetles and larvae, dragonflies and larvae, aquatic spiders, grasshoppers, tadpoles, signs of pig rootings.

Wetland Overstory/Shrub Canopy: N/A.

Vegetative Ground Cover: Score = 2.0; predominately St. John's Wort, marsh fleabane, meadow beauties, thistles, hat-pins, milkwort, gallberry, red-root, *Xyris* sp., camphorweed, dog fennel.

Adjacent Upland/Wetland Buffer: Score = 1.5; highway 50%, open 50% of wetland perimeter.

Exotic and Nuisance Plant Species: Score = 2.0; downy rose myrtle, melaleuca seedlings.

Field Indicators of Wetland Hydrology: Score = 1.5; 6 inches of water and appears to fluctuate to cyclic drying.

Water Quality Inputs and Treatment: Score = 2.0; (LU =2, TC = 2).

Overall Wrap Score: 1.5 + 2.0 + 1.5 + 2.0 + 1.5 + 2.0 divided by 18 = 0.58

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 4

Property: Corner of Bridge Rd. and FPL dirt road.

Date Of Site Visit: 6/19/97

Assessment Team Members Present:
Bev Barta, Martin Co.
Gary Roderick, Martin Co.
Brad Rieck, USFWS
John Wrublik, GFWFC
Tori Agramonte, COE
Doug Strom, DEP

NWI Wetland Classification: PSS3A: Scrub-shrub, broad leaved evergreen, temporarily flooded.

FNAI Community Type: Basin swamp.

Soil Type: Floridana fine sand, depressional.

Land Use: Open space.

Wildlife Utilization: Score = 3.0 very diverse; includes dragonflies & damselflies and larvae, water beetles, crayfish, pigmy sunfish, gambusia, least grass frog, tree frog, pig frog, and sandhill crane - foraging.

Wetland Overstory/Shrub Canopy: Score = 3.0; predominately red bay, sweet bay, red maple, dahoon holly, pondapple, slash pine, cabbage palm, myrsine.

Vegetative Ground Cover: Score = 2.0; predominately ferns, bulrush, Ludwigia, pickerel weed, milkwort, gallberry, red-root, myrsine. 50% covered with Lygodium.

Adjacent Upland/Wetland Buffer: Score = 1.5.

Exotic and Nuisance Plant Species: Score = 2.0; Lygodium appeared to be throughout half of the site; grapevine also present (50% = 1, 50% = 3).

Field Indicators of Wetland Hydrology: Score = 2.0; saturated organic soils, not a temporary scenario.

Water Quality Inputs and Treatment: Score = 2.0; (LU = 1.5, TC = 2.5).

Overall Wrap Score: 3.0 + 3.0 + 2.0 + 1.5 + 2.0 + 2.0 +2.0 divided by 21 = 0.74

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 5

Property: Ranch Colony - lot 11

Date Of Site Visit: 6/26/97

Assessment Team Members Present:
Bev Barta, Martin Co.
Gary Roderick, Martin Co.
Hugo Carter, Martin Co.
Brad Rieck, USFWS
Jose Negron, EPA
John Wrublik, GFWFC
Terry Morgan, COE

NWI Wetland Classification: PEM1F: palustrine, emergent, persistent, semi-permanently flooded.

FNAI Community Type: Depression marsh.

Soil Type: Riviera fine sand, depressional.

Land Use: Single-family, low density residential.

Wildlife Utilization: Score = 2.5; least killifish, gambusia, bluegill, crayfish, cricket frogs, and several species of birds present, e.g. little blue heron and sandhill cranes.

Wetland Overstory/Shrub Canopy: N/A.

Vegetative Ground Cover: Score = 2.5; diverse, including star rush, Hypericum, Sagittaria, duck potato, marsh pink, Xyris, bog buttons, sm. clumps of cattails.

Adjacent Upland/Wetland Buffer: Score = 2.5.

Exotic and Nuisance Plant Species: Score = 2.5; melaleuca, cattails, Lygodium.

Field Indicators of Wetland Hydrology: Score = 2.5; several feet of standing water and abundant free-floating algae. Surface flow altered.

Water Quality Inputs and Treatment: Score = 2.25; (LU = 2, TC = 2.5).

Overall Wrap Score: 2.5 + 2.5 + 2.5 + 2.5 + 2.5 + 2.25 divided by 18 = .82

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 6
Property: Ranch Colony west side, interior of Ranch Acres Circle
Date Of Site Visit: 6/26/97
Assessment Team Members Present: Bev Barta, Martin Co.
Gary Roderick, Martin Co.
Hugo Carter, Martin Co.
Brad Rieck, USFWS
Jose Negron, EPA
John Wrublik, GFWFC
Terry Morgan, COE

NWI Wetland Classification: PEM1F: palustrine, emergent, persistent, semi-permanently flooded.

FNAI Community Type: (Altered) depression marsh.

Soil Type: Riviera fine sand, depressional.

Land Use: Single-family, low density residential.

Wildlife Utilization: Score = 1.5; gambusia, bluegill, bass, killifish, apple snail eggs, dragonflies, cooter in littoral zone; interior too deep for vegetative habitat.

Wetland Overstory/Shrub Canopy: N/A.

Vegetative Ground Cover: Score = 1.0; lacks vegetation, mostly open water.

Adjacent Upland/Wetland Buffer: Score = 0.5; road, residential.

Exotic and Nuisance Plant Species: Score = 1.0; cattails, bahia grass.

Field Indicators of Wetland Hydrology: Score = 1.5; over-inundated with water with a depth of 3 feet; dead Hypericum, submerged littoral zone, trash and debris, appears to have been excavated; surface flows altered.

Water Quality Inputs and Treatment: Score = 1.5; (LU = 2, TC = 1).

Overall Wrap Score: 1.5 + 1.0 + 0.5+ 1.0 + 1.5 + 1.5 divided by 18 = 0.39

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 7
Property:	Ranch Colony - corner of SE Downwind Rd. and Mack Dairy Rd.
Date Of Site Visit:	6/26/97
Assessment Team Members Present:	Bev Barta, Martin Co. Gary Roderick, Martin Co. Hugo Carter, Martin Co. Brad Rieck, USFWS Jose Negron, EPA John Wrublik, GFWFC Terry Morgan, COE
NWI Wetland Classification:	PEM1F and PEM1C
FNAI Community Type:	Wet prairie.
Soil Type:	Riviera fine sand, depressional.
Land Use:	Single family residential, roads, open field.
Wildlife Utilization:	Score = 2.0; small fish not abundant but present - gambusia, killifish, apple snails, water snake.
Wetland Overstory/Shrub Canopy:	N/A.
Vegetative Ground Cover:	Score = 2.5; predominately beak-rush, maidencane, pickerelweed, star rush, Juncus; wax myrtle and Hypericum in fringe of wetland.
Adjacent Upland/Wetland Buffer:	Score = 2.0; 50% = 3.0, 50% 1.0 - 1.5.
Exotic and Nuisance Plant Species:	Score = 2.5; few cattails.
Field Indicators of Wetland Hydrology:	Score = 2.5; organic muck, 12 inches water, detritus, algae mats; surface flows altered.
Water Quality Inputs and Treatment:	Score = 1.5 (LU = 2, TC = 1).

Overall Wrap Score: 2.0 + 2.5 + 2.0 + 2.5 + 2.5 + 1.5 divided by 18 = .72

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 8

Property: South of Seabranch Rd.

Date Of Site Visit: 7/10/97

Assessment Team Members Present: Bev Barta, Martin Co.
Gary Roderick, Martin Co.
Brad Rieck, USFWS
Terry Morgan, COE

NWI Wetland Classification: PEM1F: palustrine, emergent, persistent, semi-permanently flooded.

FNAI Community Type: Depression marsh.

Soil Type: Wabasso sand, depressional.

Land Use: Open/natural.

Wildlife Utilization: Score = 3.0; muskrat nest, pig rootings, wildlife trails, crayfish, heron, least killifish, sunfish.

Wetland Overstory/Shrub Canopy: N/A.

Vegetative Ground Cover: Score = 3.0; predominately maidencane, pickerelweed, star rush, duck potato, water lily, yellow-eyed grass, bladderwort; diverse.

Adjacent Upland/Wetland Buffer: Score = 2.5.

Exotic and Nuisance Plant Species: Score = 2.5; Brazilian pepper, grapevine and old world climbing fern in buffer.

Field Indicators of Wetland Hydrology: Score = 3.0; water depth up to 2 feet/ road culverted.

Water Quality Inputs and Treatment: Score = 3.0 (LU = 3, TC = 3); even to north, buffered with filtration.

Overall Wrap Score: 3.0 + 3.0 + 2.5 + 2.5 + 3.0 + 3.0 divided by 18 = .94

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 9

Property: North side of Seabranch Rd. across from MC 8

Date Of Site Visit: 7/10/97

Assessment Team Members Present: Bev Barta, Martin Co.
Gary Roderick, Martin Co.
Brad Rieck, USFWS
Terry Morgan, COE

NWI Wetland Classification: PEM1F: palustrine, emergent, persistent, semi-permanently flooded.

FNAI Community Type: Depression marsh.

Soil Type: Placid sand.

Land Use: Golf course/residential.

Wildlife Utilization: Score = 2.5; marsh sparrow nest, crayfish, sunfish, grass shrimp, heron; surroundings reduce full potential.

Wetland Overstory/Shrub Canopy: N/A.

Vegetative Ground Cover: Score = 2.0; includes penny wort, St. John's wort, torpedo grass, spartina, red root, floating heart.

Adjacent Upland/Wetland Buffer: Score = 2.0; buffer 30 to 300 feet.

Exotic and Nuisance Plant Species: Score = 2.5; algal mats - nutrient overload.

Field Indicators of Wetland Hydrology: Score = 2.5; control structure probably 6 inches too high; water exhibited a slight north to south flow.

Water Quality Inputs and Treatment: Score = 2.0 (LU = 1.5, TC = 2.5).

Overall Wrap Score: 2.5 + 2.0 + 2.0 + 2.5 + 2.5 + 2.0 divided by 18 = .75

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 11 (there is no MC 10)
Property: South of Seabranch Rd.

Date Of Site Visit: 7/17/97

Assessment Team Members Present:
Bev Barta, Martin Co.
Gary Roderick, Martin Co.
Brad Rieck, USFWS
Terry Morgan, COE
Cheryl McKee, DEP
Bruce Jerner, DEP
Boyd Gunsalas, SFWMD
Dick Roberts, DEP

NWI Wetland Classification: Designated as uplands on NWI maps.

FNAI Community Type: Wet pine flatwoods.

Soil Type: Lawnwood.

Land Use: Unimproved pasture.

Wildlife Utilization: Score = 2.5; marsh rabbit scat, small mammal trails, snowy egret.

Wetland Overstory/Shrub Canopy: Score= 2.0; young pines (too many - inappropriate), some wax myrtle.

Vegetative Ground Cover: Score = 2.0; predominately wire grass, gallberry, palmetto, Xyris, red root, marshalia, beak rush.

Adjacent Upland/Wetland Buffer: Score = 2.5.

Exotic and Nuisance Plant Species: Score = 2.5; less than 5% Lygodium, downy rose myrtle, love vine.

Field Indicators of Wetland Hydrology: Score = 2.0; numerous young pines, indicative of a drop in the water table; soil was saturated with some small pools.

Water Quality Inputs and Treatment: Score = 2.8; (LU = 2.7, TC = 2.9).

Overall Wrap Score: 2.5 + 2.0 + 2.5 + 2.5 + 2.5 + 2.0 + 2.8 divided by 21 = .80

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 12

Property: South of Seabranch Rd., old Poinciana Gardens subdivision

Date Of Site Visit: 7/17/97

Assessment Team Members Present:
Bev Barta, Martin Co.
Gary Roderick, Martin Co.
Brad Rieck, USFWS
Terry Morgan, COE
Cheryl McKee, DEP
Bruce Jerner, DEP
Boyd Gunsalas, SFWMD
Dick Roberts, DEP

NWI Wetland Classification: PEM1Cd: palustrine, emergent, persistent, seasonally flooded, partially drained.

FNAI Community Type: Wet prairie with wet pine flatwoods edge.

Soil Type: Waveland sand, depressional; Holopaw fine sand.

Land Use: Open, old platted subdivision, with easy access to off road vehicles.

Wildlife Utilization: Score = 2.5; raccoon tracks, aquatic insects, small mammal trails, frogs, tadpoles, cotton rat tunnels, osprey.

Wetland Overstory/Shrub Canopy: Score = 2.5; scattered slash pines.

Vegetative Ground Cover: Score = 2.0; primarily St. John's Wort, beak-rush, gallberry, palmetto, bog buttons; vehicle impacts quite noticeable.

Adjacent Upland/Wetland Buffer: Score = 2.5.

Exotic and Nuisance Plant Species: Score = 2.0; downy rose myrtle, scattered melaleuca, Brazilian pepper, torpedo grass.

Field Indicators of Wetland Hydrology: Score = 2.0; several inches of standing water; development to the north, interior roadways and off road vehicle impacts.

Water Quality Inputs and Treatment: Score = 2.5; (LU = 3.0, TC = 3); activities lower quality.

Overall Wrap Score: 2.5 + 2.5 + 2.0 + 2.5 + 2.0 + 2.0 + 2.5 divided by 21 = .76

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 13

Property: River Fork Ranch area

Date Of Site Visit: 7/17/97

Assessment Team Members Present:
Bev Barta, Martin Co.
Gary Roderick, Martin Co.
Brad Rieck, USFWS
Terry Morgan, COE
Cheryl McKee, DEP
Bruce Jerner, DEP
Boyd Gunsalas, SFWMD
Dick Roberts, DEP

NWI Wetland Classification: PFO2F: palustrine, forested, needle-leaved deciduous, semi-permanently flooded.

FNAI Community Type: Strand swamp.

Soil Type: Riviera fine sand, depressional.

Land Use: Open and unimproved pasture (few cows).

Wildlife Utilization: Score = 1.5; crayfish burrow, cardinals, red-tail hawk, opossum, gopher tortoise; Lygodium is a severe habitat restriction.

Wetland Overstory/Shrub Canopy: Score = 1.0; cypress with Lygodium covering, some wax myrtle, lots of Brazilian pepper.

Vegetative Ground Cover: Score = 1.5; ferns, vines, beauty berry.

Adjacent Upland/Wetland Buffer: Score = 2.0; (50%= 3.0, 50% = 1.0).

Exotic and Nuisance Plant Species: Score = 0.5; predominately; caesar weed, Brazilian pepper, Lygodium cascading under cypress trees.

Field Indicators of Wetland Hydrology: Score = 1.0; saturated soil but not standing water; severe drainage impacts.

Water Quality Inputs and Treatment: Score = 2.5; (LU = 2.5, TC = 2.5).

Overall Wrap Score: 1.5 + 1.0+ 1.5 + 2.0 + .5 + 1.0 + 2.5 divided by 21 = .48

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 14

Property: Ranchland, south of Bridge Rd., off Ranch Rd.

Date Of Site Visit: 7/24/97

Assessment Team Members Present:
Gary Roderick, Martin Co.
Brad Rieck, USFWS
Cheryl McKee, DEP
Dick Roberts, DEP
Tom Monroe, DEP
Spencer Simon, USFWS
Grant Webber, USFWS

NWI Wetland Classification: PEM1C: palustrine, emergent, persistent, seasonally flooded.

FNAI Community Type: Cypress strand and depression marsh.

Soil Type: Winder sand and Floridana fine sand, depressional.

Land Use: Open/natural.

Wildlife Utilization: Score = 2.5; apple snails, white ibis, sandhill crane, green heron, soft shell turtle, sunfish, goldtop minnow.

Wetland Overstory/Shrub Canopy: Score = 2.5; predominately cypress and wax myrtle. Exotics on edge.

Vegetative Ground Cover: Score = 2.0; predominately pickerelweed, Phragmites, button bush, maidencane, red root, bladderwort, Ludwigia.

Adjacent Upland/Wetland Buffer: Score = 2.0.

Exotic and Nuisance Plant Species: Score = 2.5; sparse populations of Lygodium, Brazilian pepper, melaleuca.

Field Indicators of Wetland Hydrology: Score = 2.0 Water line on cypress trees indicates up to 2.5 feet inundation (surges); hydrology altered by road and drainage to north.

Water Quality Inputs and Treatment: Score = 1.75; (LU = 1, TC = 2.5).

Overall Wrap Score: 2.5 + 2.5 + 2.0 + 2.5 + 2.0 + 1.75 divided by 21 = .73

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 15

Property: Shiloh Farms

Date Of Site Visit: 7/24/97

Assessment Team Members Present: Gary Roderick, Martin Co.
Brad Rieck, USFWS
Cheryl McKee, DEP
Dick Roberts, DEP
Tom Monroe, DEP
Spencer Simon, USFWS
Grant Webber, USFWS

NWI Wetland Classification: PFO6C: palustrine, forested, deciduous, seasonally flooded.

FNAI Community Type: Dome swamp.

Soil Type: Floridana fine sand, depressional.

Land Use: Agriculture - row crops.

Wildlife Utilization: Score = 1.5; green tree frog, least killifish, tricolor heron, anoles, pileated woodpecker hole; for other than birds, ingress and egress restricted.

Wetland Overstory/Shrub Canopy: Score = 2.0; predominately cypress with bromeliads, pond apple, willow, surrounded by Brazilian. pepper and lygodium thicket.

Vegetative Ground Cover: Score = 2.0; predominately; sawgrass, ferns, sagitaria, flag, pickerelweed; dense mat of salvinia inappropriate.

Adjacent Upland/Wetland Buffer: Score = 0.5; agriculture.

Exotic and Nuisance Plant Species: Score = 1.0; (thick) lygodium, Brazilian pepper.

Field Indicators of Wetland Hydrology: Score = 2.0; surrounded by berm and moat, standing water 18 inch deep; moss collars indicate higher water.

Water Quality Inputs and Treatment: Score = 1.75; (LU = 1, TC = 2.5).

Overall Wrap Score: 1.5 + 2.0 + 2.0 + .5 + 1.0 + 2.0 + 1.75 divided by 21 = .51

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 16

Property: Becker Groves

Date Of Site Visit: 8/7/97

Assessment Team Members Present: Brad Rieck, USFWS
Terry Morgan, COE
John Wrublick, GFWFC
Bev Ann Barta, Martin Co.

NWI Wetland Classification: PEM1C; palustrine, emergent, persistent, seasonally flooded.

FNAI Community Type: Forested depression marsh.

Soil Type: Pineda sand.

Land Use: Natural, partially bordered by agriculture.

Wildlife Utilization: Score =2.0; least killifish, gambusia, dragonflies, water beetles, great blue heron, crayfish, cricket frog; canals are barriers to wildlife movement.

Wetland Overstory/Shrub Canopy: Score = 2.5; predominately bald cypress (mostly young), slash pine; also palmettos, wax myrtles, bromeliads

Vegetative Ground Cover: Score = 2.5; beak rush, hypericum, ludwigia, rush fuirena, red root, star rush, fern species.

Adjacent Upland/Wetland Buffer: Score = 2.0.

Exotic and Nuisance Plant Species: Score 2.5; torpedo grass, melaleuca - near north boundary by canal/roadway.

Field Indicators of Wetland Hydrology: Score = 2.0; 6 inches water depth; canal effects.

Water Quality Inputs and Treatment: Score = 2.5;
LU = 2.25 (25% = 3, 75% = 2)
TC = 2.62 (25% = 3, 75% = 2.5).

Overall Wrap Score: 2.0 + 2.5 + 2.5 + 2.0 + 2.5 + 2.0 + 2.5 divided by 21 = .76

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 17

Property: Pal-Mar

Date Of Site Visit: 8/7/97

Assessment Team Members Present: Brad Rieck, USFWS
Terry Morgan, COE
John Wrublik, GFWFC
Bev Ann Barta, Martin Co.
Kent Van Horn, SFWMD

NWI Wetland Classification: PEM1A: partially and partially designated as uplands on NWI map.

FNAI Community Type: Wet pine flatwoods.

Soil Type: Wabasso sand and Pineda sand.

Land Use: Natural.

Wildlife Utilization: Score = 2.5; gambusia, frogs, wildlife trials, flicker, red wing blackbird.

Wetland Overstory/Shrub Canopy: Score = 2.5; predominately slash pine, and wax myrtles; palmetto, myrsine, and willow also present.

Vegetative Ground Cover: Score = 2.5; predominately; Hypericum, Xyris, blue maidencane, leather fern.

Adjacent Upland/Wetland Buffer: Score = 2.1; (66% = 3, 33% = 5).

Exotic and Nuisance Plant Species: Score = 2.5; Lygodium, Brazilian pepper, Centella.

Field Indicators of Wetland Hydrology: Score = 2.0; 6 inches water depth.

Water Quality Inputs and Treatment: Score = 3.0.

Overall Wrap Score: 2.5 + 2.5 + 2.5 + 2.1 + 2.5 +2.0 + 3.0 divided by 21 = .81

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 18

Property: Pal-Mar (north of canal)

Date Of Site Visit: 8/7/97

Assessment Team Members Present: Brad Rieck, USFWS
Terry Morgan, COE
John Wrublik, GFWFC
Bev Ann Barta, Martin Co.
Kent Van Horn, SFWMD

NWI Wetland Classification: Designated as uplands on NWI.

FNAI Community Type: Wet pine flatwoods/ prairie mix.

Soil Type: Pineda sand.

Land Use: Natural.

Wildlife Utilization: Score =2.5; gambusia, frogs, night hawk; high potential; canals interrupt wildlife movement.

Wetland Overstory/Shrub Canopy: Score = 3.0; predominately slash pine, and wax myrtles; also palmetto islands.

Vegetative Ground Cover: Score = 2.5; predominately Hypericum, Xyris, blue maidencane, corkwood, beak-rush.

Adjacent Upland/Wetland Buffer: Score = 2.5. 20% = .5 (berm)
80% = 3.0

Exotic and Nuisance Plant Species: Score = 3.0.

Field Indicators of Wetland Hydrology: Score = 2.5; 6 to 12 inches water depth; equalizing culverts prevent water impoundment, canal is plugged - not contributing to drainage offsite.

Water Quality Inputs and Treatment: Score = 3.0.

Overall Wrap Score: 2.5 + 3.0 + 2.5 + 2.5+ 3.0 + 2.5 + 3.0 divided by 21 = .90

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 19

Property: Summerfield (small wetland)

Date Of Site Visit: 8/14/97

Assessment Team Members Present:
Brad Rieck, USFWS
Gary Roderick, Martin Co.
Dick Roberts, DEP
Terry Morgan, COE
John Wrublik, GFWFC
Doug Strom, DEP
Diana Bower
Bev Ann Barta, Martin Co.
Tom Monroe, DEP

NWI Wetland Classification: N/A.

FNAI Community Type: Wet Prairie.

Soil Type: N/A.

Land Use: Golf course/Residential Preserve.

Wildlife Utilization: Score = 2.0; gambusia, frogs, white ibis, great blue heron, killdeer, least killifish, pygmy sunfish. flagfish, cricket frog, loggerhead shrike, dragonflies, stripped mud turtle.

Wetland Overstory/Shrub Canopy: N/A.

Vegetative Ground Cover: Score = 3.0.

Adjacent Upland/Wetland Buffer: Score = 0.5; housing units and golf course being built.

Exotic and Nuisance Plant Species: Score = 3.0; very small area of lygodium.

Field Indicators of Wetland Hydrology: Score = 2.0; no stress to plants.

Water Quality Inputs and Treatment: Score = 0.75 Water was very turbid & surrounded by single family houses

Overall Wrap Score: 0.62

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 20

Property: Summerfield Golf and Country Club - larger than MC 19 wetland

Date Of Site Visit: 8/14/97

Assessment Team Members Present

Brad Rieck, USFWS
Terry Morgan, COE
John Wrublik, GFWFC
Bev Ann Barta, Martin Co.
Dick Roberts, DEP
Tom Monroe, DEP
Doug Strom, DEP
Diane Bowen, USFWS

NWI Wetland Classification: PEM1F: palustrine, emergent, persistent, semi-permanently flooded.

FNAI Community Type: Wet prairie/depression marsh.

Soil Type: Lawnwood fine sand, depressional.

Land Use: Golf course/residential "preserve area."

Wildlife Utilization: Score = 2.0; least killifish, gambusia, dragonfly larvae, flag fish, cricket frog, fishing spider, goldentop minnow, green heron, killdeer.

Wetland Overstory/Shrub Canopy: N/A.

Vegetative Ground Cover: Score = 2.5; perimeter of hypericum, beak-rush, sagittaria and interior of maidencane.

Adjacent Upland/Wetland Buffer: Score = 1.75; (50% = 3, 50% = .5).

Exotic and Nuisance Plant Species: Score = 2.0; one melaleuca in the interior, some lygodium and torpedo grass in perimeter.

Field Indicators of Wetland Hydrology: Score = 2.0.

Water Quality Inputs and Treatment: Score = 1.5 turbid, but less so than #19.

Overall Wrap Score: 2.0 + 2.5 + 1.75 + 2.0 + 2.0 + 1.5 divided by 18 = .65

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 21
Property:	Medalist - Phase I
Date Of Site Visit:	8/14/97 (afternoon)
Assessment Team Members Present:	Brad Rieck, USFWS Terry Morgan,COE John Wrublik, GFWFC Bev Ann Barta, Martin Co. Dick Roberts, DEP Tom Monroe, DEP Doug Strom, DEP Diane Bowen, USFWS Gary Roderick, Martin Co.
NWI Wetland Classification:	L2OWH.
FNAI Community Type:	N/A
Soil Type:	N/A
Land Use:	Golf course/residential.
Wildlife Utilization:	Score = 2.0; least killifish, gambusia, dragonfly larvae, flag fish, cricket frog, fishing spider, goldentop minnow, pig frog, great egret, moorhen, muskrat nest; surroundings deter wildlife accessibility.
Wetland Overstory/Shrub Canopy:	N/A
Vegetative Ground Cover:	Score = 2.0; predominately maidencane, torpedo grass, hydrocotle, in floating mats.
Adjacent Upland/Wetland Buffer:	Score = 1.75; (50% = 3, 50% = .5).
Exotic and Nuisance Plant Species:	Score = 2.0; salvinia, azola, melaleuca, lygodium, torpedo grass, downy rose myrtle, pampus grass, Brazilian pepper.
Field Indicators of Wetland Hydrology:	Score = 1.75; impounding structures.
Water Quality Inputs and Treatment:	Score = 2.0; salvinia and azola indicative of high nutrient input.
Overall Wrap Score:	2.0 + 20 + 1.0 + 2.0 + 1.75 + 2.0 divided by 18 = .60

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 22
Property:	Medalist - small wetland in phase II, next to road
Date Of Site Visit:	8/14/97 (afternoon)
Assessment Team Members Present:	Brad Rieck, USFWS Terry Morgan, COE John Wrublik, GFWFC Bev Ann Barta, Martin Co. Dick Roberts, DEP Tom Monroe, DEP Doug Strom, DEP Diane Bowen, USFWS Gary Roderick, Martin Co.
NWI Wetland Classification:	PEM1F.
FNAI Community Type:	Depression marsh.
Soil Type:	N/A.
Land Use:	Natural/open.
Wildlife Utilization:	Score = 2.0; gambusia, damselfly larvae, cricket frog, fishing spider, goldentop minnow, crayfish; size limitations.
Wetland Overstory/Shrub Canopy:	N/A.
Vegetative Ground Cover:	Score = 2.0; predominately maidencane, bladderwort, filamentous green algae.
Adjacent Upland/Wetland Buffer:	Score = 2.5; mostly greater than 300 feet.
Exotic and Nuisance Plant Species:	Score = 1.5; melaleuca, downy rose myrtle, algae blanket.
Field Indicators of Wetland Hydrology:	Score = 1.75; receiving excess water from culvert connection.
Water Quality Inputs and Treatment:	Score = 2.0; (LU = 2.5, TC = 2.5); obvious nutrient input and overheating in upper column.
Overall Wrap Score:	2.0 + 2.0 + 2.5+ 1.5 + 1.75 + 2.0 divided by 18 = .65

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 23
Property:	Seawinds property - impoundment square
Date Of Site Visit:	8/21/97
Assessment Team Members Present:	Brad Rieck, USFWS Tori Agramonte, COE John Wrublik, GFWFC Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Dick Roberts, DEP Tom Monroe, DEP Doug Strom, DEP Ed Weinberg, Kimley-Horn Rudd Jones, Westerra Peter Merritt, TCRPC
NWI Wetland Classification:	PEM1F.
FNAI Community Type:	Wet prairie - impounded.
Soil Type:	N/A.
Land Use:	Agriculture - few cows.
Wildlife Utilization:	Score = 2.5; the following found on the berm: bobcat scat, leopard frog, gopher tortoise scat, pileated woodpecker, vireo, Carolina wren; in water: red-bellied turtle, gambusia, dragonfly larvae, green heron
Wetland Overstory/Shrub Canopy:	N/A.
Vegetative Ground Cover:	Score = 1.5; lygodium, ludwigia, tapegrass, wax myrtle, hypericum, torpedo grass.
Adjacent Upland/Wetland Buffer:	Score = 2.0; perimeter bermed - only one breach.
Exotic and Nuisance Plant Species:	Score = 0.5; heavy infestation of exotics; Brazilian pepper, grapevine, melaleuca, cattails, lygodium, torpedo grass.
Field Indicators of Wetland Hydrology:	Score = 1.5; impounded wetland.
Water Quality Inputs and Treatment:	Score = 2.5 (LU = 2.5, TC = 2.5).

Overall Wrap Score: 2.5 + 1.5 + 2.0 + .5 + 1.5 + 2.5 divided by 18 = .58

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 24
Property:	Seawinds property - SW corner of Sec. 3, east of Ranch Rd.
Date Of Site Visit:	8/21/97
Assessment Team Members Present:	Brad Rieck, USFWS Tori Agramonte, COE John Wrublik, GFWFC Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Dick Roberts, DEP Tom Monroe, DEP Doug Strom, DEP Ed Weinburg, Kimley-Horn Rudd Jones, Westerra Peter Merritt, TCRPC
NWI Wetland Classification:	PEM1F, PEM1Cd.
FNAI Community Type:	Wet prairie.
Soil Type:	N/A.
Land Use:	Open space/agriculture - few cows.
Wildlife Utilization:	Score = 3.0 diverse prey base includes aquatic insects, numerous fish species, frogs, muskrat nest.
Wetland Overstory/Shrub Canopy:	N/A.
Vegetative Ground Cover:	Score = 2.0; wax myrtle, hypericum, beakrush, maidencane, fragrant lily, corkwood, spartina, fanwort, eleocharis (spike rushes); affected by ditching and spoil.
Adjacent Upland/Wetland Buffer:	Score = 3.0; pine flatwoods.
Exotic and Nuisance Plant Species:	Score = 2.5; melaleuca and some torpedo grass.
Field Indicators of Wetland Hydrology:	Score = 2.0; control structure present at south end of wetland; standing water now about 6 inches higher than natural.
Water Quality Inputs and Treatment:	Score = 2.75; (LU = 2.5, TC = 3.0).
Overall Wrap Score:	3.0+ 2.0 + 3.0 + 2.5 + 2.0 + 2.75 divided by 18 = .85

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 25
Property:	Seawinds property (site nicknamed "Duckpond")
Date Of Site Visit:	8/21/97
Assessment Team Members Present:	Brad Rieck, USFWS Tori Agramonte, COE John Wrublik, GFWFC Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Dick Roberts, DEP Tom Monroe, DEP Doug Strom, DEP Ed Weinberg, Kimley-Horn
NWI Wetland Classification:	PEM1Cd, PEM1Fd.
FNAI Community Type:	Basin marsh.
Soil Type:	N/A.
Land Use:	Open space/agriculture - few cows.
Wildlife Utilization:	Score = 2.5; crayfish, sailfin molly, flag fish, damselfly larvae, moorhen, fat sleeper (indicative of estuarine connection), gar, anhinga, grass shrimp, bluefin killifish.
Wetland Overstory/Shrub Canopy:	N/A.
Vegetative Ground Cover:	Score = 1.0; predominately cattail with spartina, eleocharis (spike rushes), Salvinia.
Adjacent Upland/Wetland Buffer:	Score = 2.5; pine flatwoods.
Exotic and Nuisance Plant Species:	Score = 0.5; torpedo grass, cattail, waterhorn fern.
Field Indicators of Wetland Hydrology:	Score = 1.0; control structure present and holding water 1 foot above natural level.
Water Quality Inputs and Treatment:	Score = 2.75; (LU = 2.5, TC = 3.0).
Overall Wrap Score:	2.5 + 1.0 + 2.5 + .5 + 1.0 + 2.75 divided by 18 = .57

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 26
Property:	Seawinds property (NW Corner)
Date Of Site Visit:	9/4/97
Assessment Team Members Present:	Brad Rieck, USFWS Terry Morgan, COE Bev Ann Barta, Martin Co. Dick Roberts, FL. Park Service Tom Monroe, FL. DEP Doug Strom, FL. DEP Ed Weinberg, Kimley-Horn
NWI Wetland Classification:	PEM1F.
FNAI Community Type:	Wet prairie.
Soil Type:	N/A.
Land Use:	Open space/agriculture - few cows.
Wildlife Utilization:	Score = 2.0; crayfish, gambusia, dragonfly larvae, gator flea, cricket frog, wildlife trails.
Wetland Overstory/Shrub Canopy:	N/A; (Scattered pines).
Vegetative Ground Cover:	Score = 2.5; maidencane, St. John's wort, corkwood, hat pins, beak rush, club moss, red root, yellow-eyed grass, tall milkwort
Adjacent Upland/Wetland Buffer:	Score = 2.5; buffer has a few exotics.
Exotic and Nuisance Plant Species:	Score = 2.0; melaleuca starting to move in; lygodium in small amounts in uplands.
Field Indicators of Wetland Hydrology:	Score = 2.5; small wetland, no open water; middle - probably dries up in droughts, development to south blocking flows.
Water Quality Inputs and Treatment:	Score = 2.5; (LU = 2.5, TC = 2.5).
Overall Wrap Score:	2.0 + 2.5 + 2.5 + 2.0 + 2.5 + 2.5 divided by 18 = .78

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 27
Property:	Seawinds property (West end of slough)
Date Of Site Visit:	9/4/97
Assessment Team Members Present:	Brad Rieck, USFWS Terry Morgan, COE Bev Ann Barta, Martin Co. Dick Roberts, DEP Tom Monroe, DEP Doug Strom, DEP Ed Weinberg, Kimley-Horn Toby Overdorf, Kimley-Horn Rudd Jones, Westerra
NWI Wetland Classification:	PSS6C.
FNAI Community Type:	Slough.
Soil Type:	N/A.
Land Use:	Open space/agriculture - few cows.
Wildlife Utilization:	Score = 2.5; crayfish, dragonfly larvae, grass shrimp, raccoon & hog tracks, killifish, cattle egret, apple snail eggs, armadillo, warbler.
Wetland Overstory/Shrub Canopy:	Score: 1.5; primarily pond apple, Brazilian pepper, with button bush, willow, salt bush.
Vegetative Ground Cover:	Score = 2.5; Includes smartweed, swamp fern, pickerelweed, fuirena, bacopa, beak rush, ludwigia repens.
Adjacent Upland/Wetland Buffer:	Score = 2.5; agriculture, field is near and adjacent pasture level is in good shape.
Exotic and Nuisance Plant Species:	Score = 1.0; Brazilian pepper, lygodium, primrose willow.
Field Indicators of Wetland Hydrology:	Score = 2.0; road present, agricultural dikes for property blocking water flow.
Water Quality Inputs and Treatment:	Score = 2.75; (LU = 2.5, TC = 3.0).
Overall Wrap Score:	2.5+ 1.5+ 2.5+ 2.5+ 1.0+ 2.0+ 2.5+ 2.75 divided by 21 = .70

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number: MC 28

Property: Seawinds property (South of slough)

Date Of Site Visit: 9/4/97

Assessment Team Members Present:
Brad Rieck, USFWS
Terry Morgan, COE
Bev Ann Barta, Martin Co.
Michelle Rusch, Intern - Martin Co.
Dick Roberts, DEP
Toby Overdorf, Kimley-Horn
Rudd Jones, Westerra

NWI Wetland Classification: PEM1F.

FNAI Community Type: Wet prairie.

Soil Type: N/A.

Land Use: Open space/agriculture - few cows.

Wildlife Utilization: Score = 3.0; white ibis, lubber grasshopper, sandhill crane nest, great egret, cattle egret, dragonflies, cricket frog, muskrat nest, small fish - several sp.

Wetland Overstory/Shrub Canopy: N/A.

Vegetative Ground Cover: Score = 2.75; includes beak rush, St. John's wort, maidencane, corkwood, xyris, red root, fuirena, pickerelweed, duck potato, bacopa.

Adjacent Upland/Wetland Buffer: Score = 3.0; pine/palmetto flatwoods.

Exotic and Nuisance Plant Species: Score = 2.5; melaleuca starting to invade.

Field Indicators of Wetland Hydrology: Score = 3.0; natural hydrology.

Water Quality Inputs and Treatment: Score = 2.75; (LU = 2.5, TC = 3.0).

Overall Wrap Score: 3.0 + 2.75 + 3.0 + 2.5 +3.0 + 2.75 divided by 18 = .94

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 29
Property:	Seawinds property - hardwood strand S.E.
Date Of Site Visit:	9/4/97
Assessment Team Members Present:	Brad Rieck, USFWS Terry Morgan, COE Michelle Rush, Intern with Martin Co. Bev Ann Barta, Martin Co. Dick Roberts, DEP Rudd Jones, Westerra Toby Overdorf, Kimley-Horn
NWI Wetland Classification:	PEM1F.
FNAI Community Type:	Slough (hardwood).
Soil Type:	N/A.
Land Use:	Open space/agriculture - few cows.
Wildlife Utilization:	Score = 3.0; apple snail eggs, leopard frog, crayfish, gambusia, hog tracks, grass shrimp, killifish.
Wetland Overstory/Shrub Canopy:	Score: 3.0; red maple, sweet bay, red bay, wax myrtle.
Vegetative Ground Cover:	Score = 2.5; pickerel weed, saw grass, swamp fern, false nettle, salt bush, button bush, ludwigia repens, wax myrtle, leatherfern, beak rush, lygodium.
Adjacent Upland/Wetland Buffer:	Score = 3.0; oaks, cabbage palm, slash pine, palmetto.
Exotic and Nuisance Plant Species:	Score = 2.5; lygodium starting to invade.
Field Indicators of Wetland Hydrology:	Score = 2.5; ditch has somewhat altered the wetland.
Water Quality Inputs and Treatment:	Score = 2.75 (LU = 2.5, TC = 3.0).
Overall Wrap Score:	3.0 + 3.0 + 2.5 + 3.0 + 2.5 + 2.5 + 2.75 divided by 21 = .92

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 30
Property:	Banner Lake (Hobe Sound)
Date Of Site Visit:	9/11/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Terry Morgan, COE John Wrublik, GFWFC Dick Roberts, DEP
NWI Wetland Classification:	L20WH: lacustrine, littoral, open water.
FNAI Community Type:	Sandhill upland lake.
Soil Type:	No identified in Soil Survey.
Land Use:	Low density residential/open space.
Wildlife Utilization:	Score = 2.5; pig frog, alligator, ducks, cricket frog, boat-tailed grackle, blue heron, gambusia, red-bellied woodpecker, sunfish, anhinga, killifish, gold top minnow.
Wetland Overstory/Shrub Canopy:	N/A; edge of saw palmetto, dahoon holly, swamp fern. slash pine.
Vegetative Ground Cover:	Score = 1.5; includes torpedo grass, cattails, ludwigia, spatterdock, filamentous algae, beak rush, duck potato, fuirena, buttonbush.
Adjacent Upland/Wetland Buffer:	Score = 2.5; (75% = 3, 25 % = 2).
Exotic and Nuisance Plant Species:	Score = 2.0; torpedo grass around edge of lake, cattails, Brazilian pepper, primrose willow; grape vine on this site's island.
Field Indicators of Wetland Hydrology:	Score = 3.0; isolated upland lake.
Water Quality Inputs and Treatment:	Score = 2.25; (LU = 2, TC = 2.5).
Overall Wrap Score:	2.5 + 1.5 + 2.5 + 2.0 + 3.0 + 2.25 divided by 18 = .76

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 31
Property:	Florida Club, restored swale of Roebuck Creek
Date Of Site Visit:	9/11/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Terry Morgan, COE John Wrublik, GFWFC Dick Roberts, DEP
NWI Wetland Classification:	PEM1F, PEM1Cd.
FNAI Community Type:	Swale, restored.
Soil Type:	N/A.
Land Use:	Golf Course.
Wildlife Utilization:	Score = 2.0; kingfisher, woodstork, woodpecker holes, gambusia, starling, leopard frog, tree frog, mockingbird.
Wetland Overstory/Shrub Canopy:	N/A.
Vegetative Ground Cover:	Score = 2.0; includes pickerelweed, fireflag, cord grass, canna lily, bacopa, soft rush, club-rush, hydrocotyle, hemp vine, buttonbush.
Adjacent Upland/Wetland Buffer:	Score = 0.5; golf course largely around edge of this wetland.
Exotic and Nuisance Plant Species:	Score = 1.75; torpedo grass, primrose willow, grape vine, dog fennel, lygodium, Caesar's weed, water hyacinth, limnophila sp. just starting.
Field Indicators of Wetland Hydrology:	Score = 2.0; not a natural hydroperiod, most vegetation has been planted.
Water Quality Inputs and Treatment:	Score = 1.25; (golf course = 1.5, dry retention = 1.0).
Overall Wrap Score:	2.0 + 2.0 + .5 + 1.75 + 2.0 + 1.25 divided by 18 = 0.53

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 32
Property:	Florida Club - NW. wetland preserve
Date Of Site Visit:	9/11/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Terry Morgan, COE John Wrublik, GFWFC Dick Roberts, DEP
NWI Wetland Classification:	PEM1F, PEM1Cd.
FNAI Community Type:	Wet prairie.
Soil Type:	N/A.
Land Use:	Golf course, preserve area.
Wildlife Utilization:	Score = 2.5; tree frog, cricket frog, animal trails, gambusia, water spiders, dragonfly larvae, aquatic grasshoppers.
Wetland Overstory/Shrub Canopy:	N/A.
Vegetative Ground Cover:	Score = 2.5; includes pond apple, corkwood, St. Johns wort, maidencane, wax myrtle, hatpins, xyris, bacopa, floating hearts, primrose willow, pickerelweed, beak rush, red root, swamp fern, sky flower, musk mint, plume grass.
Adjacent Upland/Wetland Buffer:	Score = 2.0; buffer is less than 300 feet.
Exotic and Nuisance Plant Species:	Score = 2.0; primrose willow, melaleuca, lygodium, limnophila.
Field Indicators of Wetland Hydrology:	Score = 2.5; wax myrtle invading the wetland.
Water Quality Inputs and Treatment:	Score = 1.75 (LU = 1.5, TC = 2).
Overall Wrap Score:	2.5 + 2.5 + 2.0 + 2.0 + 2.5 + 1.75 divided by 18 = .74

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 33
Property:	Tropical Farms - Roebuck Creek
Date Of Site Visit:	9/11/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Terry Morgan, COE John Wrublik, GFWFC Dick Roberts, DEP
NWI Wetland Classification:	PF01/3A: palustrine, forested, broad-leaved deciduous, broad-leaved evergreen, seasonally flooded.
FNAI Community Type:	Riverine.
Soil Type:	Holopaw fine sand.
Land Use:	Residential.
Wildlife Utilization:	Score = 1.25; gambusia, grass shrimp, dragonfly larvae, brown anole.
Wetland Overstory/Shrub Canopy:	Score = 2.5; cabbage palm, pop ash, water hickory, laurel oak, red bay, pond apple.
Vegetative Ground Cover:	Score = 1.0; wild coffee, American beauty berry, coral bean, Virginia willow, royal fern, myrsine, cocoplum, swamp lily.
Adjacent Upland/Wetland Buffer:	Score =1.0; adjacent houses and church.
Exotic and Nuisance Plant Species:	Score = 0.5; air potato, wedilia, Brazilian pepper, coral ardisia, lygodium, crab eyes, elephant ear, bamboo.
Field Indicators of Wetland Hydrology:	Score = 2.0; steep bank to creek due to runoff from roads, and residential development.
Water Quality Inputs and Treatment:	Score = 1.25; (LU = 1.5, TC = 1.0).
Overall Wrap Score:	1.25 + 2.5 + 1.0 + 1.0 + .5 + 2.0 + 1.25 divided by 21 = .45

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 34
Property:	McMillion Property (SF of St. Lucie River and NW corner of Becker Groves)
Date Of Site Visit:	9/18/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Nathan King, USFWS John Wrublik, GFWFC Dick Roberts, DEP Doug Strom, DEP
NWI Wetland Classification:	PF01/3C, PEM1C: palustrine, forested, broad-leaved deciduous/evergreen seasonally flooded.
FNAI Community Type:	Riverine (historic).
Soil Type:	Riviera fine sand, depressional.
Land Use:	Open space.
Wildlife Utilization:	Score = 2.5; golden orb spider, hog tracks, dragonfly, tree frog, leopard frog, Florida black snake, cardinal, barred owl, blue jay, gambusia, crane fly, squirrel tree frog, whirligig beetle
Wetland Overstory/Shrub Canopy:	Score = 3.0; red bay, maple, cabbage palms, shoestring fern, laurel oak, red marlberry.
Vegetative Ground Cover:	Score = 2.5; wild coffee (both sp.), marlberry, American beauty berry, swamp fern, strap fern, saw palmetto.
Adjacent Upland/Wetland Buffer:	Score = 2.5; citrus field on one edge; Brazilian pepper and lygodium.
Exotic and Nuisance Plant Species:	Score = 2.5; citrus, Caesar's weed, Brazilian pepper and lygodium (mostly on edge), lots of hog damage.
Field Indicators of Wetland Hydrology:	Score = 2.0; canal dewatering the creek, dike cutting off flow, no input of water from canal.
Water Quality Inputs and Treatment:	Score = 2.75 (LU = 2.5, TC = 3.0).
Overall Wrap Score:	2.5 + 3.0 + 2.5 + 2.5 + 2.5 + 2.0 + 2.75 divided by 21 = .85

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 35
Property:	Bridge Meadow Farm off Bridge Rd. (Cypress Dome)
Date Of Site Visit:	9/18/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Nathan King, USFWS John Wrublik, GFWFC Dick Roberts, DEP Doug Strom, DEP
NWI Wetland Classification:	PF06C: palustrine, forested, deciduous, seasonally flooded.
FNAI Community Type:	Cypress dome.
Soil Type:	Riviera fine sand, depressional/Tequesta variant muck.
Land Use:	Agriculture (abandoned row crops).
Wildlife Utilization:	Score = 2.0; pileated woodpecker, gambusia, water strider, dragonfly larvae, crayfish, whirligig beetle larvae, black- white warbler, water boatman.
Wetland Overstory/Shrub Canopy:	Score = 2.0; predominately cypress, some pond apple.
Vegetative Ground Cover:	Score = 2.5; swamp fern, duck potato, smartweed, leather fern, wax myrtle, duckweed, native water horn fern.
Adjacent Upland/Wetland Buffer:	Score = 1.5; mowed farm land is the buffer.
Exotic and Nuisance Plant Species:	Score = 1.0; exotic ficus sp., Brazilian pepper, para grass, lygodium (heavy), Caesar's weed.
Field Indicators of Wetland Hydrology:	Score = 1.75; low water table, surrounded by a swale, dog fennel, transitional species invading.
Water Quality Inputs and Treatment:	Score = 2.0; (LU = 1.0, TC = 1.0); but all water routed away from wetland.
Overall Wrap Score:	2.0+ 2.0+ 2.5+ 1.5+ 1.0+ 1.75+ 2.0 divided by 21 = .61

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 36
Property:	Bridge Meadow Farm (marsh)
Date Of Site Visit:	9/18/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Nathan King, USFWS John Wrublik, GFWFC Dick Roberts, DEP Doug Strom, DEP
NWI Wetland Classification:	Listed as PEM1C, but is now PSS1C.
FNAI Community Type:	Depression marsh (historic).
Soil Type:	Floridana fine sand, depressional/Riviera fine sand, depressional.
Land Use:	N/A.
Wildlife Utilization:	N/A.
Wetland Overstory/Shrub Canopy:	N.A.
Vegetative Ground Cover:	Score = 2.0; swamp fern, smartweed, duckweed, shield fern, primrose willow, Brazilian pepper seedlings.
Adjacent Upland/Wetland Buffer:	Score = 1.5.
Exotic and Nuisance Plant Species:	Score = 0.5; Brazilian pepper, Lygodium, cattails
Field Indicators of Wetland Hydrology:	Score = 1.75; surrounded by road berm; no inflow water table has been lowered; 6 inches deep in center, drainage evident.
Water Quality Inputs and Treatment:	Score = 2.0 (LU = 1.0 TC = 1.0); but all water is routed away from wetland.
Overall Wrap Score:	1.75 + 1.0+ 2.0+ 1.5+ .5 + 1.75 +2.0 divided by 21 = .50

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 37
Property:	Jonathan Dickinson State Park - site F3
Date Of Site Visit:	10/21/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Dick Roberts, DEP Doug Strom, DEP Doug Shaw, SFWMD
NWI Wetland Classification:	PEM1F: Palustrine, emergent, persistent, semi-permanently flooded.
FNAI Community Type:	Wet Prairie.
Soil Type:	Riviera fine sand, depressional.
Land Use:	Conservation.
Wildlife Utilization:	Score = 3.0; pygmy killifish, gator flea, upland avifauna, woodpecker, gnat catcher, blue jay, yellow warbler, dragonfly larvae, damselflies, fishing spider, crayfish, gambusia, back swimmer, cichlid (exotic), least killifish, semi-aquatic grasshopper, pygmy sunfish.
Wetland Overstory/Shrub Canopy:	N/A.
Vegetative Ground Cover:	Score = 2.5; hypericum, maidencane, xyris, small pickerlweed patches, green filamentous algae, chara, limnophila.
Adjacent Upland/Wetland Buffer:	Score = 3.0; pine flatwoods.
Exotic and Nuisance Plant Species:	Score = 2.5; limnoplila, downy rose myrtle on the outskirts.
Field Indicators of Wetland Hydrology:	Score = 3.0; avg. 2 feet interior water depth.
Water Quality Inputs and Treatment:	Score = 3.0;(LU = 3.0, TC = 3.0).
Overall Wrap Score:	3.0+ 2.5+ 3.0 + 2.5 + 3.0 + 3.0 divided by 18 = .94

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 38
Property:	Jonathan Dickinson State Park - site A19
Date Of Site Visit:	10/21/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Dick Roberts, DEP Doug Strom, DEP Doug Shaw, SFWMD
NWI Wetland Classification:	PEM1F: palustrine, emergent, persistent, semi-permanently flooded.
FNAI Community Type:	Sandhill Lake.
Soil Type:	Paola sand.
Land Use:	Conservation.
Wildlife Utilization:	Score = 2.5; sandwichman, golden top minnow, damselfly, aquatic moth, great blue heron, gambusia, predatory fish, water beetles, pileated woodpecker.
Wetland Overstory/Shrub Canopy:	N/A.
Vegetative Ground Cover:	Score = 2.5; edge; wax myrtle, button bush, maidencane, beak rush. Interior; water lily, red root, xyris, green algae.
Adjacent Upland/Wetland Buffer:	Score = 2.5; asphalt road splits lake, railroad nearby.
Exotic and Nuisance Plant Species:	Score = 2.0; lygodium around the edge, some dog fennel and Brazilian pepper.
Field Indicators of Wetland Hydrology:	Score = 2.5; center depth 5 - 6 feet.
Water Quality Inputs and Treatment:	Score = 2.5 (LU = 3.0, TC = 1.5).
Overall Wrap Score:	2.5 + 2.5 + 2.5 + 2.0 + 2.5 + 2.5 divided by 18 = .81

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 39
Property:	Jonathan Dickinson State Park - site E10
Date Of Site Visit:	10/21/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Dick Roberts, DEP Doug Strom, DEP
NWI Wetland Classification:	PEM1F: palustrine, emergent, persistent, semi-permanently flooded.
FNAI Community Type:	Wet prairie
Soil Type:	Waveland sand, depressional.
Land Use:	Conservation.
Wildlife Utilization:	Score = 2.5; sandwichman, lined top minnow, pygmy killifish, gambusia, dragonfly larvae, gatorflea, semi--aquatic grasshoppers, frog egg masses, young cricket frog.
Wetland Overstory/Shrub Canopy:	N/A.
Vegetative Ground Cover:	Score = 3.0; hypericum, maidencane, bladderwort, beakrush, filamentous green algae, some water lilly's, floating heart, sphagnum, xyris.
Adjacent Upland/Wetland Buffer:	Score = 2.75; pine flatwoods, wet prairie, cypress domes plus less than 10% park road .
Exotic and Nuisance Plant Species:	Score = 3.0; none.
Field Indicators of Wetland Hydrology:	Score = 3.0; center depth 2 feet; culvert under road.
Water Quality Inputs and Treatment:	Score = 2.75 (LU = 3.0, TC = 2.75).
Overall Wrap Score:	2.5 + 3.0 + 2.75 + 3.0 + 3.0 + 2.75 divided by 18 = .94

Appendix 5

Wetland Evaluation Summary
Wetland Rapid Assessment Procedure

Wetland Number:	MC 40
Property:	Jonathan Dickinson State Park - site E13
Date Of Site Visit:	10/21/97
Assessment Team Members Present:	Bev Ann Barta, Martin Co. Gary Roderick, Martin Co. Brad Rieck, USFWS Dick Roberts, DEP Doug Strom, DEP
NWI Wetland Classification:	PEM1F.
FNAI Community Type:	Wet prairie.
Soil Type:	Waveland sand, depressional.
Land Use:	Conservation.
Wildlife Utilization:	Score = 3.0; pygmy killifish, gator flea, semi-aquatic grasshoppers, dragonfly larvae, seminole killifish, deer skull, and bedding great egret.
Wetland Overstory/Shrub Canopy:	N/A; scattered pines, cypress, less than 20% cover
Vegetative Ground Cover:	Score = 3.0; hypericum, maidencane, waterdrop wort, hatpin, fanwort, love vine, fuirena, red root, beak rush, xyris.
Adjacent Upland/Wetland Buffer:	Score = 3.0; pine flatwoods/palmetto equals park land.
Exotic and Nuisance Plant Species:	Score = 3.0; none.
Field Indicators of Wetland Hydrology:	Score = 3.0; natural hydroperiod, center depth 1 inch.
Water Quality Inputs and Treatment:	Score = 3.0; (LU = 3.0, TC = 3.0).
Overall Wrap Score:	3.0+ 3.0 + 3.0 + 3.0 + 3.0 + 3.0 divided by 18 = 1.0

APPENDIX 6

LIST OF ANIMAL SPECIES OBSERVED (OR EVIDENCE OF) IN WRAP FIELD EVALUATIONS

This appendix includes a list of animal species that were identified through direct and indirect observation such as signs (e.g. scat, tracks, etc.) by members of the assessment team during the WRAP field evaluations. This list is not based on uniform survey techniques, and is not intended as a comprehensive list of species in the Project Area. However, this list provides a good indication of the animals typically encountered during the field evaluation of wetlands in the Project Area. Not all of the species in this list are primarily dependent on wetlands. Some of the species were identified in the upland buffers of the wetlands evaluated. References for the identification of these species are listed below.

Scientific Name	**Common Name**
Mammals	
Dasypus novemcinctus	nine-banded armadillo
Didelphis virginiana	opossum
Felis rufus	bobcat
Neofiber alleni	round-tailed muskrat
Odocoileus virginianus	white-tailed deer
Procyon lotor	raccoon
Sciurus carolinensis	gray squirrel
Sigmondon hispidus	cotton rat
Sus scrofa	wild hog
Sylvilagus palustris	marsh rabbit
Amphibians	
Acris gryllus	southern cricket frog
Anura sp.	tadpoles (various sp.)
Bufo quercicus	oak toad
Hyla cinerea	green treefrog
Hyla squirella	squirrel treefrog
Pseudacris ocularis	little grass frog
Rana grylio	pig frog
Sphenocephala utricularia	southern leopard frog

Appendix 6

Scientific Name	Common Name
Reptiles	
Alligator mississippiensis	American alligator
Anolis carolinensis	green anole
Anolis sagrei	brown anole
Coluber constrictor	black racer
Gopherus polyphemus	gopher tortoise
Kinosternon bauri	striped mud turtle
Nerodia sp.	water snake
Pseudemys nelsoni	Florida red-bellied turtle
Pseudemys floridana	River cooter
Trionyx ferox	Florida softshell turtle
Fishes	
Cichlasoma bimaculatum	black acara
Clarias batrachus	walking catfish
Dormitator maculatus	fat sleeper
Elassoma evergladei	Everglades pygmy sunfish
Enneacanthus gloriosus	bluespotted sunfish
Fundulus chrysotus	golden topminnow
Fundulus lineolatus	lined topminnow
Fundulus seminolis	seminole killifish
Gambusia holbrooki	mosquito fish
Heterandria formosa	Least killifish
Jordanella floridae	flagfish
Lepisosteus platyrhincus	Florida gar
Lepomis macrochirus	bluegill
Leptolucania ommata	pygmy killifish
Luciana goodei	bluefin killifish
Micropterus salmoides	largemouth bass
Poecilia latipinna	sailfin molly
Birds	
Agelaius phoeniceus	red-winged blackbird
Anatidae	ducks (unidentified sp.)
Anhinga anhinga	anhinga
Ardea herodias	great blue heron
Ardeidae	heron (unidentified sp.)
Bubulcus ibis	cattle egret
Butea jamaicensis	red-tailed hawk
Buteo lineatus	red-shouldered hawk
Butorides striatus	Green-backed heron

Appendix 6

Scientific Name	Common Name
Caprimulgus carolinensis	chuck-wills-widow
Cardinalis cardinalis	northern cardinal
Casmerodius albus	great egret
Ceryle alcyon	belted kingfisher
Charadrius vociferus	killdeer
Chordeiles minor	common nighthawk
Colaptes auratus	northern flicker
Corvus ossifragus	fish crow
Cyanocitta cristata	blue jay
Drycopus pileatus	pileated woodpecker
Dumetella carolinensis	catbird
Egretta caerulea	little blue heron
Egretta thula	snowy egret
Egretta tricolor	tricolored heron
Emberizidae	warbler (unidentified sp.)
Eudocimus albus	white ibis
Gallinula chloropus	common moorhen
Geothlypis trichas	common yellowthroat
Grus canadensis	sandhill crane
Melanerpes carolinus	red-bellied woodpecker
Melospiza georgiana	swamp sparrow
Mimus sp.	mockingbird
Mniotilta varia	black-and-white warbler
Mycteria americana	wood stork
Lanius ludovicianus	loggerhead shrike
Pandion haliaetus	osprey
Passerina sp.	bunting (unidentified sp.)
Picidae	woodpecker
Picoides pubescens	downy woodpecker
Podilymbus podiceps	pied-billed grebe
Polioptila caerulea	blue-gray gnatcatcher
Quiscalus major	boat-tailed grackle
Strix varia	barred owl
Sturnus vulgaris	European starling
Thryothorus ludovicianus	Carolina wren
Troglodytidae	wrens (various sp.)
Vireo griseus	white-eyed vireo
Vireo sp.	vireo (unidentified sp.)
Zenaida macroura	mourning dove

Appendix 6

Scientific Name	Common Name
Invertebrates	
Acrididae	grasshopper (various sp.)
Anisoptera	dragonflies/larvae
Aranaea	spiders (various sp.)
Belostoma sp.	giant waterbug
Cicadidae	cicada
Coleoptera	beetles (various sp.)
Corixidae	water boatman
Culicidae	mosquitoes
Dolomedes triton	fishing spider
Dytiscidae	predaceous diving beetles
Ensifera	katydid (unidentified sp.)
Ephemeroptera	mayfly (unidentified sp.)
Gerridae	water skimmers striders
Gyrinidae	whirligig beetles
Hemiptera	aquatic bugs (various sp.)
Hydracarina	water mites
Hydrometridae	water measurer
Hydrophilidae	water scavenger beetles
Lepidoptera	aquatic moths
Lepidoptera	butterflies
Nephila davipis	golden orb spider
Notonectidae	backswimmer
Palaemonetes paludosus	grass shrimp
Parapognx sp.	sandwichman
Peloceris femoratus	gator flea
Phasmatidae	walkingsticks
Pomacea paludosus	apple snail
Procambarus alleni	crayfish
Romalea microptera	lubber grasshopper
Solenopsis invicta	red fire ant
Tettigoniidae	long-horned grasshopper
Tipula sp.	crane fly
Veliidae	little water striders
Zygoptera	damselflies/larvae

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APPENDIX 7

LIST OF PLANT SPECIES OBSERVED IN WRAP FIELD EVALUATIONS

This appendix includes a list of plant species that were observed by members of the assessment team during the WRAP field evaluations. This list is not based on uniform survey techniques, and is not intended as a comprehensive list of species in the Project Area. However, this list provides a good indication of the plants typically encountered during the field evaluation of wetlands in the Project Area. Not all of the species in this list are primarily dependent on wetlands. Some of the species were identified in the upland buffers of the wetlands evaluated. References for the identification of these species are listed below.

Scientific Name	Common Name
Abrus precatorius	crab's eye
Acer rubrum	red maple
Acrostichum danaeaefolium	leather fern
Amphicarpum muhlenbergianum	blue maidencane
Andropogon virginicus	broomsedge
Andropogon glomeratus	chalky blue stem
Annona glabra	pond apple
Ardisia escallonioides	marlberry
Aristida sp.	wiregrass
Azolla caroliniana	mosquito fern
Baccharis sp.	saltbush
Bacopa sp.	water hyssops
Befaria racemosa	tarflower
Blechnum serrulatum	swamp fern
Boehmeria cylindrica	false nettle
Cabomba caroliniana	fanwort
Callicarpa americana	beautyberry
Campyloneurum phyllitides	strap fern
Canna flaccida	canna lily
Carex sp.	sedges
Carphephorus odoratissimus	deer tongue
Carya aquatica	water hickory
Cassytha filiformis	love vine
Casuarina equisetifolia	Australian pine
Centella asiatica	coinwort
Cephalanthus occidentalis	buttonbush
Ceratopteris pterdoides	water horn fern
Chara sp.	musk grasses

Scientific Name	Common Name
Chrysobalanus icaco	cocoplum
Citrus sp.	orange tree
Cladium jamaicensis	saw grass
Crinum americanum	swamp lily
Ctenium aromaticum	toothache grass
Cyanobacteria	blue-green algae
Cyperus sp.	umbrella sedge
Diodia virginiana	buttonweed
Dioscorea bulbiflora	air potato
Drosera capillaris	sundew
Eleocharis sp.	spikerush
Erechtites hieracifolia	fireweed
Eriocaulon sp.	hat pins
Eryngium sp.	coyote thistle
Erythrina herbacea	coral bean
Eupatorium capillifolium	dogfennel
Ficus aurea	strangler fig
Flavaria linearis	yellowtop
Fraxinus caroliniana	pop ash
Fuirena scirpoidea	rush fuirena
Hibiscus grandiflorus	swamp hibiscus
Hydrocotyle umbellata	marsh pennywort
Hydrolea corymbosum	sky flower
Hymenocallis palmeri	alligator lily
Hypericum sp.	St. John's wort
Hyptis alata	musky mint
Ilex glabra	gallberry
Ilex cassine	dahoon holly
Ipomoea sp.	morning glory
Itea virginica	Virginia willow
Juncus sp.	rushes
Lachnanthes caroliana	red root
Lachnocaulon sp.	bog buttons
Lemna sp.	duckweed
Liatris sp.	blazing star
Limnophila sessiliflora	marshweed
Ludwigia sp.	Ludwigia
Ludwigia repens	creeping seedbox
Ludwigia peruviana	primrose willow
Lycopodium sp.	clubmoss
Lygodium microphylium	Old World climbing fern

Scientific Name	Common Name
Lyonia lucida	fetterbush
Lyonia fruticosa	stagger bush
Magnolia virginiana	sweet bay
Marshalia tenuifolia	Barbara's buttons
Melaleuca quinquenervia	punk tree
Mikania sp.	mikania
Morus rubra	red mulberry
Myrica cerifera	wax myrtle
Nuphar lutea	spatterdock
Nymphaea odorata	white water lily
Nymphoides aquatica	floating heart
Osmunda regalis	royal fern
Oxypolis filiformis	water dropwort
Panicum hemitomon	maidencane
Panicum repens	torpedograss
Panicum rigidulum	red-top panic grass
Panicum sp.	various species
Parthenocissus quinquefolia	Virginia creeper
Persea borbonia	red Bay
Persea palustris	swamp bay
Phlebodium aureum	golden polypody
Phragmites australis	giant reed
Pinus elliottii	slash pine
Pluchea sp.	fleabane
Polygala cymosa	milkwort
Polygonum hydropiperoides	smartweed
Pontederia cordata	pickerelweed
Proserpinaca pectinata	mermaid weed
Psychotria sp.	wild coffee
Quercus laurifolia	laurel oak
Rapanea punctata	myrsine
Rhexia sp.	meadow beauty
Rhodomyrtus tomentosus	downy rose myrtle
Rhynchelytrum repens	natal grass
Rhynchospora colorata	star rush
Rhynchospora inundata	inundated beakrush
Rhynchospora sp.	beak rushes
Rorippa teres	marsh cress
Sabal palmetto	cabbage palm
Sabatia sp.	sabatia
Saccharum giganteum	sugarcane plume grass

Appendix 7

Scientific Name	Common Name
Sagittaria latifolia	duck potato
Sagittaria sp.	arrowheads
Salix caroliniana	Carolina willow
Salvinia minima	water fern
Schinus terebinthifolius	Brazilian pepper
Scirpus sp.	bulrush
Scleria sp.	nut-rush
Serenoa repens	saw palmetto
Smilax laurifolia	bamboo vine
Smilax auriculata	wild bamboo
Smilax bona-nox	greenbriar
Solidago sp.	goldenrod
Spartina bakeri	cordgrass
Sphagnum sp.	sphagnum moss
Stillingia aquatica	corkwood
Taxodium distichum	bald cypress
Taxodium ascendens	pond cypress
Thalia geniculata	fireflag
Thelypteris sp.	shield ferns
Tillandsia sp.	air plants
Toxicodendron radicans	poison ivy
Tricholaena rosea	natal grass
Typha sp.	cattails
Urena lobata	caesar's weed
Urochloa mutica	paragrass
Utricularia sp.	bladderworts
Vitis sp.	grape vine
Vittaria lineata	shoestring fern
Wedelia trilobata	wedelia
Woodwardia sp.	chain ferns
Xanthosoma sagittifolium	elephant ear
Xyris sp.	yellow-eyed grasses
Zebrina pendula	wandering jew

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APPENDIX 8

WETLAND POLICIES

The following represents wetland protection policies adopted in the Martin County Comprehensive Plan (revised 1998). The policy descriptions have been significantly abbreviated in places to conserve space. Consult the full text of the comprehensive plan for the complete policies.

CHAPTER 9. CONSERVATION AND OPEN SPACE ELEMENT

SECTION 9-4. GOALS, OBJECTIVES AND POLICIES

A. GOAL

The goal of Martin County is to effectively manage, conserve and preserve the natural resources of Martin County giving consideration to an equitable balance of public and private property rights. These resources include air, water, soils, habitat, fisheries and wildlife with special emphasis on restoring the St. Lucie Estuary and the Indian River lagoon.

7. OBJECTIVE

Natural Systems. To protect and preserve the functions and values of wetland and upland natural systems. These systems serve a multitude of functions, including, but not limited to flood control, ground water aquifer recharge and wildlife habitat.

a. Policy: Protection of Wetlands. All wetlands in Martin County shall be protected. No negative impacts shall be allowed in wetlands, within the wetland buffer, nor within the upland transition area surrounding the wetland. Wetland protection requirements are detailed in this Objective and in Objective A.1 of the Coastal Management Element and are also defined as Performance Standards in Section 4-5 of the Future Land Use Element. All development must be consistent with the wetland protection requirements of the Comprehensive Growth Management Plan and Rule 9J-5.013(3) FAC. The requirements include directing inconsistent and/or incompatible future land uses away from wetland areas. Compliance with all wetland protection requirements must be demonstrated prior to the issuance of a development approval or order.

The intent of sections 9-4.A.7 a-d is to protect natural wetland systems. This policy is not intended to protect man made excavations in uplands except those that are navigable and connected to the waters of the state. This policy is intended to protect natural wetlands even when impacted by man made excavations.

While man made wetlands exempt under this policy are not protected as natural wetlands, development review shall assure that impacts to them do not adversely affect drainage or natural systems.

In determining if a wetland which meets the definition in Section 9-4.A.7.b.(1) is a natural system protected under Section 9-4.A.7 a-d the following standards shall apply:

(1) Only man made wetlands clearly excavated in uplands will be exempt.

(2) Navigable canals connected to the waters of the state, whether excavated in uplands or wetlands, will not be exempt.

(3) Artificially created wetlands where there were no wetlands at the time of excavation and where there are no wetlands beyond the bank top of the excavation will be exempt.

(4) Man made wetlands which are within or directly adjacent to natural wetlands will be protected as part of the natural wetland system.

(5) If there is not sufficient evidence to prove that the excavation was man made in upland soils and is not within or adjacent to a natural wetland, then the system will be protected as a natural wetland.

b. Policy: Wetlands, General Provisions. The following definitions, restrictions, violations, waivers, and density transfer provisions shall apply:

(1) Wetland Areas. Wetlands, as defined in Subsection 373.019(17), FS, are those areas that are inundated or saturated by surface water or ground water at a frequency and a duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils. Soils present in wetlands generally are classified as hydric or alluvial, or possess characteristics that are associated with reducing soil conditions. The prevalent vegetation in wetlands generally consists of facultative or obligate hydrophytic macrophytes that are typically adapted to areas having soil conditions described above. These species, due to morphological, physiological, or reproductive adaptations, have the ability to grow, reproduce or persist in aquatic environments or anaerobic soil conditions. Florida wetlands generally include swamps, marshes, bayheads, bogs,

cypress domes and strands, sloughs, wet prairies, riverine swamps and marshes, hydric seepage slopes, tidal marshes, mangrove swamps and other similar areas. Florida wetlands generally do not include longleaf or slash pine flatwoods with an understory dominated by saw palmetto.

(2) No negative impacts shall be allowed in wetlands or within the wetland buffer, and upland transition area surrounding the wetland.

(3) Where illegal activities in violation of the Comprehensive Plan or the Codes of Laws and ordinances of Martin County have altered any wetland area so that all or part of the original area no longer meets the definition of a wetland or has negatively impacted a wetland, restoration shall be required at the site of the alteration. Restoration of buffers, habitat, and hydrology of the original wetland area shall be required. The restored wetland shall be protected as a natural wetland.

(4) Identification of Wetlands Onsite. Martin County shall continue to require that all applications for development approval include an identification of all wetland areas onsite, as defined in this Element. This requirement shall be included in the land development regulations to be adopted by July 1, 1990. All preserve areas and buffers designated on site plans shall be maintained free of exotic plants, trash and debris.

(5) Preserve Area Management Plan (PAMP) Provisions. Any application for development plan approval must contain a preserve area management plan to protect all wetland areas located onsite and offsite. The PAMP is subject to the review and approval of Martin County Growth Management Department. No development approval will be issued until the PAMP is approved by the Martin County Growth Management Department. The PAMP must contain a statement that indicates that the County has authority to enforce all provisions of the PAMP. In accordance with the PAMP, the wetland areas on site must be maintained.

c. Policy: Wetlands, Special. In addition to those wetland areas defined in this Element, there are those wetlands that are considered wetland areas of special concern.

Designated wetland areas of special concern:

(1) The North County Savannas
(2) Britt Creek
(3) Arant's Creek and Swamp
(4) Warner Creek
(5) Hutchinson Island estuarine area
(6) St. Lucie South Fork and Islands
(7) Willoughby Creek
(8) Manatee Creek
(9) Intracoastal Waterway and adjacent marshes
(10) St. Lucie South Fork headwaters
(11) Myrtle Slough
(12) Danforth Creek
(13) Kitching Creek headwaters
(14) Cypress Creek and Loxahatchee River headwaters
(15) Bessey Creek
(16) Mapp Creek
(17) Hog Creek
(18) Allapattah Slough
(19) Barley Barber Swamp
(20) Bluefield Wetlands
(21) Boar and Myer Hammocks
(22) East Creek
(23) Cane Slough
(24) Roebuck Creek
(25) Wetlands within state, regional and/or federal designated Greenways

In addition to the provisions set forth in Policy b. above, the following additional performance criteria for all wetland areas as defined in this Element must be met. Special consideration and additional protective measures will be required to assure protection of the special wetland areas indicated above. These special protective measures will be incorporated as conditions of approval during the site plan review process to ensure that the biological, scenic and navigational qualities of these special wetland areas are maintained. Development regulations providing specific explanatory language for each protective measure will be enacted by the County within the land development regulations adopted by July 1, 1990.

d. Policy: Buffer Zones and Performance Criteria for Wetlands. The following Buffer Zone Provisions and Performance Criteria for Wetland Areas identified in Policies 7, b. and c. must be met.

These provisions and criteria shall be incorporated into Martin County's Land Development Regulations by July 1, 1990.

(1) Buffer Zone Provisions:

(a) For natural creeks, rivers, water bodies connected to waters of the state, and waters of the state as defined and protected according to Chapter 403 Florida Statutes, a minimum seventy-five (75) foot wide buffer zone of native upland and transitional vegetation shall be provided and maintained from the landward extent of wetland vegetation or from Mean High Water (as determined in accordance with Section 17-4.022, Florida Administrative Code), whichever is greater.

(b) Where natural bluffs with slopes exceeding one foot vertical to three feet horizontal occur, required buffers shall start at the top of the bank. The buffer must be sized and designed to assure both stability of the bluff system and sufficient level ground to provide a visual and physical buffer of native vegetation.

(c) In all new developments where plats or site plans are required to be submitted, plans shall show sufficient preservation area to protect natural banks and prevent future impacts to wetlands. Where banks have been previously cleared or filled and are not sufficiently stabilized, then the banks shall be resloped (if necessary) and revegetated with appropriate native vegetation.

(d) Buffers should be measured from the edge of the delineated wetland and not from the wetland vegetation.

(e) For isolated wetland areas, a minimum fifty (50) foot buffer zone of appropriate native vegetation shall be provided and maintained from the landward extent of the wetland .

(f) The buffer zone must consist of preserved native vegetation. Areas of the buffer zone, void of existing, natural associations of native vegetation,

shall be supplemented with appropriate native vegetation in accordance with a preserve area management plan approved by the Martin County Growth Management Department. Noxious, exotic vegetation shall be removed and any native vegetation removed or destroyed subsequent to the adoption of this plan shall be replaced with appropriate native vegetation.

(2) Performance Criteria for Wetland Areas.

(a) The following restrictions shall apply to the direct removal of natural vegetation from the wetlands or the buffer zone surrounding the wetlands.

1) Clearing or direct removal of vegetation shall not occur except in compliance with a preserve area management plan approved by the Martin County Growth Management Department, or in compliance with those minimal activities permitted for riparian usage (e.g., docks and walkways).

2) All materials that are cleared from the wetland or buffer zone shall be removed from the site and not piled or stored within the wetland or designated upland preserve areas.

(b) Dredging and/or filling.

1) Dredging and/or filling shall not occur within the wetlands or the buffer zone surrounding the wetlands except in compliance with the provisions of the Excavation and Fill Ordinance and a preserve area management plan approved by the Martin County Growth Management Department.

2) An additional (minimum) 200 foot wide separation shall be maintained between the wetland and any lake excavations unless an alternative plan utilizing an impermeable barrier is approved by Martin County in consultation with the South Florida Water Management District.

3) Filling, which occurs landward of the buffer zone, must be stabilized and/or contained to prevent runoff and degradation of buffer zone vegetation within thirty (30) days of vegetation removal.

(c) Construction within or adjacent to the wetlands and/or wetlands buffer zone.

1) No construction shall be permitted within the wetlands or wetland buffer zones, except to provide access to the site where no reasonable upland access exists. In such circumstances, a plan shall be submitted to the Growth Management Department demonstrating that no reasonable upland access exists and specifying the proposed alternative access, and must be approved in writing. Such access must be designed and located in such a manner that the least amount of damage to the wetland and/or wetland buffer zone is assured.

2) Public and private dock structures shall be consistent with the County Dock Ordinance, as amended from time to time.

3) The structure and foundation of docks shall be designed to accommodate surface water flows and shall not be designed to impede, interrupt, or impound surface water flows.

4) Marina development shall conform to the marina siting section of the Martin County Comprehensive Growth Management Plan.

5) Maintenance of existing functional structures is permitted provided the maintenance is performed in the least intrusive manner possible and shall not result in additional damage to the wetland or wetland buffer zone.

6) The use of heavy equipment shall be minimized in the wetland areas and/or buffer zones.

7) There shall be no temporary filling of the wetland area or buffer zone for construction.

8) All pilings shall be secured, placed or set to the desired depth by the least disruptive method based on existing site characteristics.

9) Wetland buffer zones or any other designated upland preserve area shall be protected from encroachment due to construction and/or building maintenance activities as follows:

   [a] New construction proposed to be adjacent to these areas shall be setback a minimum of ten (10) feet (or greater if warranted by specific site conditions) for primary structures. Minimum preserve area setbacks for accessory structures (pool decks, screen enclosures, driveways, etc.) shall be five (5) feet.

   [b] Residential lots of record as defined in Comprehensive Growth Management Plan may have setbacks for both primary and accessory structures reduced to less than ten (10) feet, but no less than five (5) feet provided:

      (1) the existing development of adjacent lots is similar with respect to setback;

      (2) the wetland buffer zone or other designated upland preserve area can be protected from encroachment; and

      (3) the lot cannot be reasonably developed with the setback criteria in 9. [a] above.

[c] The five (5) foot setback criteria may be eliminated for lots of record provided that the Growth Management Director in consultation with the Building and Zoning Director determines that the subject lot was essentially devoid of vegetation in the preserve area on the date of the adoption of this plan and thus no purpose would be served by the additional five foot (5) buffer zone.

(d) Prohibition of planting exotic vegetation within wetlands or wetland buffer zone.

1) Planting of exotic vegetation or incompatible native vegetation shall not occur within, or encroach upon, the wetland area or buffer zone.

2) Any proposed planting occurring in the wetland area or buffer zone must receive prior approval from Martin County and shall be native vegetation compatible with the existing soil and climatic conditions.

(e) Disposal of wastes in and around the wetlands and buffer zone.

1) The discharge of domestic, industrial, or agricultural wastewaters containing heavy metals, herbicides, pesticides or any other toxic substance(s) in excess of concentrations established by State, Federal and/or County guidelines into the wetlands and/or buffer zone shall be prohibited.

2) New developments (other than residential lots of record), shall be connected to a regional sewage system if the system is within 1/4 mile of the development.

3) Existing lots of record as described in Section 4-5.A. in the Land Use Element must meet the provisions of Section 4-5.H. Wastewater Service of the Land Use Element, and must meet the requirements of the Martin County Health Department (DHRS) for a septic tank or other individual wastewater treatment system prior to receiving any development approvals. They must also meet the next provision (A.7.d.(2)(e)5).

4) Septic tanks and drain fields shall not be constructed within 75 feet of the wetland area.

5) The disposal of hazardous material in designated areas shall not occur within 200 feet of the wetland area and/or buffer zone. The regulated storage and use of hazardous material shall only be allowed, as permitted, in accordance with adopted local, state and federal regulations.

6) If a solid waste disposal facility is planned near a wetland or buffer zone, that facility shall be designed in such a manner as to have no negative effect on the wetland and/or buffer zone.

(f) Storm water and surface water management.

1) Direct discharge of storm water into wetlands and/or buffer zones shall be prohibited.

2) Storm water retention basins shall be used to maintain post-development discharges at pre-development levels. In addition, retention basins shall be designed and constructed with sediment traps and litter or trash screens. The retention basin shall be vegetated, and the use of herbicides and/or pesticides within the retention basin for vegetation and insect control shall be discouraged.

3) Any alteration of water levels within wetlands shall be prohibited unless determined necessary to restore and/or maintain the natural hydroperiod of the wetland system by way of a surface water management plan approved by Martin County in consultation with the South Florida Water Management District.

4) Timing and volume of water discharge shall be appropriate to restore and/or maintain the natural hydroperiod.

(Policies e through k have been deleted as not directly related to wetland protection. However, portions of these policies may have restrictions or conditions that are applicable to wetland protection.)

l. Policy: All agricultural uses shall be required to comply with the applicable objectives and policies set forth in this element. Any exceptions or exemptions to the policies of this Plan will require a plan amendment supported by adequate data and analysis. To the maximum extent possible, regulation and/or ordinances shall be promulgated to avoid unreasonable interference with efficient and economical use of agriculturally designated lands.

m. Policy: For all required upland preserve areas, and/or upland transition areas, new development shall provide and implement a preserve area management plan

n. Policy: Native Habitat Requirement Around Constructed Lakes. All new development shall provide and maintain native littoral zone vegetation and a buffer zone of native upland and transitional vegetation around all deepwater habitats which are constructed onsite according to the following criteria:

(1) The littoral zone area shall include a total area of at least ten (10) square feet per linear foot of lake perimeter. The littoral zone planting area consists of that area between one (1) foot above control water elevation to four (4) feet below control water elevation.

(2) The native upland and transitional zone buffer area shall also include a total area of at least ten (10) square feet per linear foot of lake perimeter. The native upland and

transitional zone planting area consists of that area beyond the landward extent of the littoral zone planting area. The native upland and transitional zone buffer may consist of preserved or planted vegetation but shall include trees, understory and groundcover of native species only.

(3) The required area of littoral zones and upland buffer zones may be created by utilizing contiguous areas adjacent to the lake or by creating "habitat islands" within the water body to the extent that no less than twenty-five (25) percent of the lake shoreline is provided with littoral zones and adjacent upland buffers a minimum of ten (10) feet wide. Utilization of islands with native littoral zone and upland vegetation are encouraged to meet this requirement.

p. Policy: Wetland buffer zones or any other designated upland preserve area shall be protected from encroachment due to construction and/or building maintenance activities

8. OBJECTIVE

Marine natural systems. These systems serve a multitude of functions, including, but not limited to wildlife habitat, flood control and erosion control.

a. Policy: Enforce Shoreline Performance Standards in review of estuarine development proposals, including docks (defined as a fixed or floating structure providing access to submerged lands). Martin County shall protect the estuarine shoreline protection zone and the upland transition zones in order to protect the stability of the estuary, enhance water quality and preserve shoreline mangrove communities.

APPENDIX 9
GLOSSARY OF WETLAND TERMS

This glossary of terms is derived in part from Cowardin *et. al.* (1979), Chapter 62-340, FAC (Gilbert *et. al.* 1995), and Miller and Gunsalus (1997) and TCRPC (1995). Refer to these documents for additional information on these terms.

Active water table - a condition in which the zone of soil saturation fluctuates, resulting in periodic anaerobic soil conditions.

Anaerobic - a situation in which molecular oxygen is essentially absent from the environment.

Appropriate plant species - plant species which are appropriate for a given community type (i.e., *Rhynchosphora tracyii* in a wet prairie, *Nymphaea odorata* in a deepwater marsh).

Aquatic plant - a plant, including the roots, which typically floats on water or requires water for its entire structural support, or which will desiccate outside of water.

Aquifer - a layer or group of layers of geologic material that contains sufficient saturated, permeable material to hold and conduct ground water.

Atlantic coastal ridge - an area of higher elevation and well-drained sandy soils, which closely parallels the edge of the mainland through the Region.

Basin marsh - a shallow herbaceous or shrubby wetland situated in a relatively large and irregular shaped basin.

Basin swamp - a relatively large and irregularly shaped basin that is not associated with rivers, but is vegetated with hydrophitic trees and shrubs that can withstand an extended hydroperiod.

Benthic community - an association of plant and animal populations occurring at or near the bottom substrate of a waterbody.

Blackwater stream - a natural river system originating in sandy lowlands where extensive wetlands and organic soils function as reservoirs, collecting rainfall and discharging it slowly to the stream.

Broad-leaved deciduous - woody angiosperm trees or shrubs with relatively wide, flat leaves that are shed during the cold or dry season; e.g., black ash (*Fraxinus nigra*).

Broad-leaved evergreen - woody angiosperm trees or shrubs with relatively wide, flat leaves that generally remain green and are usually persistent for a year or more; e.g., red mangrove (*Rhizophora mangle*).

Canopy - the plant stratum composed of all woody plants and palms with a trunk four inches or greater in diameter at breast height (4.5 feet), except vines.

Deciduous - trees or shrubs in which all the leaves are shed annually in the winter.

Deciduous stand - a plant community where deciduous trees or shrubs represent more than 50 percent of the total aerial coverage of trees or shrubs.

Decreased hydroperiod - a decrease in the annual period of inundation, resulting in a change in the plant community composition and structure. The effect is usually an increase of transitional and upland plant species.

Deepwater - permanent flooded aquatic systems such as a lake, river, estuary, or ocean.

Depression - an area that is lower in elevation than the surrounding area and is ponded for long periods of time.

Depression marsh - a shallow, isolated wetland, which is usually a rounded depression in sandy substrate with herbaceous vegetation often in concentric bands.

Desirable plant species - native plant species that are appropriate for a specific community type and provide benefits to wildlife in the forms of food, cover, and nesting potential.

Direct impacts - physical acts such as dredging or filling of wetlands.

Dome swamp - a shallow, isolated, forested wetland, which is usually a circular depression that has a domed profile because smaller trees such as cypress grow near the outer edge and bigger trees grow in the center.

Dominant - the species controlling the environment.

Drained - a condition in which ground or surface water has been reduced or eliminated from an area by artificial means.

Drift line - an accumulation of water-carried debris along a contour or at the base of vegetation that provides direct evidence of prior inundation and often indicates the directional flow of flood waters.

Dry detention areas - created impoundments with a bottom elevation of a least one foot above control elevation of the area.

Duration of inundation - period of time inundation occurs on an annual basis.

Ecosystem - all of the interacting parts of the biological and physical components of the environment.

Emergent hydrophytes - erect, rooted, herbaceous angiosperms that may be temporarily to permanently flooded at the base but do not tolerate prolonged inundation of the entire plant; e.g., bulrushes (*Scirpus* sp.), saltmarsh cordgrass.

Eutrophic lake - lake that has a high concentration of plant nutrients such as nitrogen and phosphorus.

Evapotranspiration - loss of water to the atmosphere through evaporation (loss from wet surfaces) and transpiration by plants.

Evergreen - trees or shrubs in which the leaves do not fall off annually in the winter. The canopy is never without foliage.

Evergreen stand - a plant community where evergreen trees or shrubs represent more than 50 percent of the total aerial coverage of trees and shrubs. The canopy is never without foliage.

Exotic plant species - plant species that are non-native, purposefully or accidentally introduced by humans to a geographic area. Many are invasive in nature and disrupt native plant communities.

Exotic species - animal or plant species that are not native to the region.

Facultative plants - plants, which are so problematic in their distribution, render them inappropriate for indicating inundation or soil saturation.

Facultative wet plants - plants, which under natural conditions, typically exhibit their maximum cover in areas subject to surface water inundation and/or soil saturation, but can also be found in uplands.

Fill material - any material placed in an area to increase surface elevation.

Flatwoods/prairie/marsh lake - a wetland natural community similar to a depression marsh, but with an open water zone at the center.

Floating plant - a non-anchored plant that floats freely in the water or on the surface; e.g., water hyacinth (*Eichhornia crassipes*) or common duckweed (*Lemna minor*).

Floating-leaved plant - a rooted, herbaceous hydrophyte with some leaves floating on the water surface; e.g., white water lily (*Nymphaea odorata*).

Flooded - a condition in which the soil surface is temporarily covered with flowing water from any source, such as streams overflowing their banks, runoff from adjacent or surrounding slopes, inflow from high tides, or any combination or sources.

Flooding duration - average length of time of inundation per flood occurrence. This only applies to occasional and frequent occurrences of flooding.

Flooding frequency - the number of times that flooding is likely to occur.

Floodplain - a flat expanse of land bordering a river.

Flood plain swamp - a wetland natural community occurring on flooded soils along stream channels and in low spots and oxbows within flood plains.

Flood water attenuation - the buffering of the effects of flood water by storing or retaining the water in wetland areas where the water can gradually percolate into the ground to drain off into adjacent areas.

Fresh - term applied to water with salinity less than 5 parts per thousand dissolved salts.

Freshwater tidal swamp - a forested wetland near the mouth of a river or estuary just inland from mangroves or saltmarshes.

Gleyed - a soil condition resulting from prolonged soil saturation, which is manifested by the presence of bluish or greenish colors through the soil mass or in mottles (spots or streaks) among other colors.

Grass swale - a linear depression, usually designed to capture, store, and convey stormwater runoff in an urban environment.

Ground cover - the plant stratum composed of all plants not found in the canopy or subcanopy.

Ground water - that portion of the water below the ground surface that is under greater pressure than atmospheric pressure.

Hardpan - a very dense soil layer caused by compaction of soil particles such as organic matter, silica, sesquioxides, or calcium carbonate.

Hardwood hammock - a densely wooded upland or wetland community with high plant species diversity, which is dominated by oaks, cabbage palms, or other species of hardwood trees.

Heavily impacted - impacted by human activities to such a degree as to reduce significantly the functionality of a system.

Herbaceous - a plant with no persistent woody stem above ground with the characteristics of an herb.

Holocene Epoch - a geological time division of the Cenozoic era that begins approximately 6,000 years before present and extends to the present time.

Histosols - organic soils.

Hydric hammock - a densely wooded wetland community characterized as a well developed hardwood and cabbage palm forest with an understory often dominated by palms and ferns.

Hydric soils - soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile.

Hydrological indicators - factors that may be used as evidence of inundation or saturation when evaluated with meteorological information, surrounding topography, and reliable hydrological data. Indicators include algal mats, aquatic mosses, aquatic plant, aufwuch (microscopic attached organisms), basal scarring drift lines, elevated lichen lines, evidence of aquatic fauna, morphological plant adaptations, secondary flow channels, sediment deposition, vegetated tussocks and water marks.

Hydrology - water depth, flow patterns, and duration and frequency of inundation as influenced by precipitation, surface runoff and groundwater.

Hydroperiod - annual period of inundation.

Hydrophyte - any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.

Hydrophytic vegetation - see hydrophyte.

Impervious surface - surface which does not allow for the percolation of water (e.g., asphalt parking lots and roads, rooftops).

Inappropriate plant species - plant species which are not usually considered nuisance species, however may be indicative of other problems (i.e., improper hydrology) and may dominate a particular stratum (e.g., *Rubus* sp. in a cypress forested wetland). These plant species are not considered appropriate for a particular habitat.

Increased hydroperiod - increase in the annual period of inundation, resulting in a change in the plant community composition and structure, and which can include an increase in the duration and magnitude of inundation.

Indirect impacts - impacts to wetlands such as increased nutrient loading, altered hydrology, impacts to wetland buffer, development of adjacent areas or disturbances by air, light or noise pollution.

Infiltration trench - impoundment in which incoming runoff is temporarily stored until it gradually leaves the basin by infiltrating into the soils.

Inundation - a condition in which water from any source temporarily or permanently covers a land surface.

Invasive exotic plant species - exotic plant species (e.g., punk tree, Australian pine, Brazilian pepper, Old World climbing fern, etc.) that are invading and disrupting native plant communities in Florida.

Macrophytic algae - algal plants large enough either as individuals or communities to be readily visible without the aid of optical magnification.

Magnitude of inundation - depth of inundation on an annual basis.

Mean high water - the average height of the high water over 19 years.

Mean sea level - a datum, or ``plane of zero elevation," established by averaging all stages of oceanic tides over a 19-year tidal cycle or ``epoch." This plane is corrected for curvature of the earth and is the standard reference for elevations on the earth's surface. The correct term for mean sea level is the National Geodetic Vertical Datum (NGVD).

Mesophyte, mesophytic - any plant growing where moisture and aeration conditions lie between extremes.

Mitigation - the act of providing compensation for impacting wetlands. Typical forms of mitigation include the creation of new wetlands or the restoration and enhancement of existing wetlands.

Mitigation "out-of-kind" - the act of providing compensation in which a substitute habitat type different from the habitat that was impacted by the development activity.

Mitigation "off-site" - the act of providing compensation in which a substitute habitat is provided off the site of the permitted activity and may or may not be of like kind.

Mitigation bank - an area where natural systems are protected and restored using contributions from individuals who impact similar systems at other locations. Generally, the contributions are based on wetland credits, which become available through the restoration and improvements to wetland functions in the mitigation bank.

Muck - muck is well-decomposed, organic soil material.

Natural community - an assemblage of animal and plant populations characteristic of uplands, wetlands, or waterbodies in their predevelopment condition.

Natural system - a natural community or ecosystem or group of adjacent or contiguous natural communities or ecosystems.

Needle-leaved deciduous - woody gymnosperm trees or shrubs with needle-shaped or scale-like leaves that are shed during the cold or dry season; e.g., bald cypress (*Taxodium distichum*).

Needle-leaved evergreen - woody gymnosperm with green, needle-shaped, or scale-like leaves that are retained by plants throughout the year; e.g., black spruce (*Picea mariana*).

Non-hydric soil - a soil that has developed under predominantly aerobic soil conditions. These soils normally support mesophytic or xerophytic vegetation.

Non-invasive exotic plant species - exotic plant species which have not yet been shown to be invasive to natural communities.

Nonpersistent emergents - emergent hydrophytes whose leaves and stems break down at the end of the growing season so that most above-ground portions of the plants are easily transported by currents or waves.

Non-wetland - any area that has sufficiently dry conditions that hydrophytic vegetation, hydric soils, or wetland hydrology are lacking.

Nuisance plant species - plant species which have the potential to dominate disturbed or created plant communities and form large vegetative colonies (e.g. cattails, spatterdock, primrose willow).

Obligate plants - are those plant species which under natural conditions are only found or achieve their greatest abundance in an area which is subject to surface water inundation and/or soil saturation.

Organic soil - soil composed of predominantly organic rather than mineral material; equivalent to histosol. A soil is classified as an organic soil when it is: (1) saturated for prolonged periods (unless artificially drained) and has more than 30 percent organic matter if the mineral fraction is more that 50 percent clay, or more than 20 percent organic matter if the mineral fraction has no clay; or (2) never saturated with water for more than a few days and having more than 34 percent organic matter.

Periodically - a term used to define detectable regular or irregular saturated soil conditions or inundation, resulting from ponding of ground water, precipitation, overland flow, stream flooding, or tidal influences that occur with hours, days, weeks, months, or even years between events.

Permeability - a soil characteristic that enables water or air to move through the profile, measured as the number of inches per hour that water moves downward through the saturated soil. The rate as which water moves through the least permeable layer governs soil permeability.

Persistent emergent - emergent hydrophytes that normally remain standing at least until the beginning of the next growing season; e.g., cattails (*Typha* sp.) or bulrushes (*Scirpus* sp.).

Photic zone - the upper water layer down to the depth of effective light penetration where photosynthesis balances respiration. This level (the compensation level) usually occurs at the depth of 1 percent light penetration and forms the lower boundary of the zone of net metabolic production.

Pleistocene Epoch - a geological time division of the Cenozoic era that beginnings approximately 2 million years ago and extend up to approximately 6,000 years before present.

Pine flatwoods - an upland natural community characterized as an open canopy forest dominated by slash pine trees with little or no understory, but a dense ground cover of herbs and shrubs, especially saw palmetto.

Pioneer plants - herbaceous annual and seedling perennial plants that colonize bare areas as a first stage in secondary succession.

Ponded - a condition in which water stands in a closed depression. Water may be removed only by percolation, evaporation, and/or transpiration.

Poorly drained - water is removed so slowly that the soil remains wet for a large part of the time. The water table is commonly at or near the surface during a considerable part of the year. Poorly drained conditions are due to a high water table, to a slowly permeable layer within the profile, to seepage, or to some combination of these conditions.

Positive wetland indicator - any evidence of the presence of hydrophytic vegetation, hydric soil, and/or wetland hydrology in an area.

Pretreatment systems - constructed systems designed to remove suspended solids and reduce nutrient concentrations prior to discharge. Systems can range in simplicity from grass swales and dry retention to secondary treatment and polishing ponds.

Routine wetland determination - a type of wetland determination in which office data and/or relatively simple, rapidly applied onsite methods are employed to determine whether or not an area is a wetland. Most wetland determinations are of this type, which usually does not require collection of quantitative data.

Saturation - characterized by zero or positive pressure in the soil-water interface and can generally be determined by observing free water in an unlined auger hole within 12 inches or less from the surface.

Seasonal high water - means the elevation to which the ground and surface water can be expected to rise due to a normal wet season.

Secondary productivity - macroinvertebrates, fishes and wildlife.

Signature - the unique characteristic of land and water covers, such as a certain visible wave length, when analyzed using air photographs or satellite images.

Slough - a broad, slightly depressional, poorly defined drainage way that is commonly grassy. Sloughs are generally inundated with flowing water except during extreme droughts. Sloughs are the deepest drainage ways within strand swamps and swale system.

Strand swamp - a shallow, forested wetland, which is usually an elongated depression or channel dominated by cypress.

Subcanopy - the plant stratum composed of all woody plants and palms with a trunk or main stem diameter at breast height (4.5 feet) between one and four inches, except vines.

Submergent plant - a vascular or nonvascular hydrophyte, either rooted or nonrooted, which lies entirely beneath the water surface, except for flowering parts in some species; e.g., wild celery *(Vallisneria americana*) or the stoneworts (*Chara* sp.).

Swale - a natural wetland characterized as a marsh situated in a broad shallow channel with flowing water and having emergent grasses, sedges, or herbs. Man-made swales are shallow channels designed to collect and transport stormwater runoff.

Transition zone - the area in which a change from wetland to nonwetlands occurs. Transition zones may be narrow or broad.

Undesirable plant species - exotic, nuisance or undesirable plant species for a given habitat.

Undisturbed natural community - A natural community that has not been altered significantly by selective clearing, retains its predevelopment character, and is not dominated by exotic species.

Upland - areas that are not usually flooded or saturated, do not have hydric soils, and are not dominated by hydric vegetation.

Upland buffer - an undeveloped area usually dominated by an upland natural community or landscape material that surrounds a wetland or lake.

Very poorly drained - water is removed from the soil so slowly that the water table remains at or on the surface the greater part of the time. Soils of this drainage class usually occupy level or depressed sites and are frequently ponded.

Water table - the upper surface of the surficial aquifer.

Waterbody - permanently flooded aquatic system, such as a pond, river, lake, reservoir, estuary, or ocean.

Wet detention areas - impoundments in which stormwater runoff is temporarily stored until it gradually leaves through an outflow control structure. A pool of water remains after a specific bleed-down period.

Wet flatwoods - a natural wetland characterized as relatively open-canopy forest of scattered pine trees with a shrubby understory or dense ground cover dominated by hydrophitic plants.

Wetland - an area which has hydric soils, hydrophitic vegetation, and saturated ground for a portion of the year. Wetlands are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wetland boundary - the point on the ground at which a shift from wetlands to nonwetlands or aquatic habitats occurs.

Wetland hydrology - in general terms, permanent or periodic inundation or prolonged soil saturation sufficient to create anaerobic conditions in the upper part of the soil.

Wetland soil - a soil that has characteristically developed in a reducing atmosphere, which exists when periods of prolonged soil saturation result in anaerobic conditions and has positive indicators of hydric soils, hydrophytic vegetation and wetland hydrology.

Wetland system - a series of wetlands that are linked hydrologically, at least during periods of high water.

Wetlands vegetation - the sum of macrophytic plant life that occurs in areas where the frequency and duration of inundation or soil saturation produce permanently or periodically saturated soils of sufficient duration to exert a controlling influence on the plant species present.

Wet prairie - a natural wetland characterized as a treeless plain with ground cover of grasses and herbs.

Appendix 10

JOINT PUBLIC NOTICE
U.S. ARMY CORPS OF ENGINEERS
U.S. ENVIRONMENTAL PROTECTION AGENCY

The attached Joint Public Notice for review of the Loxahatchee River Basin Wetland Planning Project for Martin County was issued on July 5, 2000. No written comments were received within the 30-day review period.

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

5 JUL 2000

JOINT PUBLIC NOTICE
U.S. ARMY CORPS OF ENGINEERS
U.S. ENVIRONMENTAL PROTECTION AGENCY

The U.S. Environmental Protection Agency (EPA), Region IV, Atlanta, Georgia and the U.S. Army Corps of Engineers (Corps), Jacksonville District wish to announce completion of the final draft of the Loxahatchee River Basin Wetland Planning Project for Martin County, Florida. This project provides information on the relative function of wetlands within the project area. This information may be used in land use planning for wetlands that fall within the jurisdiction of the Clean Water Act. Written public comments on the final draft document with its accompanying maps are encouraged and will be accepted for 30 days following the date of this public notice.

INTRODUCTION

The Clean Water Act of 1977 regulates discharge of dredge or fill material into the waters of the United States, including wetlands. Section 404 of the Clean Water Act establishes a procedure whereby the Corps may issue permits for the discharge of dredged or fill material, if the proposed project meets certain criteria, as outlined in the Section 404 (b) (1) Guidelines (40 CFR Part 230). This river basin planning project is intended to facilitate the federal Section 404 permit process by providing a preliminary determination of ecological condition of local wetlands and aquatic sites. The findings of the river basin planning process are summarized in the final draft document and maps. The results are ADVISORY in nature; the normal Section 404 (dredge and fill) permit application process will continue to be followed when any activity subject to regulation is proposed. The results can, however, be used as an effective planning tool by land owners, developers, conservation organizations and government regulatory agencies to make environmentally sound decisions, should work be contemplated at any of the identified wetland sites.

BACKGROUND

The Loxahatchee River Basin Wetland Planning Project includes portions of Martin and Palm Beach Counties. This public notice announces availability of products for the Martin County portion of the project. A separate public notice was issued for the Palm Beach County portion of this project in May of 1999.

The Martin County portion of the Loxahatchee River Basin Wetland Planning Project encompasses approximately 77,000 acres, as shown on the attached map. The project area generally includes wetlands tributary to either the Loxahatchee River or the South Fork Saint Lucie River.

This area contains a variety of wetland types including hydric hammocks, wet flatwoods, wet prairies, marshes, swamps and sloughs. These wetlands provide important benefits to local residents by enhancing water quality, storing floodwaters temporarily during storms, and providing habitat for fish, wildlife and unique plants. Many of these important wetlands are threatened by rapid urban growth.

This project was initiated in response to requests from local citizens and government officials with the goal of producing a database on which local land use decisions could be based. The resulting report and maps were developed by an interagency team of resource agencies with guidance from technical advisors with established expertise on key project issues. The products identified both highly functional and degraded wetlands and provided suggestions to compensate for future wetland losses. Ultimately, coordination between resource agencies and the public over local wetland issues should improve.

WETLAND JURISDICTION

The 77,000 acre project area contains approximately 19,959 acres of wetlands that are so designated on National Wetlands Inventory Maps produced by the U.S. Fish and Wildlife Service. Because of the large size of the project area, not all wetlands are field verified. These maps may underestimate the extent of federal wetland jurisdiction in pine flatwood areas; however, the maps provide a good preliminary estimate of wetland locations for this area.

WETLAND FUNCTIONAL ASSESSMENT

The wetland functional assessment considers wildlife habitat, wetland hydrology and water quality factors. Functions are assessed using remote techniques that have been field verified. In general, *high quality wetlands* are commonly found in Jonathan Dickinson State Park, the Atlantic Coastal Ridge Ecosystem, Pal-Mar, the Loxahatchee River and the South Fork Saint Lucie River, among others. *Medium quality wetlands* are commonly found in the northwest and south central portions of the project area, among others. *Low quality wetlands* are commonly found in improved pasture, farmed areas producing vegetable crops and citrus agricultural development areas, among others.

WETLAND DESIGNATIONS

Three categories are established for designating the relative levels of functions provided by project area wetlands as described below:

- *High quality wetlands*: Wetlands with this designation were relatively pristine in condition and appeared to be well buffered from secondary development impacts (runoff, alterations in hydrology by ditching or land disturbance); approximately 72% of project area wetlands occur in zones that are so designated.

- *Medium quality wetlands*: Wetlands in these zones generally appeared moderately degraded compared to high quality wetlands and were partially exposed to secondary development impacts; approximately 21% of project area wetlands lie in zones with this designation.

- *Low quality wetlands*: Wetlands in these zones exhibited obvious signs of degradation and were strongly subjected to secondary development impacts; approximately 3% of project area wetland are in zones with this designation.

The project area also includes approximately 57,041 acres of uplands. Some of these areas are considered suitable alternatives to filling of highly functional wetlands.

PUBLIC COMMENTS

Copies of draft documents and maps may be ordered by contacting Ross Wilcox of the Martin County Growth Management Department at (561) 288-5508. Written comments will be accepted for 30 days following publication of this notice. Please submit written comments to:

Kathy Matthews
Wetlands Section
US Environmental Protection Agency
61 Forsyth Street SW
Atlanta, GA 30303

William L. Cox, Chief
Wetlands Section
US Environmental Protection Agency,
Region IV

John R. Hall, Ph.D. , Chief
Regulatory Division
US Army Corps of Engineers,
Jacksonville District

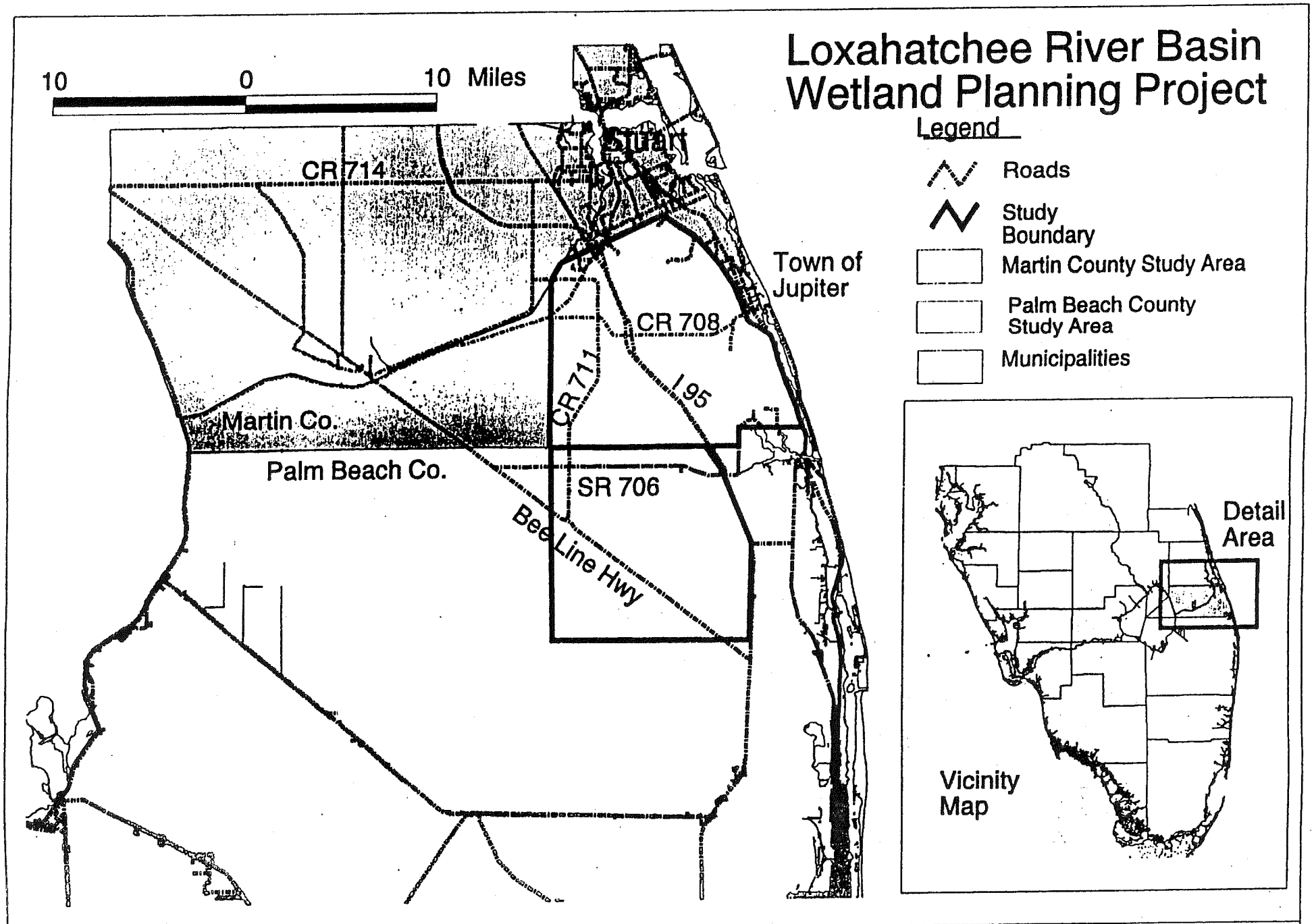

Figure 1. Study site and vicinity map showing the total project planning area and location map for the Martin County project area.