

LOXAHATCHEE RIVER BASIN WETLAND PLANNING PROJECT FOR PALM BEACH COUNTY



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ACRONYMS

ADID	Advanced Identification
CARL	Conservation and Recreational Lands
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
EPA	U.S. Environmental Protection Agency
ERM	Environmental Resources Management
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDNR	Florida Department of Natural Resources
FGFWFC	Florida Game and Fresh Water Fish Commission
FNAI	Florida Natural Areas Inventory
FS	Florida Statutes
FWPCA	Federal Water Pollution Control Act
GIS	Geographic Information System
HGM	Hydrogeomorphic Methodology
ITWCD	Indian Trail Water Control District
JDSP	Jonathan Dickinson State Park
NAPP	National Aerial Photography Program
NGVD	National Geodetic Vertical Datum
NPBCWID	Northern Palm Beach County Water Improvement District
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
SFWMD	South Florida Water Management District
SIRWCD	South Indian River Water Control District
SOR	Save Our Rivers
TCRPC	Treasure Coast Regional Planning Council
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	Wetland Rapid Assessment Procedure

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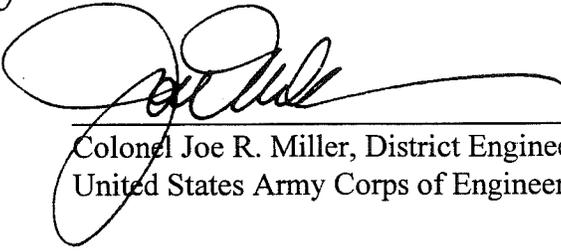
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AGENCY APPROVAL

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



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SUMMARY

The EPA initiated the Loxahatchee River Basin Wetland Planning Project in 1994 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, 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. This document and the accompanying maps are to be used for planning purposes only. The wetland boundaries shown on the maps are only approximate. The wetland boundaries do not represent official jurisdictional boundary lines for any state or federal agency or local government. This document is designed to serve as a tool for wetland protection. The classification of wetlands in this report is advisory and has no effect on local, state, or federal laws. However, it provides landowners, consultants, and land developers useful information for creating site development alternatives. The functional assessment also gives land use planners and government regulators a database for land use decisions.

The project area chosen by the two project teams includes the majority of wetlands in the watershed of the Loxahatchee River. 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 about one mile 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 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 known as WRAP, developed by the SFWMD. Both approaches were applied by a team comprised of agencies including: EPA, USFWS, COE, FGFWFC, FDEP, SFWMD, TCRPC, NRCS, Palm Beach County ERM, and the Martin County Environmental Planning Division.

Interpretation of the infrared aerial photographs resulted in the identification of areas of high, medium and low quality wetlands. Seventy-nine percent of the wetlands in the project area are located in areas of high quality wetlands, 13% in areas of medium quality wetlands, and 8% in areas of low quality wetlands. The largest area of high quality wetlands is the Loxahatchee Slough. The second largest area of high quality wetlands is Pal-Mar. Other locations identified as areas of high quality wetlands include Corbett WMA, the Cypress Creek Area, the

Loxahatchee River SOR property north of Indiantown Road, the large preserve areas on the North Palm Beach County General Aviation Airport and PGA National, and a portion of Vavrus Ranch.

The largest areas of medium quality wetlands occur in Unit 11 of the Acreage, the Sandhill Crane Addition to the Loxahatchee Slough Natural Area, on portions of the Vavrus Ranch, and in the Loxahatchee River SOR property south of Indiantown Road. Other locations identified as areas of medium quality wetlands are the preserve areas on sites that have been developed during the last 20 years. These include Old Marsh Golf Club, Palm Beach Park of Commerce, and the smaller preserve areas on PGA National and the North Palm Beach County General Aviation Airport. In addition, portions of two sites currently proposed for development, the Golf Digest and Country Lakes of Jupiter sites are identified as areas of medium quality wetlands.

The main areas of low quality wetlands include Jupiter Farms, Palm Beach Country Estates, Caloosa, and the Acreage south of Mecca Farms. A portion near the center of Vavrus Ranch is also identified as an area of low quality wetlands.

Overall WRAP scores of the 66 wetlands examined in the project area had a mean of 0.72 with a range of 0.11 to 1.0. Statistical comparison of the WRAP results in different areas is not appropriate because the wetlands chosen for WRAP were not selected randomly. However, the WRAP scores do provide a good indication of the relative functionality of representative wetlands in different parts of the project area. In addition, because of the way the wetlands were selected, the WRAP scores provide a good indication of the range of variation of wetland functions in selected areas. For example, WRAP was performed on 34 wetlands located in areas identified by the remote analysis as having high quality wetlands. The mean WRAP score in these areas was 0.80 with a range of 0.48 to 1.0. Of the 23 wetlands examined in areas of medium quality wetlands, the WRAP score mean was 0.65, with a range of 0.11 to 0.94. In areas of low quality wetlands, the mean WRAP score of the 9 wetlands examined was 0.53 with a range from 0.24 to 0.75.

The WRAP scores are generally consistent with and verify the results of the remote analysis. The locations identified as areas of high quality wetlands typically had higher WRAP scores than the locations identified as areas of low quality wetlands. On some sites, the WRAP scores showed a high degree of variability. This is especially true in areas that have been partially developed (e.g., Jupiter Farms) or partially converted to agriculture (e.g., Sandhill Crane Addition). Wetlands that had the highest WRAP scores in areas of low or medium quality wetlands were typically the wetlands that had not yet been physically disturbed to a great degree. These wetlands should be protected from future impacts.

Usually, the wetlands that had a low WRAP score in an area of high quality wetlands were impacted by a road, ditch, or nearby canal. Low WRAP scores within high quality wetland areas are useful for identifying which wetlands are most in need of restoration. The functional analysis shows that based on current landscape position, many low or medium quality wetlands have the potential to provide expanded functions. Many of the wetlands in the low and medium quality

categories could move into higher categories by implementation of restoration activities, such as the removal of exotics and hydrologic improvements.

Both the remote and field assessments utilized surrounding land use and adjacent buffer variables in evaluating wetlands. Especially in WRAP, the variable is also taken into account within evaluation criteria of other variables. 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 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.

In general, adverse impacts to wetlands should be avoided throughout the project area. Those areas identified as areas of high quality wetlands are appropriate for preservation, conservation, and enhancement of natural systems. The wetlands in areas identified as areas of medium and low-quality wetlands need to be evaluated on a case-by-case basis to determine if restoration is possible. In cases where restoration is possible, the wetlands should be preserved and restored. Where state and federal agencies determine that restoration is not possible, then mitigation should be considered. Mitigation should be required for any future wetlands that are eliminated.

The Cypress Creek Area stands out as the one major area of high quality wetlands in the project area that is not currently being pursued for public acquisition by the state. This area is located along the Martin and Palm Beach County line. Palm Beach County and Martin County should coordinate activities to protect and restore the Cypress Creek Area.

The other large areas of high quality wetlands in the project area that are not already protected are being considered for purchase through the Save Our Rivers, Conservation and Recreational Lands, or Palm Beach County Environmentally Sensitive Lands Acquisition programs. These areas include Pal-Mar and several sites being considered for addition to the Loxahatchee Slough Natural Area. Existing efforts to protect these areas should continue.

The main types of restoration activities that can benefit the Loxahatchee River are related to improving the water storage capabilities of wetlands within the river basin. Wetlands that have been ditched or partially drained have a reduced hydroperiod. This negatively affects the river in 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.

Many of the wetland systems in the project area could benefit from restoring the hydroperiod to a more natural condition. Foremost among these is the Loxahatchee Slough. Much of the slough has been purchased recently by Palm Beach County for conservation and recreational purposes. Palm Beach County and the SFWMD should continue to work together to implement plans to

improve the water storage capabilities of the Loxahatchee Slough.

The Loxahatchee River also suffers from reduced hydrologic flows because connections from certain wetland systems have been diverted from the drainage basin. For example, historic water flows from the portion of the Loxahatchee Slough that is now contained in the City of West Palm Beach WCA have been cut off from the river. The city, county, and SFWMD should continue to work together to explore and implement such a plan.

The individual wetlands in many other areas are in need of improvements to restore the hydroperiod to natural conditions. The main areas with the largest opportunities for improvement include Cypress Creek Area, Unit 11 of the Acreage, Sandhill Crane Addition, and Vavrus Ranch. These areas fall within the jurisdiction of Palm Beach County or the City of Palm Beach Gardens. The need to improve the water storage in certain wetlands on these properties should be recognized in any plans for development of the properties. The county should continue with its land acquisition program to assist in purchasing and restoring these areas.

Fieldwork revealed that the hydrological flows from the wetlands on the west side to the east side of Pal-Mar may be partially blocked by SR 711. SFWMD should conduct an investigation to determine the need and potential benefits of improving the hydrological connection between the east and west sides of Pal-Mar. 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.

Currently, the wetlands in Jupiter Farms, Palm Beach Country Estates, and Whispering Trails are being eliminated as new residential development occurs. Because these areas have many small lots that are exempt from permit criteria, wetlands are generally not being protected and mitigation is not being required for wetland impacts. Although the wetland loss on an individual lot may be minimal, the cumulative loss of wetlands in these areas is significant. State and federal agencies, as well as county should work with the SIRWCD to develop a wetland mitigation program for these areas. Such a program would involve reevaluating the use of COE Nationwide permits, and replacing them with general permits requiring mitigation to offset the cumulative and indirect wetland impacts.

The Loxahatchee River could benefit from the placement of a WPA within the watershed to increase water storage. This would help compensate for the loss of storage associated with existing development. Ideally, water stored in a WPA could be released to the Northwest Fork of the Loxahatchee River during the dry season or periods of drought. Mecca Farms is the only large property in the project area that appears appropriate for a WPA. The SFWMD and Palm Beach County should investigate the suitability and potential benefit of purchasing the Mecca Farms property and using it to develop a WPA.

All of the local governments in the project area have strong wetland protection policies. An additional policy that Palm Beach County should consider is one that emphasizes coordination with Martin County 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 that all of the local governments in the project area should consider is one that ensures that the water storage function of wetlands is not lost when mitigation is allowed. The protection of water storage functions of wetlands is one of the most important actions needed to assist in restoring more natural hydrologic flows to the Loxahatchee River.

Finally, another policy that should be considered by all of the local governments in the project area is one that provides incentives to private property owners to remove exotic pest vegetation from their properties. State and federal agencies should assist the local governments to develop acceptable incentives that will promote the removal of exotic pest 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 extending into southern Martin and northern Palm Beach Counties. A portion of the river, along the Northwest Fork, is designated as a National Wild and Scenic River because of its outstanding natural qualities. The Loxahatchee River is the only such federally designated river in Florida (FDEP 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 stormwater faster 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 saltwater intrusion up the river channel, which has altered aquatic ecosystems and caused a change in the vegetation along the riverbanks.

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 EPA initiated the Loxahatchee River Basin Wetland Planning Project in 1994 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, 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.

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 as follows:

1. To provide information that will 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 state and federal agencies 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.

Section 230.80 of EPA's 404(b)(1) guidelines (40 C.F.R. 230) allows EPA and the CWA Section 404 permitting authority to identify sites that are suitable or unsuitable to receive discharges of fill. The results of such an advanced identification (ADID) program are advisory, not regulatory. Though this planning effort in Palm Beach County originated under the auspices of traditional ADID, the project team decided in early planning stages that the designations of suitable and unsuitable, with respect to the placement of fill material in wetlands, is not appropriate in this document because of regulatory implications. Instead, designations of areas of high, medium, and low quality wetlands are presented. An additional second level functional assessment based on field visits is used to provide greater details about representative wetlands. This project is designed to serve as a tool rather than a basis for federal wetland regulatory decisions.

Use of this Planning Document

The results of this project are advisory in nature. Federal, state, and local planning and regulatory agencies should use the maps and information on wetland quality when making resource protection, development, and permit decisions. Use of this document should allow greater coordination between agencies and greater consistency in regulatory determinations. The project results should also be used by individual landowners to help avoid high quality wetlands when planning new development. This will save time and expense in the permitting process, and will help to preserve the best of the remaining wetland systems.

This document and the accompanying maps are to be used for planning purposes only. The wetland boundaries shown on the maps are only approximate. The wetland boundaries do not represent official jurisdictional boundary lines for any state or federal agency or local government. This document is designed to serve as a tool for wetland protection. The classification of wetlands in this report is advisory and has no effect on local, state, or federal laws. However, it provides landowners, consultants, and land developers useful information for creating site development alternatives. The functional assessment also gives land use planners and government regulators a database 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 the natural resources as a system. The information provided in this document will allow for development that can maximize the legal utility of the land while minimizing the impacts to natural resources in order to promote a more sustainable use of the land.

PROJECT AREA

Selection of the Project Area

The project area chosen by the two project teams includes the majority of wetlands in the watershed of the Loxahatchee River (Figure 1). 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 about one mile 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.

Drainage Patterns

The main branch of the Loxahatchee River is the Northwest Fork which flows northward from Palm Beach County into Martin County (Figure 2). The river enters JDSP at Indiantown Road and then turns southeast as it leaves the park. The Northwest Fork is then joined by the Southwest Fork and the North Fork before emptying into the Atlantic Ocean through the Jupiter Inlet (Law Environmental 1991). Cypress Creek is a major tributary that originates in northern Palm Beach County and flows northeastward until joining the Northwest Fork. Kitching Creek is another major tributary that flows south in Martin County until joining the Northwest Fork in JDSP.

Historically, the Northwest Fork originated in the Hungryland and Loxahatchee Sloughs. The Loxahatchee Slough is one of the most extensive wetland systems in the project area. It includes a mixture of habitats, including pine flatwoods, cypress forest, and wet prairie (SFWMD 1997). The southern portion of the slough, known as the West Palm Beach Water Catchment Area (WCA), is impounded and managed by the City of West Palm Beach as a source of potable water. The hydrologic connection between the slough and WCA was disrupted when the CSX Railway, Beeline Highway (SR 710), and Northlake Boulevard were originally constructed.

Another major change affecting drainage patterns in the river basin was the construction of the C-18 canal (Lin 1988). This canal was built in 1957-1958 by the COE as part of the Central and Southern Florida Flood Control Project. The C-18 canal was constructed to improve drainage and provide flood protection for areas near the slough and J.W. Corbett Wildlife Management Area (WMA) (Figure 2). The east branch of the C-18 canal is a 6.1-mile segment that originates a half-mile northwest of the intersection of SR 710 and Northlake Boulevard. The east branch runs north through the Loxahatchee Slough and merges with the west branch near the north end of the slough. The west branch begins near Corbett WMA and runs northeast about 7.9 miles

through an area that was formerly known as the Hungryland Slough. After the east and west branches merge, the C-18 canal runs to the north about 2 miles and then to the northeast about 3 miles. The C-18 canal discharges into the Southwest Fork of the Loxahatchee River through the S-46 structure, which is located north of Indiantown Road, east of the Florida Turnpike. The S-46 structure is a gated spillway managed by the SFWMD to control the water surface elevations in the C-18 canal, and regulate discharges to the Southwest Fork of the Loxahatchee River (Cooper and Lane 1988).

The C-14 is a north-south canal that extends from the C-18 canal to discharge directly into the Northwest Fork of the Loxahatchee River, about a half-mile south of Indiantown Road. The C-14 canal terminates at the G-92 control structure located where the C-14 intersects the C-18 canal. The C-14 canal is part of the drainage system managed by the South Indian River Water Control District (SIRWCD) in the Jupiter Farms residential area. Drainage in Jupiter Farms occurs through a series of east-west collector canals and flows into the C-14 canal. The G-92 control structure has two functions: 1) to discharge excess water from the SIRWCD to the C-18 canal, and 2) to augment flows in the Northwest Fork with water from the C-18 canal. Operation of the structure is in accordance with a surface water management plan between the SFWMD and the SIRWCD. During flooding conditions water may be discharged from the C-14 canal through the G-92 central structure to the C-18 canal. During non-flooding conditions, water may be discharged from the C-18 canal through the G-92 structure to the C-14 canal to help maintain a minimum base flow of water to the Northwest Fork (Cooper and Lane 1988).

The C-18 basin forms the main drainage basin in the Palm Beach County portion of the project area. It encompasses an area of more than 100 square miles, including the northern portion of the Loxahatchee Slough. The western reaches of the basin include the eastern portion of Corbett WMA (Cooper and Lane 1988). Twenty-one subbasins within the C-18 basin have been identified (Lin 1988). Drainage basins within the project area but outside the C-18 basin include the WCA in the southeast, M-1 basin in the southwest, Pal-Mar basin in the northwest, Jupiter Farms (C-14) basin, and the Cypress Creek basin in the northern portion of the project area (Figure 3). The WCA is impounded and, as noted above, water is released to the east as a source of potable water for urban areas. The residential area in the southwestern portion of the project area is known as the Acreage. It drains to the M-1 basin of the Indian Trail Water Control District (ITWCD). The M-1 basin drains to the west and south, away from the project area, through a series of canals and roadside swales. 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). Drainage from Jupiter Farms is through a series of collector canals that feed into the C-14 canal, which as described above, may discharge water to the Northwest Fork or the C-18 canal. 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 site, drains directly into the Northwest Fork. Immediately to the west, another small area of about 2 square miles drains north into Martin County and eventually flows through Cypress Creek to reach the Northwest Fork.

Major Wetland Areas

The largest concentrations of wetlands in the project area occur in locations that have not been developed or cleared of native vegetation. Several of these areas are publicly owned and are managed for recreation and the protection of natural resources. Most of these areas that are not already publicly owned are under consideration for public purchase through the CARL (FDEP 1997) and SOR (SFWMD 1997) programs. The major wetland areas are shown in Figure 2 and described below.

Atlantic 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 Ridge Ecosystem are being considered for public purchase 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.

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. Most of this area is currently owned by Watermark Communities Inc. and is being leased for agricultural uses.

Hungryland Slough. This is the remnant slough system that is bisected by the west branch of the C-18 canal. Much of this slough has been drained or filled. It formerly flowed from the area near Corbett WMA to merge with the northern portion of the Loxahatchee Slough. Remnants of this slough are preserved in the Loxahatchee Slough Natural Area recently acquired by Palm Beach County.

Jonathan Dickinson State Park. 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. This 57,000-acre preserve area in northern Palm Beach County is owned and managed by the FGFWFC. 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. Much of this property was purchased through the SOR program (SFWMD 1997) and Palm Beach County purchased a portion. The property includes a portion of the historic floodplain of the Northwest Fork of the Loxahatchee River, which is designated as a National Wild and Scenic River (FDEP and SFWMD 1997). The area purchased by the SOR program from SR 76 to the former park boundary is managed by JDSP.

Loxahatchee Slough. This area covers approximately 13,000 acres and forms the historic headwaters of the Northwest Fork of the Loxahatchee River. Predominant natural communities include wet flatwoods, marshes, cypress swamps, wet prairies, and hydric hammock. Palm Beach County has purchased more than 10,000 acres known as the Loxahatchee Slough Natural Area, which includes the main part of the slough. Adjacent and nearby properties are still being considered for purchase through the SOR program and by Palm Beach County. The largest of these is referred to as the "Sandhill Crane Addition." It lies to the west of the slough, south of the west branch of the C-18 canal, and north of SR 710. The West Palm Beach WCA is an impounded portion of the slough located south of SR 710.

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 is proposed for purchase through the CARL and SOR programs. Only the southeastern part of Pal-Mar is located within the project area.

South Fork 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 Ridge Ecosystem. The Conservation Fund (1997) and TCRPC (1997) have discussed the protection of natural connections between this area and JDSP.

West Palm Beach Water Catchment Area. This impounded area was formerly continuous with the Loxahatchee Slough. The area is now managed by the City of West Palm Beach as a source of potable water (Dames and Moore 1989; Mock Roos 1996). Only the northern portion of the WCA occurs within the project area.

WETLAND FEATURES

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, both federal and state wetland protection provisions are applied to areas categorized as wetlands.

The federal definition of wetlands in the United States 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 CWA. 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.”

Both federal and state requirements must be met for a Section 404 permit. The 1993 Florida legislature mandated in subsection 373.421(1), FS, that the Environmental Regulatory Commission must adopt a unified statewide methodology for delineating the landward extent of wetlands and surface water other than wetlands. The legislature developed a new statewide wetland definition for this methodology in January 1994, which is contained in Chapter 62-340, 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 (FDEP), 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.”

Types of Wetlands in the Project Area

The Florida Natural Areas Inventory (FNAI and FDNR 1990) provides the most complete and widely accepted classification of natural communities in Florida (Appendix 1). 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% 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, also known as a blackwater stream, is the only true riverine system in the project area in Palm Beach County. A brief description of the types of wetlands in and near the project area follows:

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.

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 hydrophytic plants.

Wet prairie - a natural wetland characterized as a treeless plain with ground cover of grasses and herbs.

Floodplain swamp - a wetland natural community occurring on flooded soils along stream channels and in low spots and oxbows within floodplains.

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

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 systems.

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

Swale - a natural wetland characterized as a marsh situated in a broad shallow channel with flowing water and having emergent grasses, sedges, or herbs.

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 hydrophytic trees and shrubs that can withstand an extended hydroperiod.

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

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.

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

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.

Functions and Values of Wetlands

Wetland functions are the actions that are naturally performed by wetlands. Wetland functions are the physical, chemical, and biological processes that characterize wetland ecosystems. Most functions fall into three broad categories: hydrologic, biogeochemical, and maintenance of habitat and food webs (Table 1). Wetland functions are a result of the interaction between the physical components of wetlands such as soil, water, detritus, plants and animals with the geological, chemical, and biological processes that occur in the wetland. Individual wetlands function in part through interaction with the 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.

Wetland values are a measure of the importance of the wetland as a natural resource, as a benefit to natural ecosystem management, and as a benefit to the public interest. Simply, the value of a wetland is a measure of its importance to society. Wetland functions are valued to various degrees by society, but there is no precise, general relationship between wetland functions and the value of wetlands to society. Wetland values are difficult to determine objectively. Because value is a societal perception, it often changes over time, even if 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. Summary of major wetland functions derived from Smith et al. (1995). This summary does not include all wetland functions, nor are all of the functions shown characteristic of every wetland.

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.	<u>Onsite</u> : replenish soil moisture, import/export materials, conduit for organisms. <u>Offsite</u> : 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.	<u>Onsite</u> : Provide habitat and maintain physical and biogeochemical processes. <u>Offsite</u> : Reduce dissolved solid and particulate loading and help maintain and improve surface water quality.
Storage of Subsurface Water.	<u>Onsite</u> : Maintain biogeochemical processes <u>Offsite</u> : Recharge surficial aquifers and maintain baseflow and seasonal flow in streams.
Moderation of Groundwater Flow or Groundwater Discharge.	<u>Onsite</u> : Maintain habitat. <u>Offsite</u> : 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.	<u>Onsite</u> : Contribute to nutrient capital of ecosystem <u>Offsite</u> : 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.	<u>Onsite</u> : Contributes to nutrient capital of ecosystem. <u>Offsite</u> : 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.	<u>Onsite</u> : Contributes to nutrients capital of ecosystem. Contaminants are removed or rendered innocuous. <u>Offsite</u> : 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.	<u>Onsite</u> : Contributes to nutrient capital of ecosystem. <u>Offsite</u> : Reduced downstream particulate loading helps to maintain or improve surface water quality.
Export of Organic Carbon: the export of dissolved or particulate organic carbon.	<u>Onsite</u> : Enhances decomposition and mobilization of metals. <u>Offsite</u> : 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.	<u>Onsite</u> : Maintain habitat for plants and animals (e.g., endangered species and critical habitats), for rest and agriculture products, and aesthetic, recreational, and educational opportunities. <u>Offsite</u> : Maintain corridors between habitat islands and landscape/regional biodiversity.

Many wetlands have had their hydrology, water quality or vegetative composition negatively altered in the past. The result of such negative alterations to these parameters usually reduces the water storage potential and provides lower habitat value to fish and wildlife. These cumulative results can lead to the degradation of the ecosystem, which ultimately results in a lower benefit to the public interest. A reduction in the function of a system of wetlands may also lead to the reduction in the functions and values of nearby wetland systems. A good example of this is when the water storage capabilities of isolated wetlands within the watershed of a river are negatively impacted. This can lead to reduced ground and surface water flows to the river, and ultimately reduces the recreational value of the river to society.

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 that is 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.

The lack of a universally accepted functional assessment methodology has required that several wetland assessment methods be developed that are locally specific. The development of project and regionally specific methodologies promotes the ability to complete the approach with the time and resources that are normally available, and to provide a level of technical accuracy and precision that is consistent with the time, resources, and information available. In addition, there can be an increased sensitivity and effectiveness in measuring wetland function with a local or regionally tailored assessment methodology.

The project team considered using a new wetland assessment procedure 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. This assessment procedure uses a hydrogeomorphic classification system to group wetlands based on geomorphic setting, water source, and hydrodynamics. The geomorphic setting refers to the landform of a wetland, its geologic evolution, and its topographic position in the landscape. Water source refers to origin of the water that exists in a wetland. Hydrodynamics refers to the direction of movement and energy level of surface water in the wetland. The assessment procedure is unique in that it utilizes the concepts of hydrogeomorphic classification, functional capacity, and reference wetlands. HGM was not adopted for use in this project because the procedure was still being developed and not ready for use at the time when needed for this project. In addition, it was noted that HGM was labor intensive, making it difficult to apply to many wetlands in the project area.

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. 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 including: EPA, USFWS, COE, FGFWFC, FDEP, SFWMD, NRCS, TCRPC, Palm Beach County ERM, and the Martin County Environmental Planning Division.

Data Sources

Topography. The topography of the project area can be examined on portions of four USGS quadrangle maps: West Palm Beach 2 NE, West Palm Beach 2 SE, Rood, and Delta. 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 provide topographic information. Many individual wetlands can be identified on these maps.

Soil Survey. The soil survey of Palm Beach County was produced by the U.S. Department of Agriculture (USDA Soil Conservation Service 1978). This document describes the soil types in Palm Beach 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 12 maps corresponding with sheet numbers 5-7, 14-16, 23-25, and 33-35. Major field work for the soil survey was conducted from 1968-1974. The soils are mapped using 1970 aerial photography. The soil survey map shows the location of numerous wetlands.

Land Cover. The FGFWFC provided a land cover map of the project area that shows vegetative communities. The 1:24,000 scale map was produced using 1988 Landsat Thematic Mapper satellite imagery. The primary use of the FGFWFC land cover maps is to identify natural communities for statewide planning efforts (Cox et al. 1994). The overall accuracy of the map is estimated at 80-90%. Numerous wetland communities are identifiable on this map.

National Wetlands Inventory. The USFWS has prepared the NWI, a series of maps that identifies and classifies wetlands. The NWI maps correspond with the USGS quadrangle maps, which form the 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). The NWI maps were updated by the SFWMD in 1990. In addition, the NWI maps were updated using 1994 and 1995 aerial photographs at specific locations within the project area where recent changes to wetlands were known to have occurred. Wetlands are identified on the maps using alphanumeric codes to indicate the type of wetland, dominant vegetation, and hydrological characteristics.

Infrared Aerial Photography. The most recent infrared aerial photographs of the project area available were obtained from Photo Science, Inc. of Gaithersburg, Maryland. The photographs were taken in 1994 and 1995 as part of the 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 maps. Nine photographs were specially ordered for this project. Details concerning these photographs are provided in the next section of this report.

Remote Analysis

The first level of analysis of wetlands in the project area was through the interpretation of aerial photography. This type of analysis has the advantage that it can be applied equally to all wetlands within the entire project area. This is important because of the large size of the project area and because the project team did not have access to all properties with wetlands. The main

disadvantage to this type of analysis is that certain details, such as identifying the exact vegetation composition in a particular wetland, cannot be determined without a field inspection. For example, the remote analysis can not always distinguish exotic and nuisance species, which may affect the quality of the wetland.

The most recent color infrared aerial photographs available through the NAPP were obtained for this analysis. The aerial photographs were taken between March 18, 1994 and February 2, 1995. The full image of each photograph covered an area of approximately 25 square miles. We obtained 40" x 40" enlargements of each photograph necessary 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. Photo 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. Scoring was accomplished by thorough discussion and team consensus on each element. 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 wetland functions affected by surrounding land use and condition of the land. 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 could 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 stormwater 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.

Project team members used markers to write on the acetate covering the photographs to define the boundaries between different land covers. The land cover in each zone was classified as urban, agricultural, or natural. The urban category was applied to areas with buildings associated with residential/golf course, commercial, industrial, or institutional uses present within the zone. The agricultural category was applied to zones in which most individual wetlands were adjacent to cleared pasture, row crops, groves, or other agricultural land uses. The natural classification was applied to zones where most individual wetlands were adjacent to natural communities. Scores representing relative wetland functions were assigned to each zone as follows: urban land cover was assigned a score of 1, agricultural a score of 2, and natural a score of 3.

Drainage Network. This feature is related to wetland functions affected by alteration of groundwater and surface water hydrology. In general, wetlands adjacent to or intersected by ditches or drainage canals exhibit impaired functionality relative to those where a drainage system has not been developed. Ditches and canals often alter wetland hydroperiod and pattern of

hydrology. 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.

The project team classified the drainage network in each zone as major, intermediate, or minor. The major classification was applied to zones having a series of rows or a grid pattern of ditches or roadside swales present. One or more ditches intersected most individual wetlands within this zone. 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 may have been intersected by a ditch or roadside swale. The minor classification was applied to zones having few ditches present and where a ditch did not intersect most individual wetlands. Major drainage network was assigned a score of 1, intermediate a score of 2, and minor a score of 3.

Wetland Water Level. This feature is directly related to the signature of individual wetlands. At the time the aerial photographs were taken, wetland water levels were relatively high. Most of the marshes and wet prairies in undeveloped portions of the project area were filled with water and are identified by a characteristic dark color on the infrared aerial photographs. Wetlands of a similar type (i.e., marshes and wet prairies), but with greatly reduced water levels due to drainage activities, typically show up with a much lighter color. In cases where marshes and wet prairies are intersected by ditches, lower water levels are an indicator of reduced wetland functions. A reduction in depth, duration, and frequency of wetland inundation can 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 can be significantly disrupted. In some instances, reduced water levels can sever wetland ecosystem connectivity, isolating wetlands that were historically interconnected.

The project team classified the color of the wetlands in each zone as light, intermediate, or dark. The 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. This color based variable is not sensitive to forested wetlands, including wet pine flatwoods in terms of quality evaluation. The intermediate classification was applied to zones where some of the wetlands within the zone appeared lighter in color than undisturbed wetlands of a similar type, indicating a partially reduced water level. The dark 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.

Next, the three scores corresponding with the classification of the land cover, drainage network, and wetland water level were then added together to calculate a total score for each zone. Zones having a total score of 3-4 were characterized as areas of relatively low quality wetlands; 5-7 as areas of medium quality wetlands; and 8-9 as areas of high quality wetlands.

Field Analysis

The second level of analysis of wetlands in the project area was through a field inspection. The advantages to a field inspection are that more details about the wildlife utilization, vegetation, hydrology, and water quality can be obtained than from the interpretation of aerial photography. However, this methodology is labor and time intensive. Therefore, it is not practical to apply it to all of the wetlands in the project area. Also, this methodology could not be applied in areas where the project team was unable to gain access to private property.

After considering several methodologies, the project team selected WRAP (Miller and Gunsalus 1997). This procedure was selected for several reasons. It has been regionally tailored for freshwater wetlands in southern Florida. Its variable selection and associated descriptors are sensitive to conditions in the project area. It incorporates use of easily obtainable existing data, effectively addresses ecological and anthropogenic factors in wetland function, and can be done within an hour or two of field time. Furthermore, the developers of WRAP have performed statistical analyses that demonstrate that the results of WRAP are highly repeatable. Most of the variation in WRAP scores are attributed to wetland differences, not variation in the way wetland variables were scored by the individuals conducting WRAP (Miller and Gunsalus 1997).

WRAP was applied to 66 wetlands in the Palm Beach County portion of the project area from December 5, 1996 to July 8, 1997 (Figure 5). The first priority in choosing wetlands for this analysis was to include properties with a high potential for development. The second priority was to include a variety of wetland types. The third priority was to choose a representative sampling of wetlands at locations that were classified as areas of high, medium, or low quality wetlands, based on the remote analysis.

The project team followed the details of WRAP provided in a 1996 draft of Miller and Gunsalus (1997). The individuals responsible for developing WRAP, Raymond E. Miller, Jr. and Boyd E. Gunsalus, 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, the project team examined available maps and aerial photographs to determine adjacent land uses to assist in evaluating the wetland. The project team also examined soil survey maps and National Wetland Inventory (NWI) maps prior to visiting a wetland. 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% of the wetland perimeter and inspecting 100% of the wetland perimeter where possible. In some situations such as in the Loxahatchee Slough, where the wetland was extremely large, inspection of 100% of this wetland perimeter was not possible. In these circumstances, the WRAP analysis was only applied to the portion of the wetland that was visited by the project team.

Members of the project team made observations of wildlife, identified plant communities and exotic species, and searched for hydrological and water quality indicators while in the field. 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. Scoring was accomplished by thorough discussion and team consensus on each variable. 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 are 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 exhibited no evidence of wildlife utilization it received 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 had no desirable wetland overstory/shrub canopy trees present it received a score of 0; if it had 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 was not applied when the wetland had less than 20% coverage by canopy/shrub species.

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 had no desirable vegetative ground cover present (i.e., greater than 75% of undesirable vegetation), it received a score of 0; minimal desirable vegetative ground cover present (i.e., approximately 50% undesirable vegetation), a score of 1; a moderate amount of desirable vegetative ground cover present (i.e., less than 25% undesirable vegetation), a score of 2; and abundant desirable vegetative ground cover present (less than 10% 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 depth of the adjacent buffer ring around a wetland 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 had no adjacent upland/wetland buffer, it received 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 had become severely altered with strong evidence of succession to transitional, upland, or open water plant communities it received a score of 0; the hydrologic regime was inadequate to maintain a viable wetland, a score of 1; the hydrologic regime was adequate to maintain a viable wetland system, but external features may affect wetland hydrology, a score of 2; and the hydrologic regime was 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% is based on the treatment category. Scores for land use types encountered in this project are as follows: recreation/open space received 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 were averaged to provide one final score for the water quality inputs and treatment category.

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 for each wetland as follows. First, the scores for each of the seven variables were added together. This total was divided 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 18. This procedure yielded an overall WRAP score ranging from 0 to 1 for each wetland.

RESULTS

General Assessment

Topography. The land elevation in the project area ranges from approximately 14 feet NGVD in the eastern area near the Loxahatchee River and Slough, to about 25 feet NGVD in the western area near Pal-Mar. Numerous depressions are scattered throughout the project area. However, because of the relatively flat topography in the project area, topographic maps are not included in this report.

Soils. The soil survey of Palm Beach County is depicted on black-and-white aerial photographs taken in 1970 (USDA Soil Conservation Service 1978). Twelve of the photographs were pieced together to form the composite photograph shown in Figures 6a and 6b. Soils in the project area occur in distinctive associations, which consists of major and minor soil types. All of the five naturally occurring soil associations in the project area have hydric components, characteristic of wetlands (Carlisle 1995). The soil associations found within the project area are described below.

The Winder-Tequesta association is the main soil association in the Loxahatchee Slough. This area has nearly level, poorly drained sandy soils that have a loamy subsoil, and sometimes have a thin layer of muck at the surface. This area is made up of broad, low flats, depressions, and drainage ways. Winder and Tequesta are major soil types in this association. The minor soil types in this association are Riviera, Hallandale, Chobee, Pinellas, Holopaw, and Okeelanta.

The Riviera association is the most abundant soil association in the project area. It occurs primarily north and west of the Loxahatchee Slough. This area has nearly level, poorly drained sandy soils that have a loamy subsoil. This area is made up of broad, low flatwoods and grassy sloughs interspersed with numerous wet prairies and swampy areas. Riviera soils, the major soil type in this association, often occur in depressions covered with water for long periods. The minor soil types in this association are Holopaw, Oldsmar, Pineda, Pinellas, Boca, and Hallandale.

The Wabasso-Riviera-Oldsmar association occurs primarily near Pratt & Whitney, Caloosa, in a portion of Pal-Mar and the Cypress Creek area, as well as a narrow band along the east side of the Loxahatchee Slough (Figure 4). This area is nearly level and has poorly drained sandy soils that have a loamy subsoil. Portions of this area have a weakly cemented sandy layer over the loamy subsoil. This area is made up of broad flatwoods and grassy sloughs interspersed with many wet prairies, depression marshes, and swampy areas. The major soil types in this association include Wabasso, Riviera, and Oldsmar. Minor soil types in this association are Pineda, Pinellas, Boca, and Holopaw.

The Riviera-Boca association occurs east of the Loxahatchee Slough but west of the Wabasso-Riviera-Oldsmar association. It is made up of broad, low flatwoods interspersed with grassy sloughs, depression marshes, and swampy areas. This area is characterized by nearly level, poorly drained sandy soils that have a loamy subsoil. Riviera and Boca make up the major soil

types in this association. The minor soil types in this association are Pineda, Holopaw, Pinellas, and Hallandale.

The Myakka-Immokalee-Basinger association occurs in the extreme northeastern portion of the project area near the Florida Turnpike. This association is made up of broad, flatwoods areas interspersed with grassy sloughs and many shallow depressions. This area is nearly level and has poorly drained soils that are sandy throughout. Some of these soils have a weakly cemented layer. The major soil types are Myakka, Immokalee, and Basinger. The minor soil types in this association are Placid and Anclote.

The soil survey shows that at the time of the survey in 1974, only a small portion of the project area was dominated by the Quartzipsamments-Urban land association. This occurs east of the Loxahatchee Slough, on a portion of the proposed Golf Digest development site. This association is made up of soils that have been filled, graded, shaped, or generally altered for urban development.

Land Cover. Twelve land cover categories were identified by the FGFWFC satellite imagery (Table 2). The main wetland categories include freshwater marsh and wet prairie, hardwood swamp, and cypress swamp. Together, these three coverages account for 24% of the project area. By examining a map of these coverages, it is evident that each occurs at scattered locations throughout the project area (Figures 7a and 7b). However, the main concentrations of freshwater marsh and wet prairie are located in and near the Loxahatchee Slough, Corbett WMA, and Pal-Mar. The largest concentration of hardwood swamp in the project area occurs along the Loxahatchee River. The main concentrations of cypress swamps occur in and just east of the Cypress Creek area north of Indiantown Road, and in and adjacent to the Loxahatchee Slough, especially near the Beeline Highway. A large stand of cypress also occurs in Corbett WMA just south of Pratt & Whitney. Field investigations indicate that much of what is identified as dry prairie in the satellite imagery is not accurate. A large portion of these areas should actually be classified as wet flatwoods, a wetland community (FNAI and FDNR 1990).

National Wetlands Inventory. The NWI data classifies about 35.7% of the project area as wetlands, 3.0% as excavated areas, and 61.3% as uplands (Table 3). The majority of the wetlands in the project area are considered to be palustrine emergent, scrub shrub, or forested systems (Figures 8a and 8b). The NWI data classifies approximately 16.4% of the wetlands in the project area as partially drained/ditched. Major areas identified as being partially drained/ditched include the Loxahatchee River, and all of the wetlands in Unit 11 of the Acreage.

Infrared Aerial Photography. The nine infrared aerial photographs used in the remote analysis were pieced together to form a composite photograph shown in Figures 9a and 9b. Even through some of the photographs were taken on different dates, the signatures of the wetlands appeared similar on different photographs. This was confirmed by examining wetlands on overlapping sections of photographs. In general, the wetlands and waterbodies show up dark; the roads, developed areas, and cleared areas show up light; and the vegetated areas show up as various shades of red. This 1994/1995 photograph (Figures 9a and 9b) can be compared with the 1970

soil survey photograph (Figures 6a and 6b) to examine wetland changes that have occurred during this 25-year period.

Table 2. Land cover acreages based on the FGFWFC Landsat Thematic Mapper Satellite imagery (Figures 7a and 7b).

Class description	Acres	Percent cover
Barren/developed	13,940.6	21.4
Dry prairie	13,418.6	20.6
Freshwater marsh and wet prairie	10,749.0	16.5
Pinelands	10,476.1	16.1
Grassland/agriculture	9,764.2	15.0
Hardwood swamp	3,214.9	4.9
Cypress swamp	1,700.4	2.6
Hardwood hammocks and forests	807.1	1.2
Open water	765.3	1.2
Exotic plant communities	276.0	0.4
Shrub swamp	66.5	0.1
Xeric oak scrub	5.8	0.0
Total	65,184.5	100.0

Table 3. Wetland and upland acreages based on the National Wetlands Inventory (Figures 8a and 8b).

NWI Classification	Acres	Percent cover
Wetlands, unmodified	19,547.7	29.8
<u>Wetlands, partially drained/ditched</u>	<u>3,846.4</u>	<u>5.9</u>
Wetlands, total	23,394.1	35.7
Wetlands, total	23,394.1	35.7
Excavated areas	1,984.3	3.0
<u>Uplands</u>	<u>40,204.4</u>	<u>61.3</u>
Total	65,582.8	100.0

Results of the Remote Analysis

Interpretation of the infrared aerial photographs resulted in the identification of areas of high, medium and low quality wetlands. The NWI wetland boundaries were used to display these areas in Figures 10a and 10b. Seventy-nine percent of the wetlands in the project area are located in areas of high quality wetlands, 13% in areas of medium quality wetlands, and 8% in areas of low quality wetlands (Table 4). The largest area of high quality wetlands is the Loxahatchee Slough. The second largest area of high quality wetlands is Pal-Mar. Other locations identified as areas of high quality wetlands include Corbett WMA, the Cypress Creek area, the Loxahatchee River SOR property north of Indiantown Road, the large preserve areas on the North Palm Beach County General Aviation Airport and PGA National, and a portion of Vavrus Ranch.

Table 4. Wetland acreages corresponding with the remote analysis classification of areas of high, medium, and low quality wetlands (Figures 10a and 10b). Wetland acreages are based on NWI data (Figures 8a and 8b).

Wetland types	High quality	Medium quality	Low quality	Total
Unmodified	17,342.0	1,991.6	213.1	19,546.7
Partially drained/ditched	1,113.4	1,138.5	1,594.5	3,846.4
Total	18,455.4	3130.1	1807.6	23,393.1

The largest areas of medium quality wetlands occur in Unit 11 of the Acreage, the Sandhill Crane addition to the Loxahatchee Slough Natural Area, on portions of the Vavrus Ranch, and in the Loxahatchee River SOR property south of Indiantown Road. Other locations identified as areas of medium quality wetlands are the preserve areas on sites that have been developed during the last 20 years. These include Old Marsh Golf Club, Palm Beach Park of Commerce (TCRPC 1981), and the smaller preserve areas on PGA National (TCRPC 1978) and the North Palm Beach County General Aviation Airport (TCRPC 1990). In addition, portions of two sites currently proposed for development, the Golf Digest and Country Lakes of Jupiter sites, are identified as areas of medium quality wetlands.

The main areas of low quality wetlands include Jupiter Farms, Palm Beach Country Estates, Caloosa, and the Acreage south of Mecca Farms. A portion near the center of Vavrus Ranch is also identified as an area of low quality wetlands.

Results of the Field Analysis

Appendix 5 includes a summary for each of the 66 wetlands in which WRAP was conducted (Figure 5). The summaries include the individual scores pertaining to each of the variables examined when WRAP was applied. Overall WRAP scores of the 66 wetlands examined in the project area had a mean of 0.72 with a range of 0.11 to 1.0 (Table 5). Two wetlands received a score of 1.0, indicating maximum functionality and minimal disturbance. One of these wetlands is located in Pal-Mar (Wetland 11, Appendix 5), and the other is located in the Cypress Creek area (Wetland 36). The site with the lowest score of 0.11, indicating extremely low wetland functions, is located on the proposed Golf Digest development site. This location (Wetland 53) was identified as a wetland in a permit application, but it was not classified as a wetland by the NWI. The site was impacted by fill and was drained by nearby canals. Inspection of the soil survey photograph indicates that a more extensive wetland formerly occupied this site.

Statistical comparison of the WRAP results in different areas is not appropriate because the wetlands chosen for WRAP were not selected randomly. However, the WRAP scores do provide a good indication of the relative functionality of representative wetlands in different parts of the project area. In addition, because of the way the wetlands were selected, the WRAP scores provide a good indication of the range of variation of wetland functions in selected areas. For example, WRAP was performed on 34 wetlands located in areas identified by the remote analysis as having high quality wetlands. The mean WRAP score in these areas was 0.80 with a range of 0.48 to 1.0. Of the 23 wetlands examined in areas of medium quality wetlands, the WRAP score mean was 0.65, with a range of 0.11 to 0.94. In areas of low quality wetlands, the mean WRAP score of the 9 wetlands examined was 0.53 with a range from 0.24 to 0.75. A discussion of the WRAP scores at different locations within the project area is provided in the following section of this report.

Table 5. Overall WRAP scores for 66 wetlands in the project area in Palm Beach County.

Wetland Number ^a	General Location ^b	Quality Designation ^c	WRAP Score ^d
1	Sandhill Crane Addition	medium	0.72
2	Sandhill Crane Addition	medium	0.50
3	Sandhill Crane Addition	medium	0.76
4	Sandhill Crane Addition	medium	0.94
5	Sandhill Crane Addition	medium	0.50
6	Sandhill Crane Addition	medium	0.55
7	Sandhill Crane Addition	medium	0.67
8	Sandhill Crane Addition	medium	0.79
9	Sandhill Crane Addition	medium	0.67
10	Pal-Mar	high	0.83
11	Pal-Mar	high	1.00
12	Pal-Mar	high	0.67
13	Pal-Mar	high	0.79
14	Pal-Mar	high	0.83
15	Pal-Mar	high	0.97
16	Jupiter Farms	low	0.69
17	Jupiter Farms	low	0.57
18	Jupiter Farms	low	0.64
19	Jupiter Farms	low	0.40
20	Jupiter Farms	low	0.24
21	The Acreage (Unit 11)	medium	0.76
22	The Acreage (Unit 11)	medium	0.86
23	The Acreage (Unit 11)	medium	0.83
24	The Acreage (Unit 11)	medium	0.76
25	MacArthur Parcel 19 ^e	medium	0.43
26	MacArthur Parcel 19	medium	0.69
27	MacArthur Parcel 19	high	0.88
28	MacArthur Parcel 19	high	0.86
29	Loxahatchee Slough Addition	high	0.83
30	Loxahatchee Slough Addition	high	0.75
31	Loxahatchee Slough Addition	high	0.67
32	Loxahatchee Slough Addition	high	0.89
33	Loxahatchee Slough Addition	high	0.62
34	Cypress Creek Area	high	0.50
35	Cypress Creek Area	high	0.62
36	Cypress Creek Area	high	1.00
37	Cypress Creek Area	high	0.86

Table 5. Continued.

Wetland Number ^a	General Location ^b	Quality Designation ^c	WRAP Score ^d
38	Cypress Creek Area	high	0.76
39	Cypress Creek Area	high	0.97
40	Cypress Creek Area	high	0.92
41	Cypress Creek Area	high	0.78
42	Cypress Creek Area	high	0.97
43	Loxahatchee Slough	high	0.83
44	Hungryland Slough	high	0.98
45	Hungryland Slough	high	0.97
46	Old Marsh Golf Club	medium	0.81
47	Palm Beach Country Estates	low	0.48
48	Palm Beach Country Estates	low	0.43
49	Whispering Trails	low	0.55
50	Whispering Trails	low	0.75
51	Golf Digest Site	high	0.89
52	Golf Digest Site	medium	0.56
53	Golf Digest Site	medium	0.11
54	Golf Digest Site	medium	0.50
55	Golf Digest Site	high	0.80
56	Golf Digest Site	high	0.48
57	Golf Digest Site	high	0.86
58	Country Lakes of Jupiter Site	medium	0.67
59	Country Lakes of Jupiter Site	medium	0.75
60	Country Lakes of Jupiter Site	medium	0.67
61	Country Lakes of Jupiter Site	medium	0.79
62	Golf Digest Site	high	0.67
63	Golf Digest Site	high	0.89
64	Golf Digest Site	high	0.56
65	Golf Digest Site	high	0.79
66	Loxahatchee Slough	high	0.52

^aWetland numbers correspond with the locations shown in Figure 5.

^bGeneral locations correspond with areas shown in Figure 4.

^cQuality designations are based on results of the remote analysis shown in Figures 10a and 10b.

^dDetails on the scoring of each wetland are provided in Appendix 5.

^eMacArthur Foundation properties were recently sold to Watermark Communities Inc.

DISCUSSION

General Features

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 (Lin 1988).

Soils. Comparison of the soil survey map (Figures 6a and 6b) with the list of hydric soils in Palm Beach County (Appendix 2) indicates a predominance of hydric soils in the project area. Riviera soils are one of the most common hydric soils in the project area. Riviera soils were encountered in 74% of the wetlands examined during the WRAP field evaluations.

Many of the hydric soils listed in Appendix 2 have nonhydric inclusions. Therefore, the soil survey alone is not always a reliable indicator of wetlands. Use of the soil survey in conjunction with the NWI and field verification is a better way of identifying wetlands. Also, the soil types shown in Figures 6a and 6b are difficult to read because of the reduction in map scale. The original Palm Beach County soil survey maps (USDA Soil Conservation Service 1978) should be consulted for a more clear presentation of soil types. The main purpose for including the soils map in Figures 6a and 6b is because the 1970 black-and-white aerial photograph provides a historical perspective to examine changes in wetlands in the project area.

Land Cover. The FGFWFC land cover maps (Figures 7a and 7b) are useful for identifying major wetland systems in the project area, and for statewide planning. However, the 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 FGFWFC land cover classification system, dry prairie is an upland community (Appendix 3). Comparison of these areas with the NWI maps and verified through field inspections, a large portion of the areas classified as dry prairie is actually wet flatwoods, which is a wetland community following the FNAI wetland classification system.

Comparison of the FGFWFC land cover acreages in Table 2 with the NWI acreages in table 3 indicates a difference of 398.3 total acres in the project area. This difference is minor and represents only 0.6% of the total project area. The difference is caused by the fact that the land cover maps were produced by the FGFWFC and the NWI maps were produced by the SFWMD. The difference in acreage is attributed to minor differences in the placement of the project area boundary lines on the digital GIS maps produced by the two agencies.

National Wetlands Inventory. Coupled with the soil survey and recent infrared aerial photographs, the NWI map (Figures 8a and 8b) is one of the most useful tools for identifying wetlands in the project area. However, the NWI wetland boundaries have been shown to underestimate wetland area as defined by present federal delineation guidelines (Rolband 1995).

Observations by the project team as well as data analyzed by Rolband support this observation. Wet flatwoods appear to be the most likely natural community left out of 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 site inspections by the COE for identification and delineation of wetlands. A combination of data sources and field verification are best in evaluating wetlands.

In spite of the reduction in scale of the NWI maps in Figures 8a and 8b, most of the wetland classification codes are legible on the map. There are minor differences in the NWI wetland boundaries when comparing Figures 8a and 8b with Figures 10a and 10b. This is because Figures 8a and 8b are based on the 1984 mapping by the USFWS, and Figures 10a and 10b were updated in 1990 by the SFWMD. Also, the wetland boundaries were updated again using 1994 and 1995 data at selected locations in the project area where recent changes to wetland boundaries were known to have occurred.

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 database in a digital format.

Comparison of the Remote and Field Analyses

The remote and field analyses yielded different types of results that complement one another. These analyses are not entirely comparable because the remote analysis covered the entire project area and the field evaluation only applied to select areas. Furthermore, statistical comparison of the WRAP scores is not appropriate because the wetlands used in the field analyses are not based on random selection. Because of the lack of ability to conduct field visits to wetlands within the entire project area, the project team determined that greater benefits for the project could be achieved by conducting WRAP in select areas. The project team selected wetlands that appeared to be typical of other wetlands in the area. Also, when the opportunity arose, the project team selected wetlands exemplifying the extremes in wetland condition (e.g., pristine vs. highly impacted).

The WRAP scores can be used for making relative comparisons of the functionality of similar types of wetlands in selected areas. The scores are based on field procedures developed specifically for purposes of evaluating wetlands for this report. The WRAP scores presented should not be used out of context to calculate mitigation ratios, or to compare with other areas not visited by the project team.

As a general guideline, wetlands with WRAP scores ranging from 0.8 to 1.0 indicate high quality wetlands; 0.6 to 0.8, medium quality wetlands; and below 0.6, low quality wetlands. The factors contributing to a low score may not be the same for wetlands with similar scores. Therefore, caution is advised in using the WRAP score alone to make a statement about the quality of an individual wetland. Site specific features should be considered in characterizing the quality of an individual wetland.

The WRAP scores are generally 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 showed a high degree of variability. This is especially true in areas that have been partially developed (e.g., Jupiter Farms) or partially converted to agriculture (e.g., Sandhill Crane Addition). Wetlands that have the highest WRAP scores in areas of low or medium quality wetlands are typically the wetlands that have not yet been physically disturbed to a great degree. These wetlands should be protected from future impacts.

Usually, the wetlands having a low WRAP score in an area of high quality wetlands are impacted by a road, ditch, or nearby canal. Low WRAP scores within high quality wetland areas are useful for identifying which wetlands are most in need of restoration. The functional analysis shows that based on current landscape position, many low or medium quality wetlands have the potential to provide expanded functions. Many of the wetlands in the low and medium quality categories could move into higher categories by implementation of restoration activities, such as the removal of exotics and hydrologic improvements.

Both the remote and field assessments utilized surrounding land use and adjacent buffer variables in evaluating wetlands. Especially in WRAP, the variable is also taken into account within evaluation criteria of other variables. 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 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.

In general, adverse impacts to wetlands should be avoided throughout the project area. Those areas identified as areas of high quality wetlands are appropriate for preservation, conservation, and enhancement of natural systems. The wetlands in areas identified as areas of medium and low quality wetlands need to be evaluated on a case-by-case basis to determine if restoration is possible. In areas where restoration is possible, the wetlands should be preserved and restored. Where state and federal agencies determine that restoration is not possible, then mitigation should be considered. Mitigation should be required for any wetlands that are eliminated.

Major Locations in the Project Area

The major locations in the project area are discussed below. Refer to Table 5 for a summary of the quality designations and WRAP scores of the wetlands in these areas. Refer to Figure 5 for the location of wetlands where WRAP was conducted.

Country Lakes of Jupiter Site. This area is located north of Indiantown Road and west of the Loxahatchee River (Figure 4). The existing land use is primarily agriculture, and much of the natural upland communities have been replaced with pasture. There are numerous shell rock pits remaining from former mining operations. This site has scattered cypress swamps, depression

marshes, and wet prairies spread over the property. Drainage is to the east toward the Loxahatchee River (Figure 3) through the adjacent residential area known as Oak Wood Estates. A residential development is proposed on the Country Lakes of Jupiter property.

This site was classified as an area of medium quality wetlands in the remote analysis (Figure 10a). WRAP was conducted in four wetlands on this property (Wetlands 58-61, Appendix 5). The average WRAP score was 0.72 and ranged from 0.67 to 0.79. These scores indicate an intermediate level of wetland functions. In general, the wetlands in this area are worthy of preservation and could benefit from restoration activities designed to improve hydrology.

Cypress Creek Area. This area is located north of Indiantown Road and west of the Loxahatchee River (Figure 4). The existing land use is primarily agriculture, but many of the natural upland communities remain intact on the property. This forested area is interspersed with cypress swamps, depression marshes, and wet prairies. This area forms the headwaters of Cypress Creek. Drainage is to the northeast into Martin County (Figure 3). Most of this area is currently owned by Watermark Communities Inc. and is being leased for agricultural uses.

The Cypress Creek Area was classified as an area of high quality wetlands in the remote analysis (Figure 10a.) The field visit revealed that a wide range in individual wetland quality exists on this site. WRAP was conducted in nine wetlands on this property (Wetlands 34-42, Appendix 5). The average WRAP score was 0.82 and ranged from 0.50 to 1.00. Four of the nine wetlands had WRAP scores above 0.90, indicating a high level of wetland functions. The lowest score was in Wetland 54, which was intersected by numerous ditches. The reduction in hydrology caused by the ditches contributed to an extensive level of exotic plant species in this wetland.

Although the Cypress Creek Area is partially impacted by agricultural activities, the wetlands in this area are generally of high quality. Many of the individual wetlands could benefit from restoration activities designed to improve hydrology and remove exotic plant species. The protection of this area as a natural system is important for restoring natural flows to Cypress Creek and the Northwest Fork of the Loxahatchee River.

Golf Digest Site. This area is located north of PGA Blvd. and east of the Loxahatchee Slough (Figure 4). The existing land use is primarily agriculture, and much of the natural upland communities have been eliminated on portions of the property. Fill has been deposited on the southwestern portion of the property, and there are numerous narrow lakes within this area. The northwestern and southeastern portions of the property remain in relatively natural condition. Numerous depression marshes and wet prairies occur on this site, especially in the northwestern and southeastern portions. Drainage is to the west toward the Loxahatchee Slough (Figure 3). A residential golf community is proposed on the Golf Digest property.

The southwest and northeast parts of the Golf Digest property were classified as areas of medium quality wetlands in the remote analysis (Figure 10b). The northwest and southeast parts were classified as areas of high quality wetlands. WRAP was conducted in eight wetlands that were located in the area of high quality wetlands (Wetlands 51, 55-57, and 62-65, Appendix 5). The average WRAP score in these wetlands was 0.74, and the scores ranged from 0.48 to 0.89. The

WRAP scores revealed that individual wetlands exhibited a wide range of wetland functionality. The wetland with the lowest score of 0.48 (Wetland 56) had a ditch draining it, which impacted its hydrology and contributed to an extensive level of exotic plant species.

WRAP was conducted at three locations in the portion of the property that was classified as an area of medium quality wetlands (Wetlands 52-54, Appendix 5). As described in the Results section of this report, Wetland 53, which received a score of 0.11, can best be described as a former wetland that had been drained and filled. We applied the WRAP procedure to this wetland because it was identified as wetland in a permit application. However, this site was not identified as a wetland by the NWI. Excluding this wetland from consideration, the average WRAP score was 0.53, and scores ranged from 0.50 to 0.56 in the area designated as medium quality wetlands. The WRAP scores over the entire site indicate an intermediate level of wetland functions and a great variation among wetlands on the site. The wetlands on this site are worthy of preservation and could benefit from restoration activities designed to improve hydrology and remove exotic plant species.

Hungryland Slough. This area is located in the northwestern portion of the Loxahatchee Slough Natural Area recently purchased by Palm Beach County (Figure 4). Natural communities dominate this area. The west branch of the C-18 canal, which has modified the historical drainage patterns in this area, bisects the Hungryland Slough. The uplands in this area are dominated by pine flatwoods, and several types of wetlands occur, including wet flatwoods, cypress swamps, depression marshes, and wet prairies. Drainage is to the east toward the Loxahatchee Slough (Figure 3).

This area was classified as an area of high quality wetlands in the remote analysis (Figure 10a). WRAP was conducted in two wetlands within and near the Hungryland Slough (Wetlands 44 and 45, Appendix 5). These wetlands had WRAP scores of 0.97 and 0.98, indicating a high level of wetland functions. In both cases the main impacts were exotic plant species, but the impacts were minimal. These high quality wetland systems could benefit from continued management activities to remove exotic species. The functions of these wetlands could also be improved by efforts to restore the Loxahatchee Slough and maintain higher levels of water in the C-18 canal. These actions would help maintain the hydroperiod in these wetlands during times of drought.

Jupiter Farms. This large residential area is located along Indiantown Road, west of the Loxahatchee River and east of Pal-Mar (Figure 4). This long standing, low-density development has numerous undeveloped lots. Many of the undeveloped lots are covered with pine forest or remnant wetland systems. There are scattered cypress swamps, depression marshes, and wet prairies spread throughout Jupiter Farms. Drainage is toward the east to the C-14 canal, which drains into the Northwest Fork of the Loxahatchee River (Figure 3). The drainage system is maintained by the SIRWCD (see previous discussion of drainage patterns in this report).

The Jupiter Farms area was classified as an area of low quality wetlands in the remote analysis (Figure 10a). The field visit revealed a large range in functionality of the wetlands in Jupiter Farms. WRAP was conducted in five wetlands (Wetlands 16-20, Appendix 5). The average WRAP score was 0.51, with scores ranging from 0.24 to 0.69. These scores are among the lowest

of all the areas evaluated in the project. These scores indicate a reduced level of wetland functions compared with wetlands in most other areas. While many individual wetlands in Jupiter Farms have significant wetland functions, there is little hope of improving the quality of these wetlands in the future. This is because of the overall extent of development in the area, the unlikelihood that historic drainage patterns and ground water elevations can be restored, and because of development in the area. However, future impacts to wetlands in Jupiter Farms should be compensated by wetland mitigation elsewhere in the drainage basin of the Loxahatchee River. Such a mitigation program would be beneficial to the Loxahatchee River by assisting to provide the water storage necessary to maintain base flows to the river, especially during the dry season and during drought conditions (FDEP and SFWMD 1997).

Loxahatchee Slough. The area forms the historic headwaters of the Northwest Fork of the Loxahatchee River. A major portion of the slough was recently purchased by Palm Beach County and is known as the Loxahatchee Slough Natural Area (Figure 4). Natural communities in the area of the slough include pine flatwoods, hydric hammock, wet flatwoods, wet prairie, slough, strand swamp, basin marsh, basin swamp, depression marsh, and dome swamp. The Loxahatchee Slough is transected by the C-18 canal, which has altered the historic drainage patterns in this area. Drainage is toward the C-18 canal, which flows to the north (Figure 3).

This area was classified as an area of high quality wetlands in the remote analysis (Figure 10b). WRAP was conducted in two wetlands within the slough (Wetlands 43 and 66, Appendix 5). These wetlands had WRAP scores of 0.83 and 0.52. Both of these wetlands were located within several hundred feet of the C-18 canal. It is likely that water drawdown effects from the canal negatively impact the hydrology of these and other wetlands in the slough. Wetland 66 was chosen as a WRAP site because of its obvious impacts and heavy infestation of melaleuca. This wetland has been proposed as a possible mitigation site associated with the proposed Golf Digest development. It probably represents the lower extreme of quality of wetlands in the Loxahatchee Slough. The entire slough system could benefit from restoration activities designed to improve hydrology and remove exotic plant species.

Loxahatchee Slough Addition. This area is located just south of PGA Blvd. and north of the Beeline Hwy, just west of the Loxahatchee Slough Natural Area (Figure 4). Portions of this area form the fringes of the historic Loxahatchee Slough. Natural communities dominate much of this area, but a portion of it on the southeastern side has been filled and has several large excavated areas. The wetlands in this area include strand swamp and basin marshes. Drainage is to the east into the Loxahatchee Slough (Figure 3).

The Loxahatchee Slough Addition was classified as an area of high quality wetlands in the remote analysis (Figure 10b). WRAP was conducted in five wetlands on this property (Wetlands 29-33, Appendix 5). The average WRAP score was 0.75, and the range was 0.62 to 0.89. Several ditches and widespread presence of exotic vegetation, especially melaleuca, are responsible for reducing the functions of the wetlands in this area. The wetlands in this area should be protected because they function as part of the Loxahatchee Slough. These wetlands could benefit from restoration activities designed to improve hydrology and remove exotic plant species.

MacArthur Parcel 19. This area is located east of the Loxahatchee River on the north and south sides of Indiantown Road and the C-18 canal (Figure 4). The existing land use is primarily agriculture north of the C-18 canal, and natural communities on the triangular portion of the property south of the C-18 canal. The wetlands on these parcels are mainly dome and strand swamps dominated by cypress, and depression marshes. North of Indiantown Road drainage is northwest toward the Loxahatchee River; south of Indiantown Road drainage is toward the C-18 canal (Figure 3). Watermark Communities Inc. recently purchased this parcel and other properties owned by the MacArthur Foundation.

The portion of this parcel north of the C-18 canal was classified as an area of medium quality wetlands in the remote analysis (Figure 10a). The part of the property south of the C-18 canal was classified as an area of high quality wetlands. WRAP was conducted in two wetlands in the agricultural area near Indiantown Road (Wetlands 25 and 26, Appendix 5). These two wetlands had scores of 0.43 and 0.69, and averaged 0.56. The reduced functions were attributed to the extensive ditching and heavy exotic infestation, especially in and near Wetland 25 located north of Indiantown Road.

WRAP was conducted in two wetlands in the portion of MacArthur Parcel 19 south of the C-18 canal, which was classified as an area of high quality wetlands in the remote analysis (Figure 10a). The WRAP scores for Wetlands 27 and 28 were 0.88 and 0.86 (Appendix 5). Although these are relatively high WRAP scores, indicating high wetland functions, the nearby C-18 canal probably has some drawdown effects, which impacts wetland hydrology at certain times of the year and during periods of drought. The majority of the wetlands on MacArthur Parcel 19 are worthy of preservation and could benefit from restoration activities designed to improve hydrology and remove exotic plant species. This area has the potential for wetland recreation that would benefit the adjacent river system.

Old Marsh Golf Club. This area is located on the east side of the Loxahatchee Slough near the end of Hood Road (Figure 4). This is a partially developed golf and residential community. Portions of the undeveloped areas remain dominated by natural pine flatwoods, depression marshes, and wet prairies. Drainage is to the south on to the northwest portion of the Golf Digest property (Figure 3). The existing wetlands on this site have been preserved. The NPBCWID maintains the wetland preserve areas.

This area was classified as an area of medium quality wetlands in the remote analysis (Figure 10b). WRAP was conducted in one wetland on this property (Wetland 46, Appendix 5). The WRAP score was 0.81, indicating a relatively high level of wetland functions. The wetland chosen for this analysis appeared to be typical of the wetlands in the Old Marsh community. Future development in this community has the potential to reduce the wetland functions. The use of WRAP in future years would be an excellent way of monitoring any changes in the wetland functions.

Pal-Mar. This area is located west of Jupiter Farms along the Palm Beach and Martin County line (Figure 4). Only a portion of the 37,000 acres that makes up Pal-Mar is included in the project area. Natural communities primarily dominate this area, although agricultural uses occur

in certain portions of Pal-Mar. The natural communities include pine flatwoods, wet flatwoods, marshes, swamps, and wet prairies. The natural drainage pattern is to the east toward Cypress Creek, but the historical patterns of flow have been altered (Figure 3). Pal-mar does not have an outfall location that has been permitted by the SFWMD. Water flows from Pal-Mar to the Loxahatchee River are primarily through ground water seepage. The portion of Pal-Mar lying south of Indiantown Road is part of the C-18 drainage basin, and this area drains southeast to the west branch of the C-18 canal (Figure 3).

This area was classified as an area of high quality wetlands in the remote analysis (Figure 10a). WRAP was conducted in six wetlands in Pal-Mar (Wetlands 10-15, Appendix 5). The WRAP score was 0.85, and the range was 0.67 to 1.00. The lowest score was in Wetland 12, which was bisected by SR 711. Impacts from road construction, roadside ditches, and a culvert under the road are responsible for reducing the function of this particular wetland. This represents a lower extreme of quality of wetlands in Pal-Mar, since most of the wetlands are not directly adjacent to roads. A heavy infestation of melaleuca was noted in Wetland 14, and other wetlands in which WRAP was not conducted. It was also noted that SR 711 appeared to be blocking the flow of surface water from the west to the east. This area could benefit from restoration efforts to restore normal hydrologic flows where they are impacted by roads and ditches. Also, the control of exotic plant species should be a priority in Pal-Mar.

Palm Beach Country Estates. This area is located south and east of the C-18 canal and north and east of the Loxahatchee Slough (Figure 4). This area of low-density residential land use is similar to Jupiter Farms. Many of the undeveloped lots are covered with pine forest or remnant wetland systems. There are scattered cypress swamps, depression marshes, and wet prairies spread through Palm Beach Country Estates. Drainage is to the east below the Florida Turnpike and out of the project area (Figure 3).

Palm Beach Country Estates was classified as an area of low quality wetlands in the remote analysis (Figure 10a). WRAP was conducted in two wetlands in Palm Beach Country Estates (Wetlands 47 and 48, Appendix 5). The WRAP scores were 0.48 and 0.43, indicating relative low wetland functions compared with wetlands in most other areas. While many individual wetlands in Palm Beach Country Estates have significant wetland functions, there is little hope of improving the quality of these wetlands in the future. This is because of the overall extent of development in the area, the unlikelihood that historic drainage patterns and ground water elevations can be restored, and because of the continuation of new development. However, future impacts to wetlands in this area should be compensated by wetland mitigation elsewhere in the drainage basin of the Loxahatchee River. Such a mitigation program would be beneficial to the Loxahatchee River by assisting to provide the water storage necessary to maintain base flows to the river, especially during drought conditions (FDEP and SFWMD 1997).

Sandhill Crane Addition. This area is located north of SR 710, south of the west branch of the C-18 canal, east of Caloosa, and west of the Loxahatchee Slough (Figure 4). The existing land use is primarily agriculture, and much of the natural upland communities have been replaced with pasture for raising cattle. There are numerous ditches throughout the property. Wetlands on this site include cypress swamps, depression marshes, and wet prairies. Drainage is through a

series of ditches that eventually flow north to the C-18 canal (Figure 3). The area is named for the high population of Florida sandhill cranes found during an ecological inventory and assessment of this property (Erwin 1992).

This site was classified as an area of medium quality wetlands in the remote analysis (Figure 10b). WRAP was conducted in nine wetlands on this property (Wetlands 1-9, Appendix 5). The average WRAP score was 0.67 with a range of 0.50 to 0.94. The WRAP scores revealed that individual wetlands exhibited a wide range of functionality. The two wetlands (Wetlands 2 and 5) with the lowest scores of 0.50 had ditches running directly through them. The wetlands on this site are worthy of preservation and could benefit from restoration activities designed to improve hydrology, remove exotic plant species, and restore native upland communities surrounding the wetlands.

The Acreage (Unit 11). This area is located southwest of SR 710 and adjacent to the east side of Corbett WMA (Figure 4). The existing land cover is primarily natural communities, but the entire area has been criss-crossed with a system of dirt roads and ditches. This area was formerly prepared for residential development, but a lack of ability to provide adequate drainage and sanitary sewer services prevented this area from being developed. Palm Beach County is currently in the process of purchasing this property for conservation and recreational use. Funds obtained from mitigation of wetlands in the remainder of the Acreage, which primarily occurs south of the project area, and other areas within Palm Beach County are being used to purchase and restore the properties in Unit 11. This area has scattered swamps, depression marshes, and wet prairies. Drainage is to the south toward the west branch of the C-18 canal (Figure 3).

Unit 11 was classified as an area of medium quality wetlands in the remote analysis (Figure 10b). WRAP was conducted in four wetlands in this area (Wetlands 21-24, Appendix 5). The average WRAP score was 0.80, and the score ranged from 0.76 to 0.86. These scores indicate an intermediate to high level of wetland functions, especially for an area that has been disturbed by such an extensive series of ditches and roads. The wetlands in this area should be protected and could benefit from continued restoration activities designed to improve hydrology and remove exotic plant species.

Whispering Trails. This area is located east of Caloosa, south of Jupiter Farms, north of the west branch of the C-18 canal, and west of the Loxahatchee Slough Natural Area. The existing land use is low density residential with some agricultural activities. This area is very similar to Jupiter Farms, except a lower percentage of the lots have been developed. Many of the undeveloped lots are covered with pine forest or remnant wetland systems. There are scattered swamps, marshes, and wet prairies spread throughout this area. Drainage is toward the south to the C-18 canal (Figure 3).

Whispering Trails was classified as an area of low quality wetlands in the remote analysis (Figure 10a). WRAP was conducted in two wetlands in this area (Wetlands 49 and 50, Appendix 5). The WRAP scores were 0.55 and 0.75 in these wetlands. Impacts to the wetlands in Whispering Trails were similar to the situation found in Jupiter Farms. However, inspection of aerial photography suggests that several of the wetlands may be close to pristine condition with

an extensive area of natural upland buffer. Although there are perhaps several very high quality wetlands in Whispering Trails, the potential for protecting them as the area builds out is limited. This is because of the unlikelihood that historic drainage patterns and ground water elevations can be maintained as new development occurs in the area. However, future impacts to wetlands in Whispering Trails should be compensated by wetland mitigation elsewhere in the drainage basin of the Loxahatchee River. Such a mitigation program would be beneficial to the Loxahatchee River by assisting to provide the water storage necessary to maintain base flows to the river, especially during the dry season and during drought conditions (FDEP and SFWMD 1997).

Other Areas. WRAP was not conducted at all locations within the project area because of logistical constraints. Several of these areas are already developed or approved for development, including the Acreage, Caloosa, Eastpointe Country Club, Palm Beach Park of Commerce (TCRPC 1998), PGA National (TCRPC 1978), Pratt & Whitney, and the north Palm Beach County General Aviation Airport (TCRPC 1990). These sites are all classified as areas of low and medium quality wetlands in the remote analysis, except for the major preserve areas on the airport site and the western preserve area in PGA National, which were classified as areas of high quality wetlands. Since these areas have already been developed, there is little need to further examine wetland protection measures. The need to mitigate future wetland impacts in Caloosa and the Acreage is similar to the need that exists for Jupiter Farms and Palm Beach Country Estates (see discussion above).

The main locations identified as areas of high quality wetlands that were not examined using WRAP include Corbett WMA, the Loxahatchee River corridor, and parts of the Vavrus Ranch. Corbett WMA and the river corridor are already protected, so these areas were not considered high priority for the WRAP analysis.

Vavrus Ranch is one of the largest areas containing wetlands that have not been protected. It is located along Northlake Blvd., south and west of the North Palm Beach County General Aviation Airport. This area is currently in agriculture. Large-scale plans to develop this property were submitted to TCRPC for review in the late 1980s, but these plans were later withdrawn. Vavrus Ranch contains areas that have been cleared for pasture and crops, but it also contains several areas dominated by natural communities. Palm Beach County has identified portions of this property as areas desirable to purchase for conservation and recreational uses. Drainage on this property is toward the north to the west branch of the C-18 canal (Figure 3).

In the remote analysis, the northeastern portion of Vavrus Ranch was classified as an area of medium quality wetlands; much of the southern and eastern portions were identified as areas of high quality wetlands; and the east-central portion of the property was classified as an area of low quality wetlands. Unfortunately, the project team did not receive permission to access this property to perform WRAP on these wetlands. Interpretation of aerial photography suggests that this site has many wetlands worthy of preservation. The wetlands on this property could probably benefit from restoration activities to improve hydrology and remove exotic plant species.

Another area that warrants consideration in this report is Mecca Farms, which is located between Corbett WMA and Vavrus Ranch, just south of Unit 11 of the Acreage (Figure 4). Mecca Farms consists entirely of groves and a large retention area in the northeast corner of the property. Drainage is toward the north to the west branch of the C-18 canal (Figure 3). WRAP was not conducted on this site.

Mecca Farms is important to consider not for the wetlands it has, but for the wetlands it lacks. Inspection of the soil survey map (Figure 6b) shows the historic distribution of soils on this property. These soils are primarily Riviera sand, and Riviera sand, depressional, two of the most common hydric soils in the project area. The wetlands on these sites have been replaced by groves and a water retention area. Currently, there is a proposal to create a shell-rock mine on this site. This is the only sizable location in the project area where the wetlands have been completely eliminated, and buildings associated with residential, commercial, or industrial development have not been constructed. These characteristics make this area suitable for the creation of a water preserve area (WPA), because it could be flooded without impacting naturally occurring wetlands or existing development. Also, this area is ideally suited for a WPA because it is located directly adjacent to the C-18 canal. Water could be stored at this location and released to the Northwest Fork of the Loxahatchee River during the dry season or periods of drought. The maintenance of base flows to the Northwest Fork of the Loxahatchee River is of primary importance to protecting the river system (FDEP and SFWMD 1997).

Key Areas Important for Protection

The Cypress Creek Area stands out as the one major area of high quality wetlands in the project area that is not currently being pursued for public acquisition by the state. 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 2-3 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 revealed that ditches associated with agricultural operations impact the hydrology of many of these wetlands. The protection and restoration of the wetlands in the Cypress Creek Area would 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 floodwater 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.

The other large areas of high quality wetlands in the project area that are not already protected are being considered for purchase through the SOR, CARL, or Palm Beach County Environmentally Sensitive Lands Acquisition Program. These areas include Pal-Mar and several sites being considered for addition to the Loxahatchee Slough Natural Area. Existing efforts to protect these areas should continue.

Key Areas Important for Restoration

The main types of restoration activities that can benefit the Loxahatchee River are related to improving the water storage capabilities of wetlands within the basin. Wetlands that have been ditched or partially drained have a reduced hydroperiod. This negatively affects the river in 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.

Many of the wetland systems in the project area could benefit from restoring the hydroperiod to a more natural condition. Foremost among these is the Loxahatchee Slough. The area surrounding the slough has been under a great deal of development pressure. However, much of the slough has been purchased recently by Palm Beach County for conservation and recreational purposes. The SFWMD has been developing plans for several years to restore the hydroperiod of the Loxahatchee Slough and minimize the unnatural effects of the C-18 canal, which runs through the center of the slough (SFWMD 1997). Palm Beach County and the SFWMD should continue to work together to implement plans to improve the water storage capabilities of the Loxahatchee Slough.

The Loxahatchee River also suffers from reduced hydrologic flows because connections from certain wetland systems have been diverted from the drainage basin. For example, historic water flows from the portion of the Loxahatchee Slough that is now contained in the City of West Palm Beach WCA have been cut off from the river. The City of West Palm Beach and SFWMD are currently investigating opportunities to provide additional water flow from the WCA to the slough (Mock Roos 1996, SFWMD 1997). The city, county, and SFWMD should continue to work together to explore and implement such a plan. Efforts to restore the slough are described in the Northern Palm Beach County Comprehensive Water Management Plan, which is currently under development by the SFWMD.

The individual wetlands in many other areas are in need of improvements to restore the hydroperiod to natural conditions. The main areas with the largest opportunities for improvement include Cypress Creek Area, Unit 11 of the Acreage, Sandhill Crane Addition, and Vavrus Ranch. These areas fall within the jurisdiction of Palm Beach County or the City of Palm Beach Gardens. The need to improve the water storage in certain wetlands on these properties should be recognized in any plans for development of the properties. The county should continue with its land acquisition program to assist in purchasing and restoring these areas.

Finally, during the fieldwork for the project, it was noted that the hydrological flows from the wetlands on the west side to the east side of Pal-Mar may be partially blocked by SR 711. SFWMD should conduct an investigation to determine the need and potential benefits of improving the hydrological connection between the east and west sides of Pal-Mar. 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.

Key Areas in Need of a Mitigation Program

Currently, the wetlands in Jupiter Farms, Palm Beach Country Estates, and Whispering Trails are being eliminated as new residential development occurs. Wetlands in these areas are generally not being protected and mitigation is not being required for wetland impacts. This is because many of these wetlands occur on less than 2.5 acres lots, which are exempt from Palm Beach County's wetlands protection ordinance. Also, mitigation is not being required by the COE for wetland impacts within single-family residential developments, when the amount of impact meets the criteria COE Nationwide permits. Although the wetland loss on an individual lot may be minimal, the cumulative loss of wetlands in these areas is significant. These areas all lie within Palm Beach County. The county has developed a program through a cooperative agreement with state and federal agencies and ITWCD to provide mitigation in Unit 11 for impacts to wetlands in other parts of the Acreage. The Loxahatchee River would benefit from a similar program being applied to Jupiter Farms, Palm Beach Country Estates, and Whispering Trails. State and federal agencies as well as the county should work with the SIRWCD to develop a wetland mitigation program for these areas. Such a program would involve reevaluating the use of COE Nationwide permits, and replacing them with general permits requiring mitigation to offset the cumulative and indirect wetland impacts.

Potential Site for a Water Preserve Area

The Loxahatchee River could benefit from the placement of a WPA within the watershed to increase water storage. This would help compensate for the loss of storage associated with existing development. Ideally, water stored in a WPA could be released to the Northwest Fork of the Loxahatchee River during the dry season or periods of drought. The maintenance of base flows to the river is of primary importance to protecting the river system (FDEP and SFWMD 1997).

Mecca Farms is the only large property in the project area that appears appropriate for a WPA. This is the only area that could be flooded without impacting existing natural upland and wetland communities, or buildings associated with residential, commercial, or industrial development. In addition, Mecca Farms appears to be ideally located for a WPA because it is directly adjacent to the west branch of the C-18 canal, which would be used to transport water to the Loxahatchee River. The SFWMD and Palm Beach County should investigate the suitability and potential benefit of purchasing the Mecca Farms property and using it to develop a WPA. At the present time a shell-rock mine has been proposed to be located on the Mecca Farms property. It is not clear how a shell-rock mine would affect the future potential of the site as a WPA.

Threatened and Endangered Species

State and federally listed animal species whose known ranges fall within project area are provided in Table 6. Several of these species require wetlands for survival throughout their life cycle. Some species require wetlands to fulfill some portion of their life history needs. 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 all the species listed in Table 6, 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. Both the West Indian manatee and common snook utilize riverine systems.

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 main concentration of snail kites near the project area is a roost on the property of the Palm Beach County Solid Waste Authority, which is adjacent to the WCA. As many as 212 kites have been counted entering this roost during an evening survey. Several pairs of kites have nested at the site in recent years (Rumbold and Mihalik 1994). In times of drought, kites often travel many miles in search of wetlands containing apple snails (Beissinger and Takekawa 1983). Rumbold and Mihalik (1994) found that kites tended to fly up to 10 miles to forage. The protection of wetlands within the project area will provide foraging habitat for kites, and will provide travel routes to areas with higher water levels during periods of drought.

Another endangered species in the project area that has a great potential to benefit from the protection of wet flatwoods is the red-cockaded woodpecker. 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. Only about 25 clans composed of two to eight individuals are known to occur within Corbett WMA. 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.

Listed plant species that are known to occur within wetlands in the project area are identified in Table 7. 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.

Exotic Species

A major threat to wetland systems in the project area is from 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 8. 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 often grows in the fringes of wetlands and can dominate the upland buffer. Melaleuca sometimes grows into a forest that completely dominates a wetland. Old World climbing fern often 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 (SFWMD 1997). The City of West Palm Beach, Palm Beach County, FDEP and SFWMD have existing programs to control these species on public lands. It would be beneficial if local governments could develop incentives for private landowners to eradicate exotic pest species on private lands.

Table 6. Threatened and endangered animals 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). 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 C.F.R. 17.11. The FGFWFC 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; Humphrey (1992) for mammals; and Deyrup and Franz (1994) for invertebrates.

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

Table 6. Continued.

Scientific Name	Common Name	Designated Status ¹		
		FCREPA ²	FGFWFC ³	USFWS ⁴
<i>Mammals</i>				
<i>Blarina carolinensis shermani</i>	Sherman's short-tailed shrew	SU	SSC	
<i>Peromyscus floridanus</i>	Florida mouse	T	SSC	
<i>Sciurus niger shermani</i>	Sherman's fox squirrel	T	SSC	
<i>Trichechus manatus latirostris</i>	West Indian manatee	T	E	E

¹E = Endangered; R = Rare; T = Threatened; T(S/A) = Threatened/Similarity of Appearance; SSC = Species of Special Concern; SU = Status Undetermined

²Florida Committee on Rare and Endangered Plants and Animals

³Florida Game and Fresh Water Fish Commission

⁴United States Fish and Wildlife Service

Table 7. 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
<i>Acrostichum danaeifolium</i>	giant leather fern		C
<i>Bletia purpurea</i>	pine pink		T
<i>Calopogon barbatus</i>	bearded grass pink		T
<i>Calopogon multiflorus</i>	many-flowered grass pink		E
<i>Campyloneurum phyllitidis</i>	long strap fern		E
<i>Chrysophyllum oliviforme</i>	satinleaf		E
<i>Dennstaedtia bipinnata</i>	cuplet fern	E	E
<i>Drosera intermedia</i>	water sundew		T
<i>Encyclia tampensis</i>	butterfly orchid		C
<i>Eulophia alta</i>	wild coco		T
<i>Hexalectris spicata</i>	crested coralroot		E
<i>Lilium catesbaei</i>	Catesby's lily		T
<i>Lycopodium cernuum</i>	nodding club moss		C
<i>Nemastylis floridana</i>	celestial lilt	T	E
<i>Nephrolepis biserrata</i>	giant sword fern		T
<i>Ophioglossum palmatum</i>	hand adder's tongue fern	E	E
<i>Osmunda cinnamomea</i>	cinnamon Fern		C
<i>Osmunda regalis</i>	royal fern		C
<i>Pecluma ptilodon</i>	swamp plume polypody		E
<i>Peperomia humilis</i>	pepper (unnamed)		E
<i>Pinguicula caerulea</i>	blue-flowered butterwort		T
<i>Platanthera nivea</i>	snowy orchid		T
<i>Pogonia ophioglossoides</i>	rose pogonia		T
<i>Spiranthes laciniata</i>	lace-lip ladies' tresses		T
<i>Spiranthes longilabris</i>	long-lip ladies' tresses		T
<i>Spiranthes vernalis</i>	ladies' tresses		T
<i>Stenorrhynchos lanceolata</i>	leafless red beak orchid		T
<i>Thelypteris serrata</i>	dentate lattice vein fern		E
<i>Tillandsia balbisiana</i>	inflated wild pine		T
<i>Tillandsia fasciculata</i>	common wild pine		E
<i>Tillandsia flexuosa</i>	twisted air plant	T	E
<i>Tillandsia utriculata</i>	giant wild pine		E
<i>Tillandsia valenzuelana</i>	soft-leaved wild pine		T

¹E = Endangered; R = Rare; T = Threatened; SSC = Species of Special Concern;

C = Commercially Exploited

²Florida Committee on Rare and Endangered Plants and Animals

³Florida Department of Agriculture and Consumer Services

Table 8. 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*) (shoebuttan ardisia)
Bischofia javanica (bischofia)
Brachiara mutica (Pará grass)
Casuarina equisetifolia (= *C. litorea*) (Australian pine)
Casuarina glauca (suckering Australian pine)
Coiocasia 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 guajava (guava)
Psidium littorale (= *P. cattleianum*) (strawberry guava)
Rhodomyrtus tomentosus (downy 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)

Wetland Protection Policies

Federal Regulations. The Federal Water Pollution Control Act (FWPCA) designated as 33 United States Code (U.S.C.) 1344, was a result of water pollution control statutes that were passed in the 1950s and 1960s. The FWPCA was renamed as the Clean Water Act (CWA) in 1977. Under Section 404 of the CWA, 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 CWA 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.

Decisions that are made according to Federal guidelines must meet a 21 item Public Interest Test. No permit will be granted for work in wetlands 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 EPA. These guidelines require that the proposed wetland impact address alternatives, water quality considerations, significant degradation, and minimizing adverse impacts. Affected wetland impacts must also address in the following sequence: avoidance, minimization, and proposals for mitigation and compensation.

State Regulations. In 1993, the Florida legislature passed the Florida Environmental Reorganization Act. One of the principal mandates of the this Act was for the WMDs and FDEP to adopt rules incorporating the State's 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.

SFWMD and FDEP administer the state wetlands permitting process in both Martin and Palm Beach Counties. The legislation is contained in the Chapter 40E, FS. The implementation of this legislative mandate is through the Environmental Resource Permitting process. Short 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 it will not cause unacceptable secondary water resource impacts. 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 fish and wildlife. 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.

Mitigation for impacts to wetlands may be approved after all practicable modifications have been implemented to reduce or eliminate impacts to wetland functions. Mitigation usually consists of restoration, enhancement, creation or preservation of wetlands, other surface waters or uplands. However, mitigation policies differ among agencies. For example, the COE does not accept upland preservation as a form of mitigation.

Out-of-kind mitigation 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: a) on-site mitigation is not expected to have long term viability; and b) off-site mitigation would provide greater ecological value than on-site mitigation.

Regional and Local Government Policies. Wetland protection policies have been adopted in the Strategic Regional Policy Plan (TCRPC 1995) and in the comprehensive plans of the four local governments having jurisdiction in the project area (Palm Beach County 1989, Town of Jupiter 1990, City of Palm Beach Gardens 1990, City of West Palm Beach 1989). These policies are used in planning activities and in the review of development proposals. The policies adopted by TCRPC are advisory. However, each local government has the legal authority to insure that development proposals are consistent with the adopted wetland protection policies in their respective comprehensive plans.

All of the local governments in the project area have strong wetland protection policies (Appendix 8). An additional policy that Palm Beach County should consider is one that emphasizes coordination with Martin County 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. The importance of protecting these areas is described in the preceding sections of this report.

Another new policy that all of the local governments in the project area should consider is one that ensures that the water storage function of wetlands is not lost when mitigation is allowed. The removal of invasive exotic vegetation is important for the restoration of many wetland systems, but this form of mitigation should not be accepted as compensation for the loss of water storage functions of wetlands. The protection of water storage functions of wetlands is one of the most important actions needed to assist in restoring more natural hydrologic flows to the Loxahatchee River.

Finally, another policy that should be considered by all of the local governments in the project area is one that provides incentives to private property owners to remove exotic pest vegetation from their properties. State and federal agencies should assist the local governments to develop acceptable incentives that will promote the removal of exotic pest vegetation on private properties.

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. Refer to the discussion in the report for literature citations and references to specific illustrations. The conclusions and recommendations are as follows:

1. Seventy-nine percent of the wetlands in the project area occur in locations identified as areas of high quality wetlands, 13% in areas of medium quality wetlands, and 8% in areas of low quality wetlands.
2. The largest area of high quality wetlands in the project area is the Loxahatchee Slough. The second largest area of high quality wetlands is Pal-Mar. Other locations identified as areas of high quality wetlands include Corbett WMA, the Cypress Creek Area, the Loxahatchee River SOR property north of Indiantown Road, the preserve areas on North Palm Beach County General Aviation Airport and PGA National, and a portion of Vavrus Ranch.
3. The largest areas of medium quality wetlands occur in Unit 11 of the Acreage, the Sandhill Crane Addition to the Loxahatchee Slough Natural Area, on portions of the Vavrus Ranch, and in the Loxahatchee River SOR property south of Indiantown Road. Other locations identified as areas of medium quality wetlands are the preserve areas on sites that have been developed during the last 20 years. These include Old Marsh Golf Club, Palm Beach Park of Commerce, and the smaller preserve areas on PGA National, and the North Palm Beach County General Aviation Airport. In addition, portions of two sites currently proposed for development, known as the Golf Digest and Country Lakes of Jupiter sites, are identified as areas of medium quality wetlands.
4. The main areas of low quality wetlands include Jupiter Farms, Palm Beach Country Estates, Caloosa, and the Acreage south of Mecca Farms. A portion near the center of Vavrus Ranch is also identified as an area of low quality wetlands.
5. 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. The WRAP scores are generally consistent with and verify the results of the remote analysis. The locations identified as areas of high quality wetlands typically had higher WRAP scores than the locations identified as areas of low quality wetlands. On some sites, the WRAP scores showed a high degree of variability. This is especially true in areas that have been partially developed (e.g., Jupiter Farms) or partially converted to agriculture (e.g., Sandhill Crane Addition). Wetlands that had the highest WRAP scores in areas of low or medium quality wetlands were typically the wetlands that had not yet been physically disturbed to a great degree. These wetlands should be protected from future impacts.

7. Usually, the wetlands that had a low WRAP score in an area of high quality wetlands were impacted by a road, ditch, or nearby canal. Low WRAP scores within high quality wetland areas are useful for identifying which wetlands are most in need of restoration. The functional analysis shows that based on current landscape position, many low or medium quality wetlands have the potential to provide expanded functions. Many of the wetlands in the low and medium quality categories could move into higher categories by implementation of restoration activities, such as the removal of exotics and hydrologic improvements.

8. Both the remote and field assessments utilized surrounding land use and adjacent buffer variables in evaluating wetlands. Especially in WRAP, the variable is also taken into account within evaluation criteria of other variables. 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 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.

9. In general, adverse impacts to wetlands should be avoided throughout the project area. Those areas identified as areas of high quality wetlands are appropriate for preservation, conservation, and enhancement of natural systems. The wetlands in areas identified as areas of medium and low quality wetlands need to be evaluated on a case-by-case basis to determine if restoration is possible. In areas where restoration is possible, the wetlands should be preserved and restored. Where state and federal agencies determine that restoration is not possible, then mitigation should be considered. Mitigation should be required for any wetlands that are eliminated.

10. The Cypress Creek Area stands out as the one major area of high quality wetlands in the project area that is not currently being pursued for public acquisition by the state. 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 2-3 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 revealed that ditches associated with agricultural operations impact the hydrology of many of these wetlands. The protection and restoration of the wetlands in the Cypress Creek Area would 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 floodwater 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.

11. The other large areas of high quality wetlands in the project area that are not already protected are being considered for purchase through the SOR, CARL, or Palm Beach County Environmentally Sensitive Lands Acquisition programs. These areas include Pal-Mar and several sites being considered for addition to the Loxahatchee Slough Natural Area. Existing efforts to protect these areas should continue.

12. The main types of restoration activities that can benefit the Loxahatchee River are related to improving the water storage capabilities of wetlands within the river basin. Wetlands that have been ditched or partially drained have a reduced hydroperiod. This negatively affects the river in 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.

13. Many of the wetland systems in the project area could benefit from restoring the hydroperiod to a more natural condition. Foremost among these is the Loxahatchee Slough. Much of the slough has been purchased recently by Palm Beach County for conservation and recreational purposes. The SFWMD has been developing plans for several years to restore the hydroperiod of the Loxahatchee Slough and minimize the unnatural effects of the C-18 canal, which runs through the center of the slough. Palm Beach County and the SFWMD should continue to work together to implement plans to improve the water storage capabilities of the Loxahatchee Slough.

14. The Loxahatchee River also suffers from reduced hydrologic flows because connections from certain wetland systems have been diverted from the drainage basin. For example, historic water flows from the portion of the Loxahatchee Slough that is now contained in the City of West Palm Beach WCA have been cut off from the river. The City of West Palm Beach and SFWMD are currently investigating opportunities to provide additional water flow from the WCA to the slough. The city, county, and SFWMD should continue to work together to explore and implement such a plan.

15. The individual wetlands in many other areas are in need of improvements to restore the hydroperiod to natural conditions. The main areas with the largest opportunities for improvement include Cypress Creek Area, Unit 11 of the Acreage, Sandhill Crane Addition, and Vavrus Ranch. These areas fall within the jurisdiction of Palm Beach County or the City of Palm Beach Gardens. The need to improve the water storage in certain wetlands on these properties should be recognized in any plans for development of the properties. The county should continue with its land acquisition program to assist in purchasing and restoring these areas.

16. Field observations suggest that the hydrological flows from the wetlands on the west side to the east side of Pal-Mar may be partially blocked by SR 711. SFWMD should conduct an investigation to determine the need and potential benefits of improving the hydrological connection between the east and west sides of Pal-Mar. 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.

17. Currently, the wetlands in Jupiter Farms, Palm Beach Country Estates, and Whispering Trails are being eliminated as new residential development occurs. Wetlands in these areas are generally not being protected and mitigation is not being required for wetland impacts. This is

because many of these wetlands occur on less than 2.5 acres lots, which are exempt from Palm Beach County's wetlands protection ordinance. Also, mitigation is not being required by the COE for wetland impacts within single-family residential developments, when the amount of impact meets the criteria COE Nationwide permits. Although the wetland loss on an individual lot may be minimal, the cumulative loss of wetlands in these areas is significant. These areas all lie within Palm Beach County. The county has developed a program through a cooperative agreement with state and federal agencies and ITWCD to provide mitigation in Unit 11 for impacts to wetlands in other parts of the Acreage. The Loxahatchee River would benefit from a similar program being applied to Jupiter Farms, Palm Beach Country Estates, and Whispering Trails. State and federal agencies as well as the county should work with the SIRWCD to develop a wetland mitigation program for these areas. Such a program would involve reevaluating the use of COE Nationwide permits, and replacing them with general permits requiring mitigation to offset the cumulative and indirect wetland impacts.

18. The Loxahatchee River could benefit from the placement of a WPA within the watershed to increase water storage. This would help compensate for the loss of storage associated with existing development. Ideally, water stored in a WPA could be released to the Northwest Fork of the Loxahatchee River during the dry season or periods of drought. The maintenance of base flows to the river is of primary importance to protecting the river system.

19. Mecca Farms is the only large property in the project area that appears appropriate for a WPA. This is the only area that could be flooded without impacting existing natural upland and wetland communities, or buildings associated with residential, commercial, or industrial development. In addition, Mecca Farms appears to be ideally located for a WPA because it is directly adjacent to the west branch of the C-18 canal, which would be used to transport water to the Loxahatchee River. The SFWMD and Palm Beach County should investigate the suitability and potential benefit of purchasing the Mecca Farms property and using it to develop a WPA.

20. All of the local governments in the project area have strong wetland protection policies. An additional policy that Palm Beach County should consider is one that emphasizes coordination with Martin County 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.

21. Another new policy that all of the local governments in the project area should consider is one that ensures that the water storage function of wetlands is not lost when mitigation is allowed. The removal of invasive exotic vegetation is important for the restoration of many wetland systems, but this form of mitigation should not be accepted as compensation for the loss of water storage functions of wetlands. The protection of water storage functions of wetlands is one of the most important actions needed to assist in restoring more natural hydrologic flows to the Loxahatchee River.

22. An additional new policy that should be considered by all of the local governments in the project area is one that provides incentives to private property owners to remove exotic pest vegetation from their properties. State and federal agencies should assist the local governments

to develop acceptable incentives that will promote the removal of exotic pest vegetation on private properties.

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Figure 1. Map of southern Florida showing the location of the Martin and Palm Beach County portions of the project area.

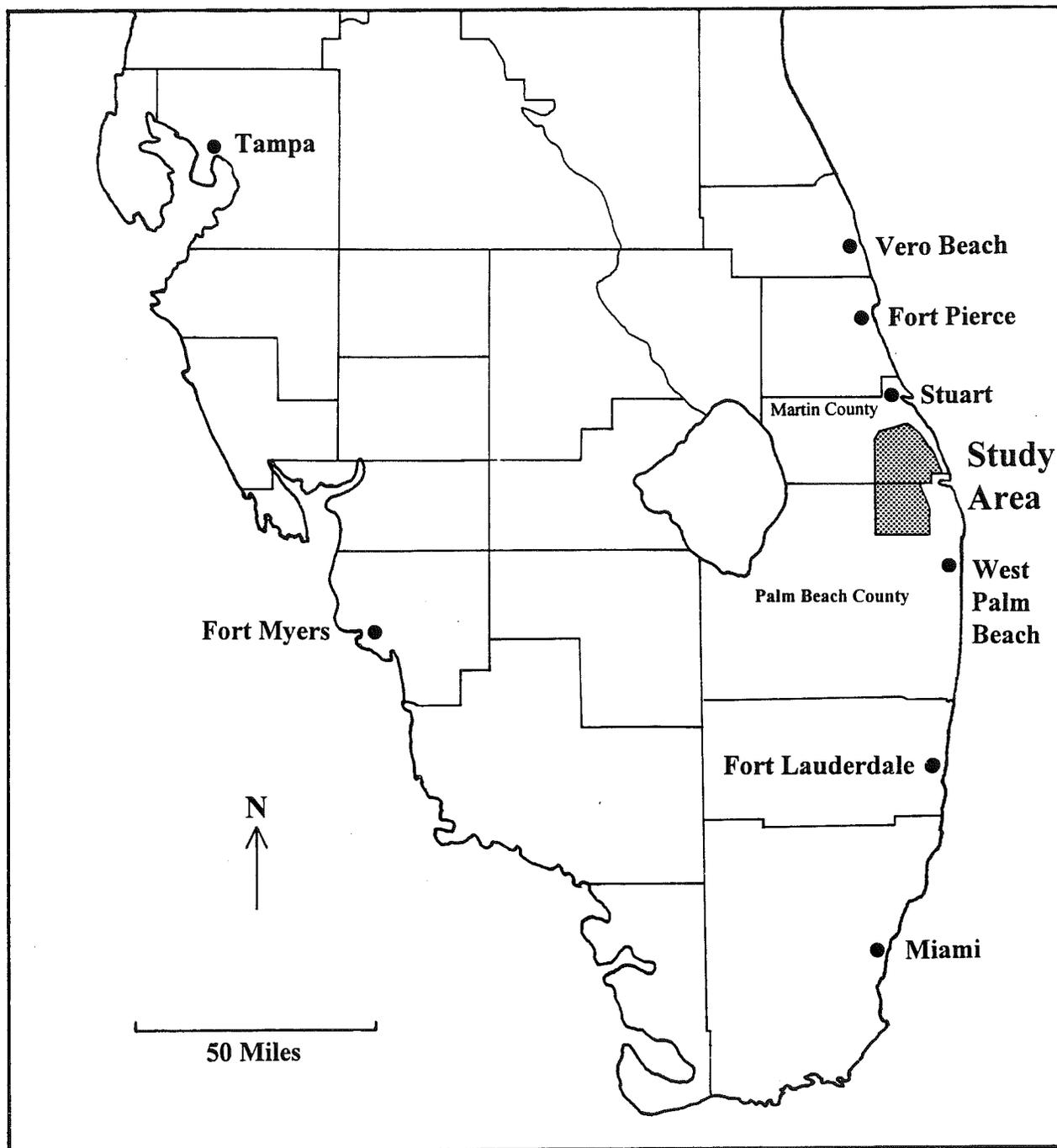


Figure 2. Major wetland areas in the Martin and Palm Beach County portions of the project area.

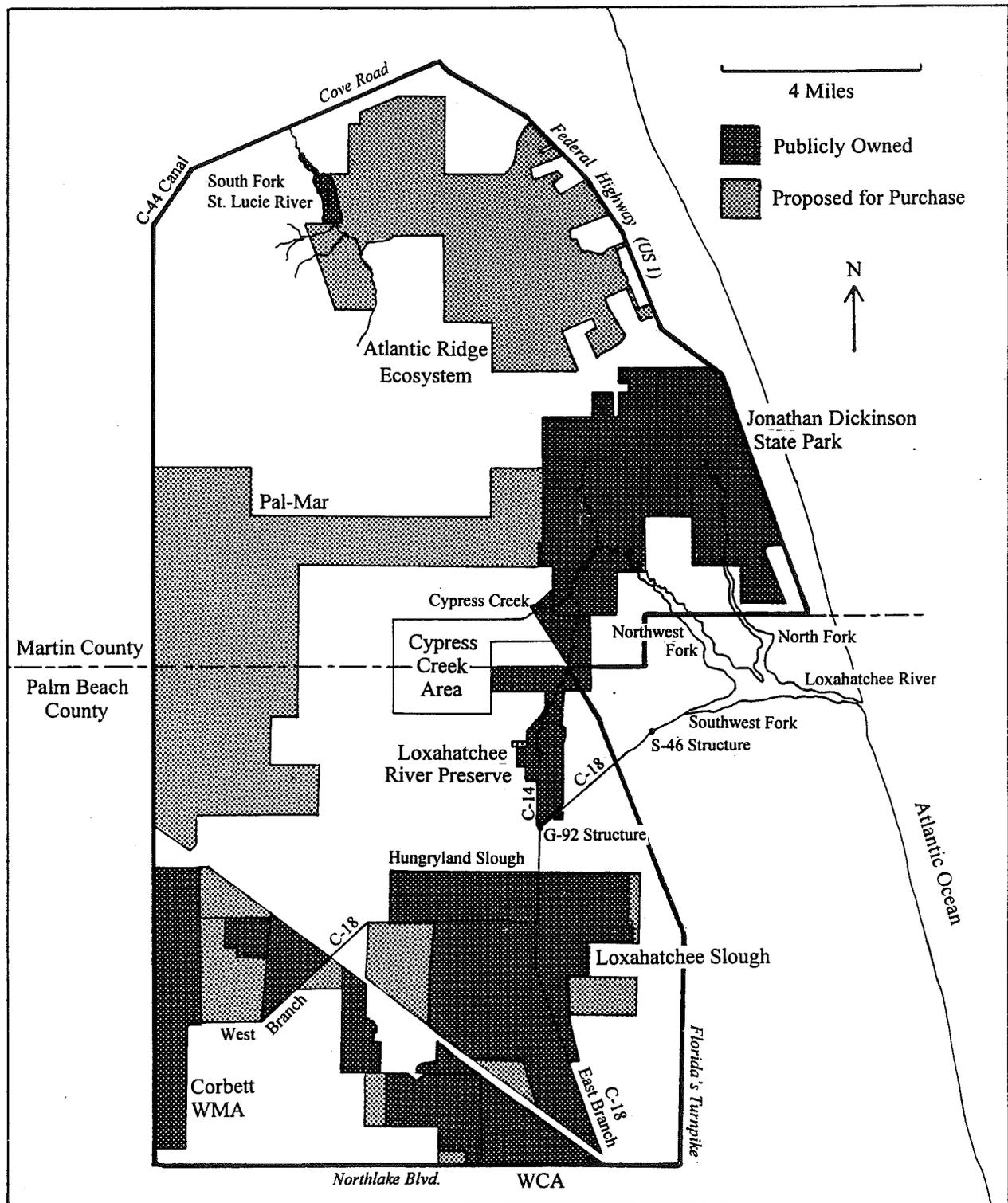


Figure 3. Drainage subbasins and primary flow directions in the project area. This map depicting the C-18 basin is based on illustrations contained in Lin (1988) and Mock Roos (1996), and personal communication with F. Lund of the SFWMD.

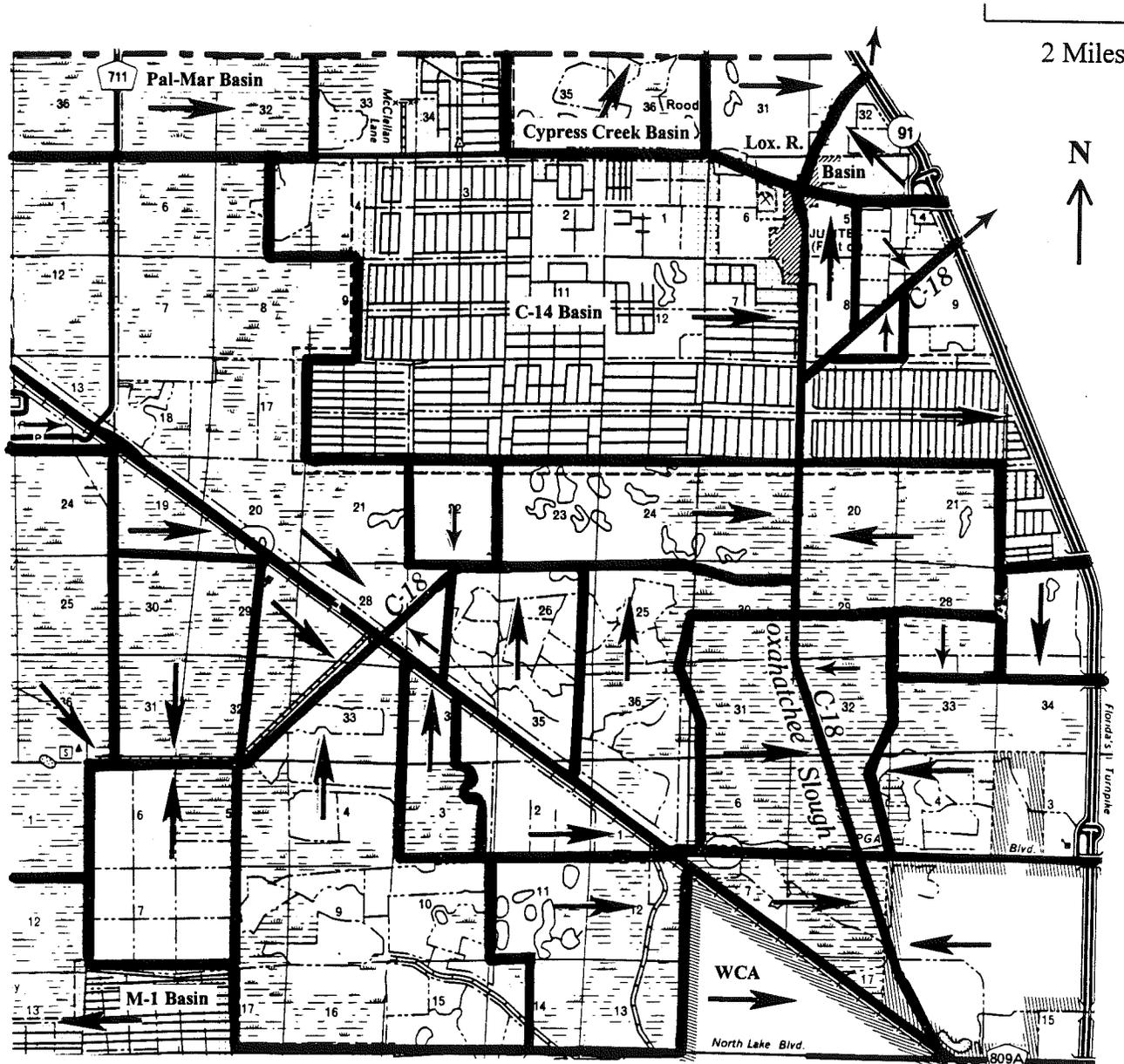
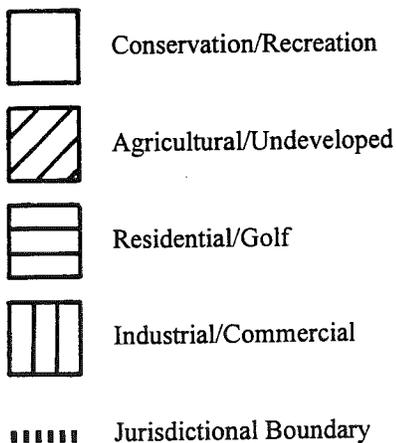
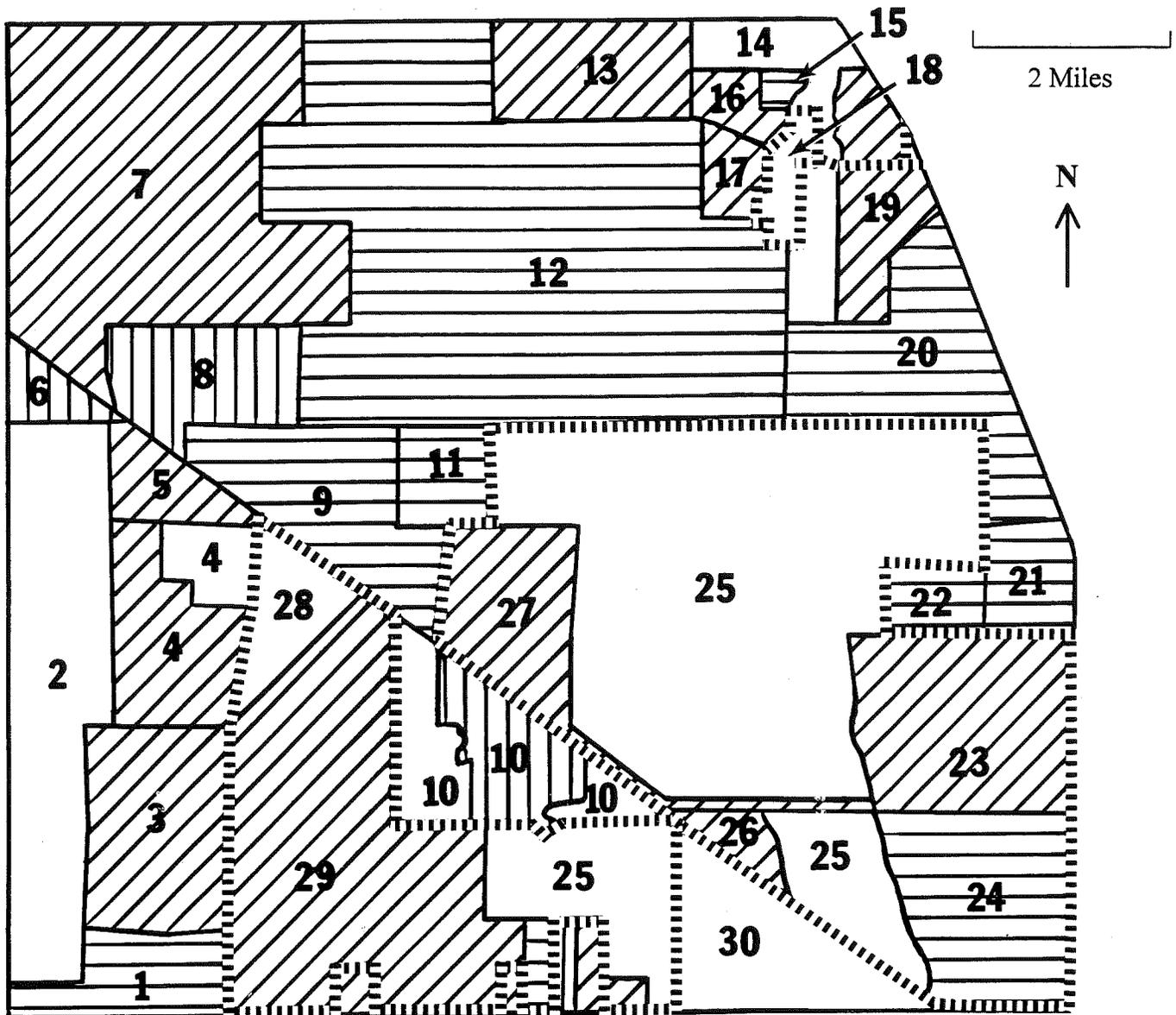


Figure 4. Existing land use and general locations in the project area.



Palm Beach County

- 1 The Acreage
- 2 Corbett WMA
- 3 Mecca Farms
- 4 The Acreage (Unit 11)
- 5 Private
- 6 Pratt & Whitney
- 7 Pal-Mar
- 8 Palm Beach Park of Commerce
- 9 Caloosa
- 10 NPBC General Aviation Airport
- 11 Whispering Trails
- 12 Jupiter Farms
- 13 Cypress Creek Area
- 14 Loxahatchee River Preserve
- 15 Oak Wood Estates
- 16 Country Lakes of Jupiter

Palm Beach County

- 17 Private
- 19 MacArthur Parcel 19
- 20 Palm Beach Country Estates
- 21 Eastpointe Country Club
- 22 Old Marsh Golf Club

Town of Jupiter

- 18 River Bend Park

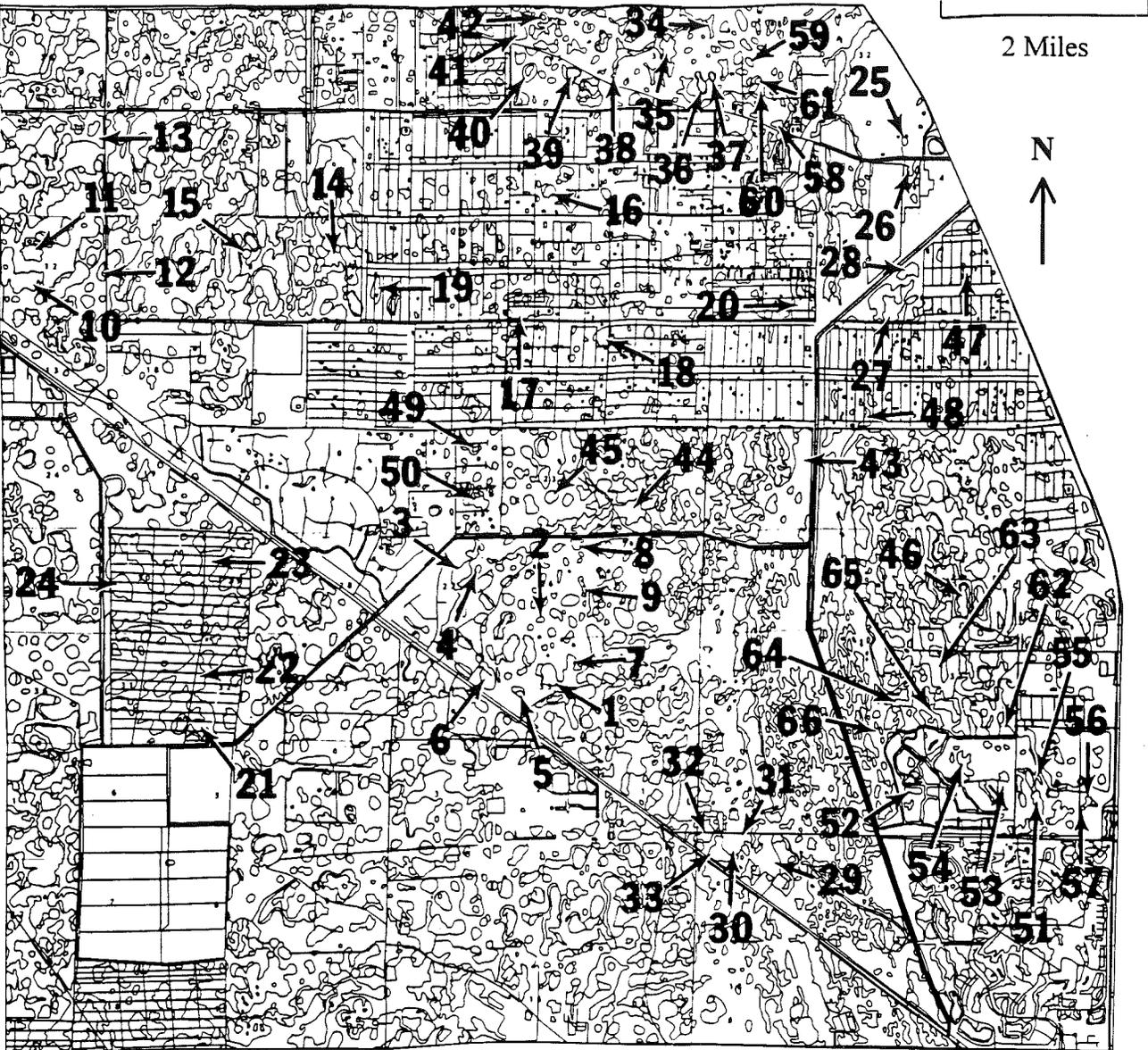
City of Palm Beach Gardens

- 23 Golf Digest
- 24 PGA National
- 25 Loxahatchee Slough Natural Area
- 26 Loxahatchee Slough Addition
- 27 Sandhill Crane Addition
- 28 Palm Beach Co. Natural Area
- 29 Vavrus Ranch

City of West Palm Beach

- 30 Water Catchment Area

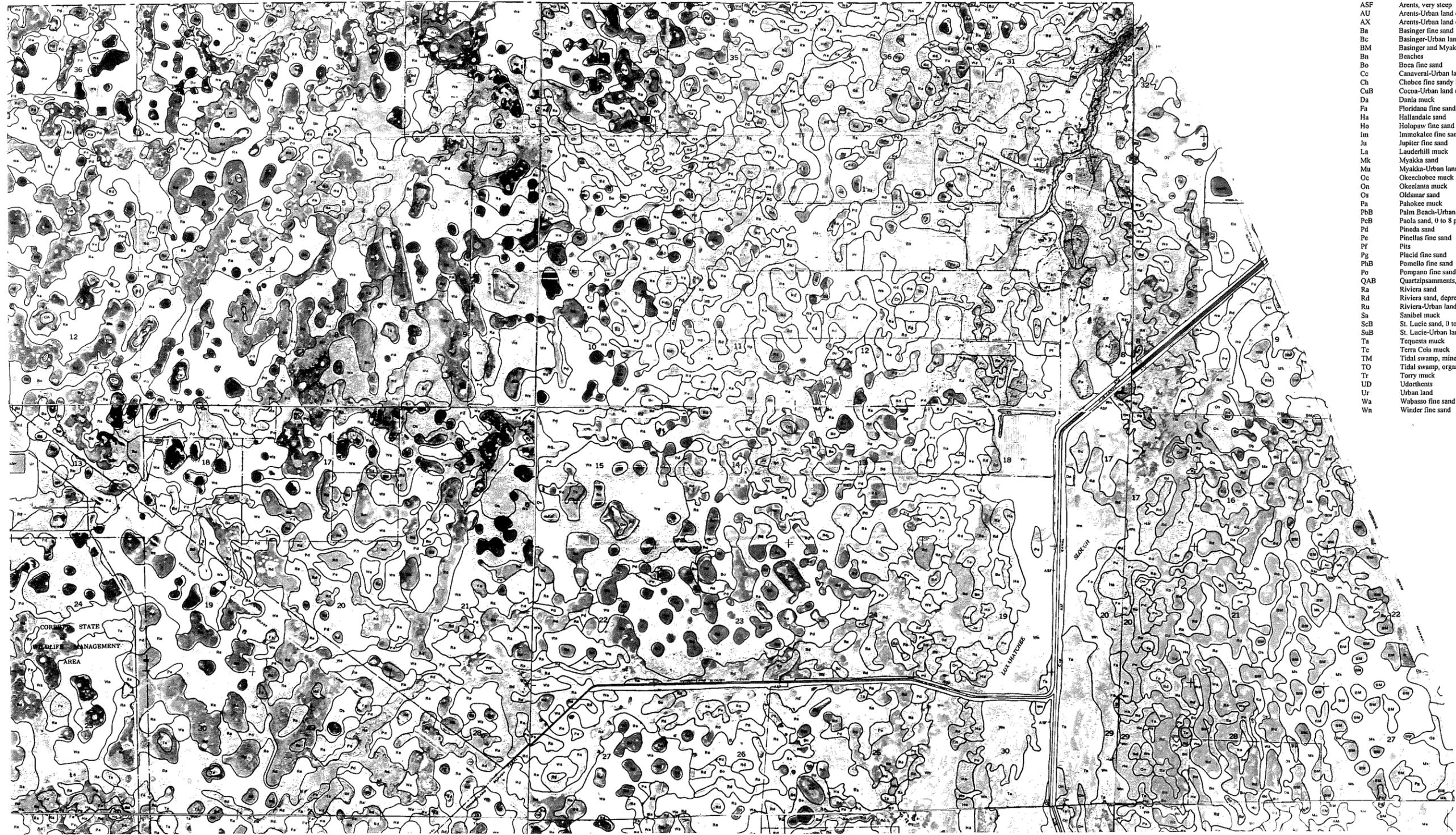
Figure 5. Sites of field visits where WRAP was applied in Palm Beach County.



Soil Survey

LEGEND Soil Survey

- AdB Adamsville sand, organic subsoil variant
- An Anclote fine sand
- ASF Arents, very steep
- AU Arents-Urban land complex
- AX Arents-Urban land complex, organic substratum
- Ba Basinger fine sand
- Bc Basinger-Urban land complex
- BM Basinger and Myakka sands, depressional
- Bn Beaches
- Bo Boca fine sand
- Cc Canaveral-Urban land complex
- Ch Choctaw fine sandy loam
- CuB Cusco-Urban land complex
- Da Dania muck
- Fa Floridana fine sand
- Ha Hallandale sand
- Ho Holopaw fine sand
- Im Immokalee fine sand
- Ju Jupiter fine sand
- La Lauderdale muck
- Mk Myakka sand
- Mu Myakka-Urban land complex
- Oc Okcechobee muck
- On Okceclanta muck
- Os Oldsmar sand
- Pa Pahokee muck
- PbB Palm Beach-Urban land complex
- PcB Paola sand, 0 to 8 percent slopes
- Pd Pineda sand
- Pe Pinellas fine sand
- Pf Pits
- Pg Placid fine sand
- PhB Ponce de Leon fine sand
- Pa Pompano fine sand
- QAB Quartzipsammments, shaped
- Ra Riviera sand
- Rd Riviera sand, depressional
- Ru Riviera-Urban land complex
- Sa Sanibel muck
- ScB St. Lucie sand, 0 to 8 percent slopes
- SnB St. Lucie-Urban land complex
- Ta Tequesta muck
- Tc Terra Ceia muck
- TM Tidal swamp, mineral
- TO Tidal swamp, organic
- Tr Torrey muck
- UD Udorthens
- Ur Urban land
- Wa Wabasso fine sand
- Wn Winder fine sand



0 0.5 1 1.5

Miles

Scale 1:50,000

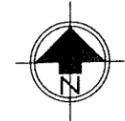
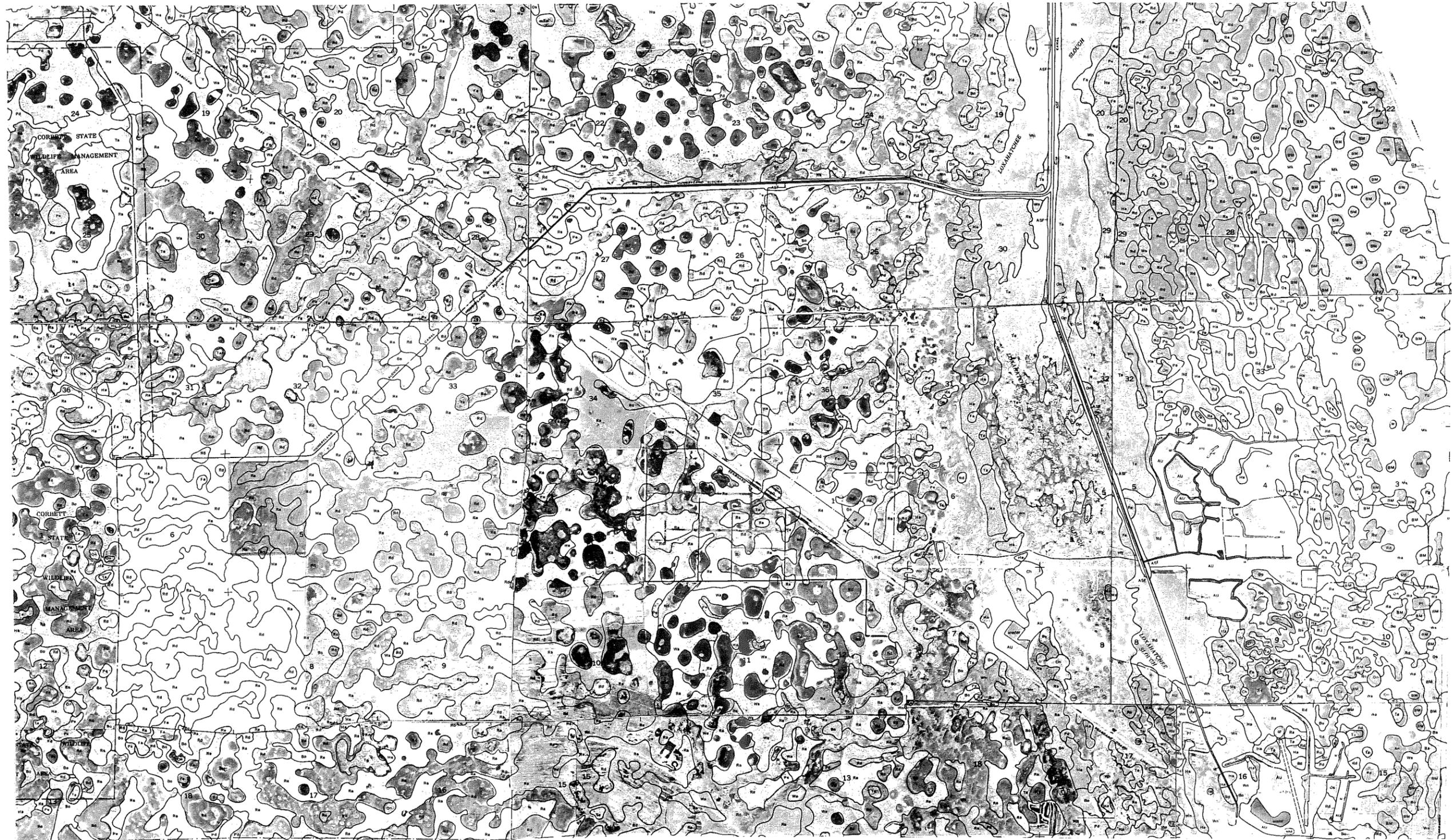


Figure 6a. Soil Survey
North Half of the Project Area

Soil Survey



Source: Palm Beach County Soil Survey (USDA Soil Conservation Service 1978)
Date of Photography: 1970
Refer to Legend in Figure 6a

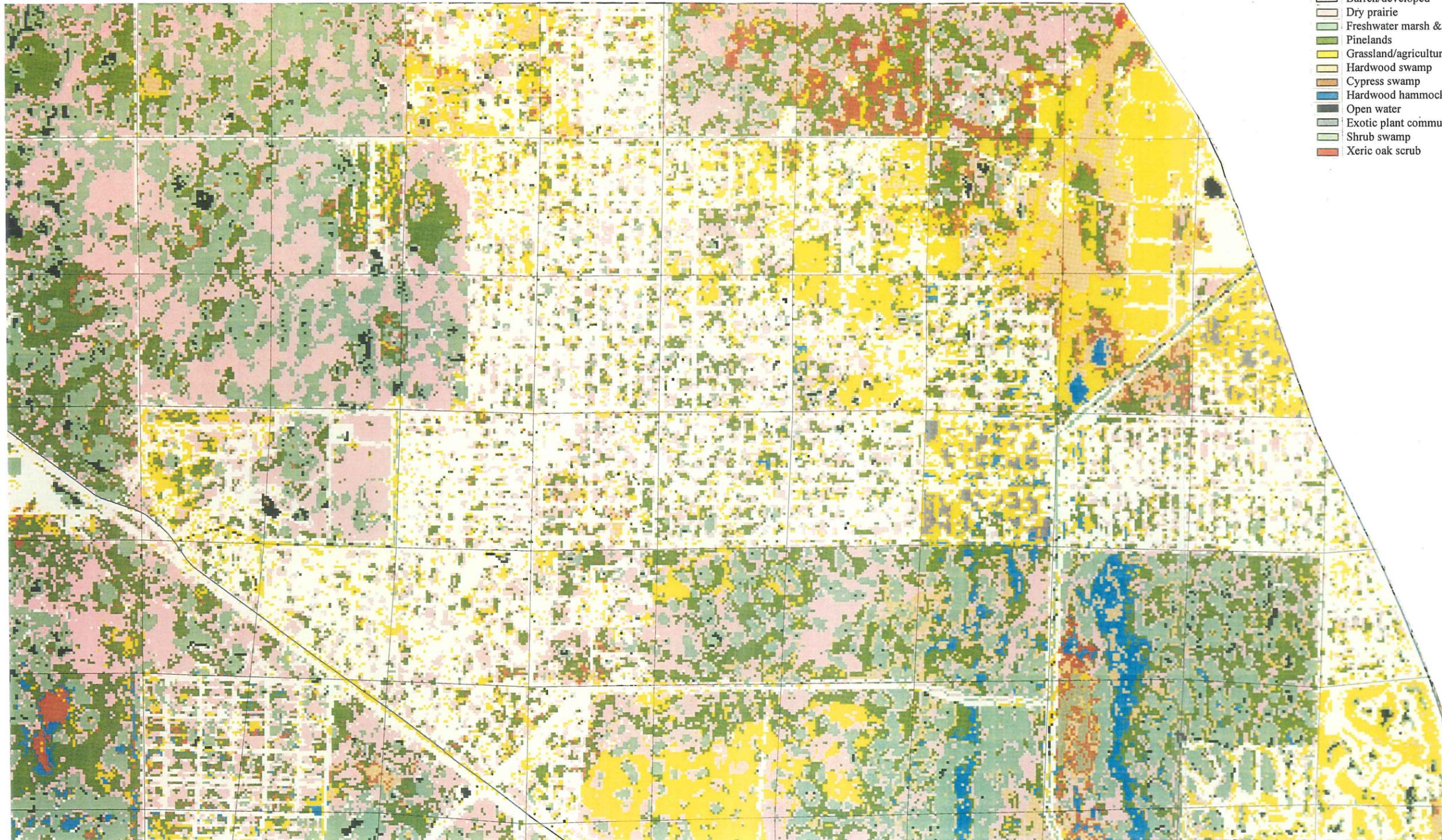


Figure 6b. Soil Survey
South Half of the Project Area

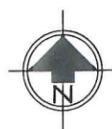
Land Cover

LEGEND Land Cover

-  Barren/developed
-  Dry prairie
-  Freshwater marsh & wet prairie
-  Pinelands
-  Grassland/agriculture
-  Hardwood swamp
-  Cypress swamp
-  Hardwood hammocks & forests
-  Open water
-  Exotic plant communities
-  Shrub swamp
-  Xeric oak scrub

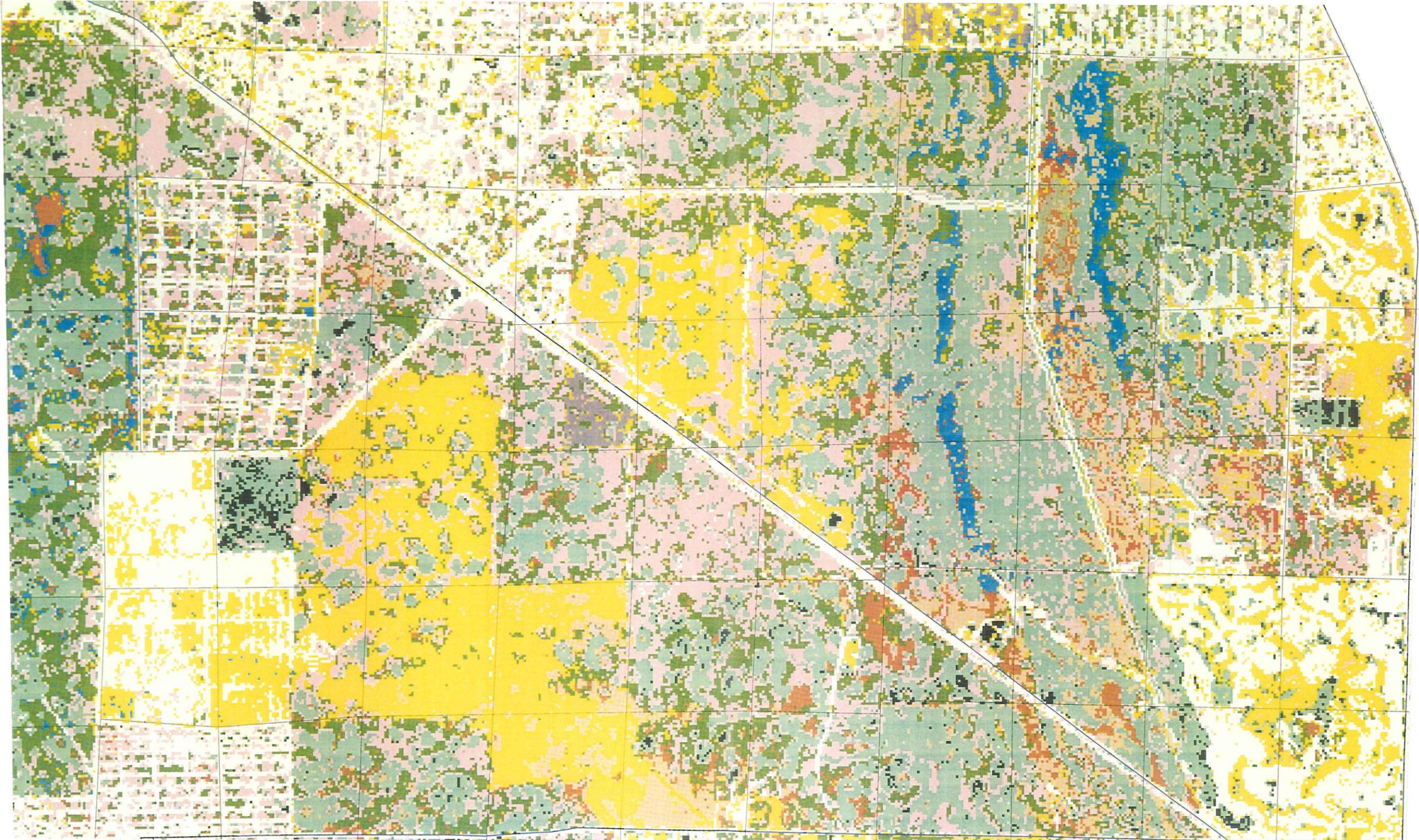


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**Figure 7a. Land Cover
North Half of the Project Area**

Land Cover



Source: FGFWFC Landsat Thematic Mapper Satellite Imagery
Date of Imagery: 1988
Refer to Legend in Figure 7a



Figure 7b. Land Cover
South Half of the Project Area

National Wetlands Inventory

LEGEND NWI Designations

- Systems:**
- E - Estuarine
 - R - Riverine
 - L - Lacustrine
 - P - Palustrine
- Classes and Subclasses:**
- EM - Emergent
 - 1 - Persistent
 - 2 - Nonpersistent
 - SS - Scrub-Shrub
 - 1 - Broad-leaved Deciduous
 - 2 - Needle-leaved Deciduous
 - 3 - Broad-leaved Evergreen
 - 4 - Needle-leaved Evergreen
 - 5 - Dead
 - 6 - Deciduous
 - 7 - Evergreen
 - FO - Forested
 - 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
- Water Regime Modifiers:**
- A - Temporarily Flooded
 - B - Saturated
 - C - Seasonally Flooded
 - D - Seasonally Flooded/Well Drained
 - E - Seasonally Flooded/Saturated
 - F - Semipermanently 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 Drained/Ditched
 - f - Farmed
 - h - Diked/Impounded
 - r - Artificial Substrate
 - s - Spoil
 - x - Excavated



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Miles

Scale 1:50,000

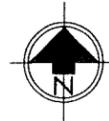
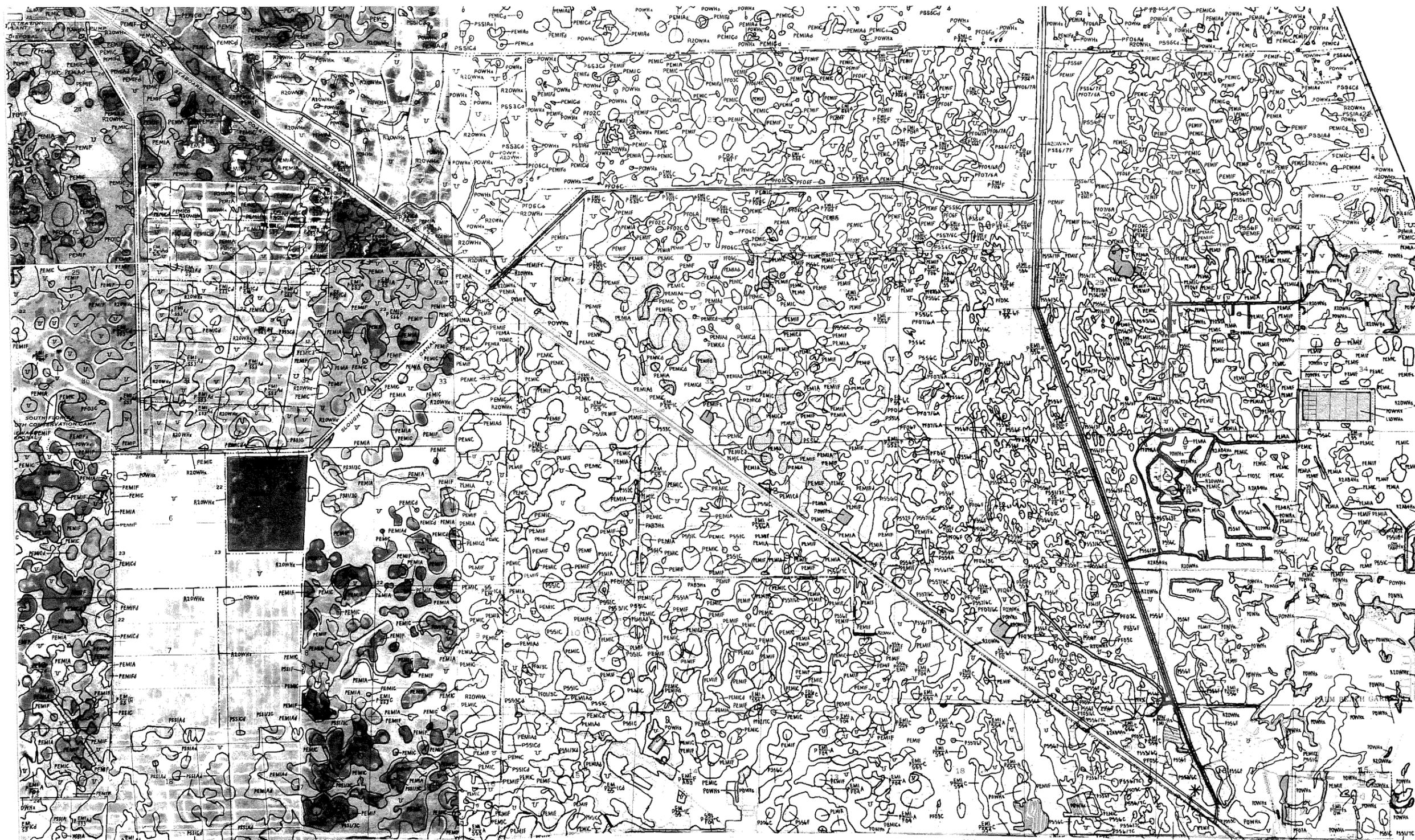


Figure 8a. National Wetlands Inventory
North Half of the Project Area

National Wetlands Inventory



Source: USFWS National Wetlands Inventory
Date of Inventory: 1984
Refer to Legend in Figure 8a

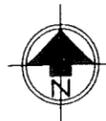
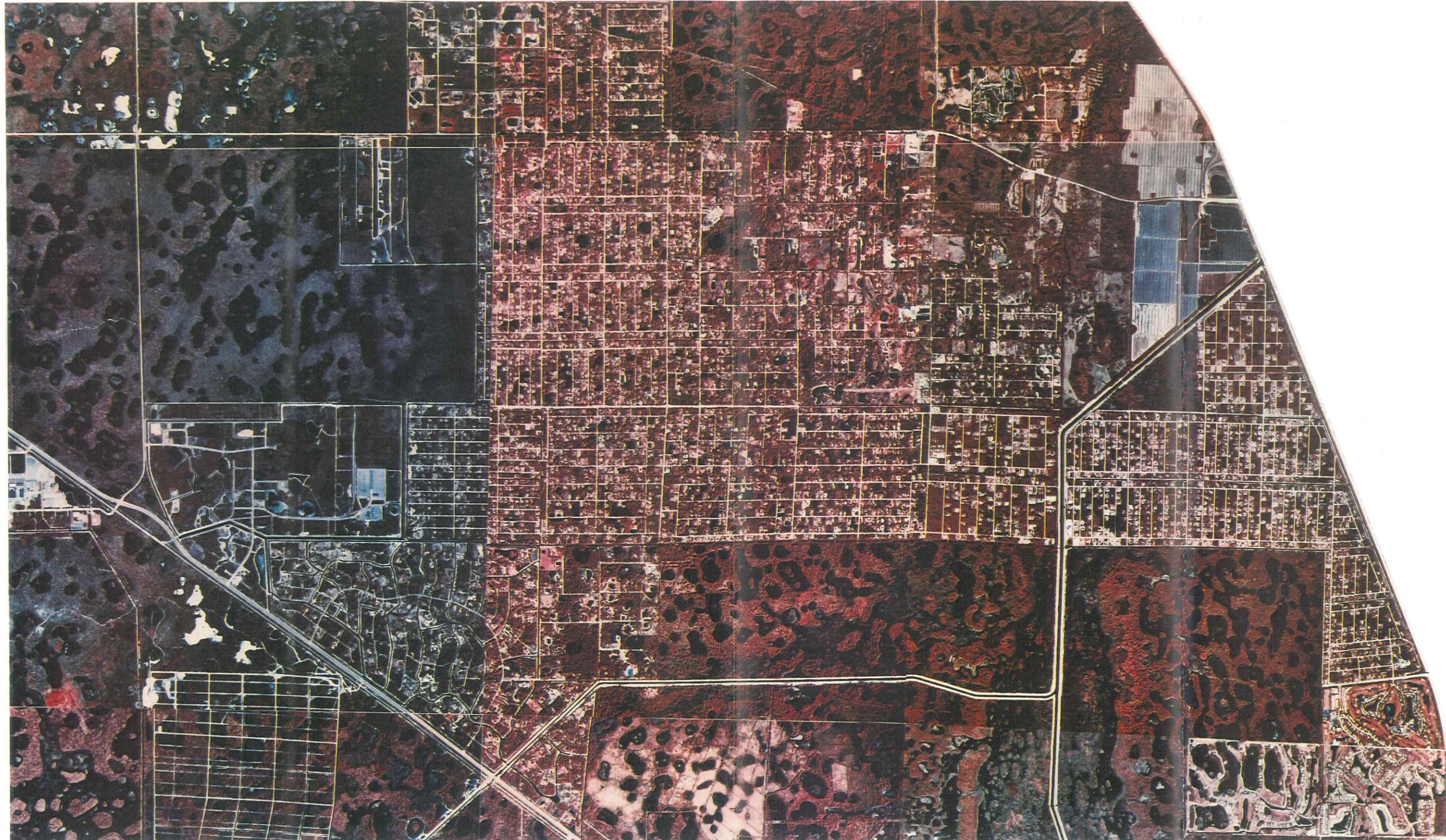


Figure 8b. National Wetlands Inventory
South Half of the Project Area

Infrared Aerial Photograph

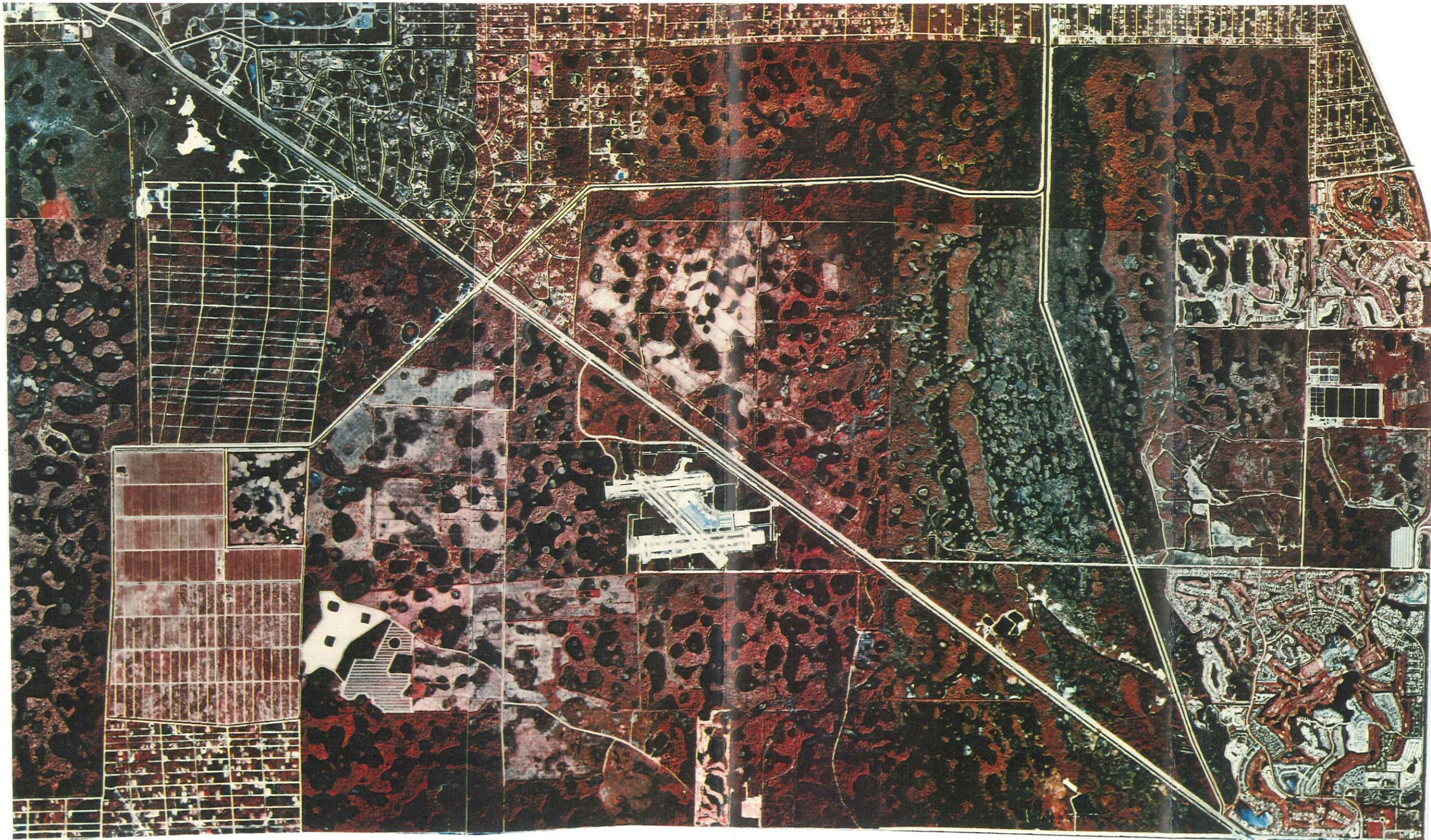


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Miles
Scale 1:50,000



Figure 9a. Infrared Aerial Photograph
North Half of the Project Area

Infrared Aerial Photograph



Source: National Aerial Photography Program
Date of Photography: 1994/1995



**Figure 9b. Infrared Aerial Photograph
South Half of the Project Area**

Areas of High, Medium and Low Quality Wetlands

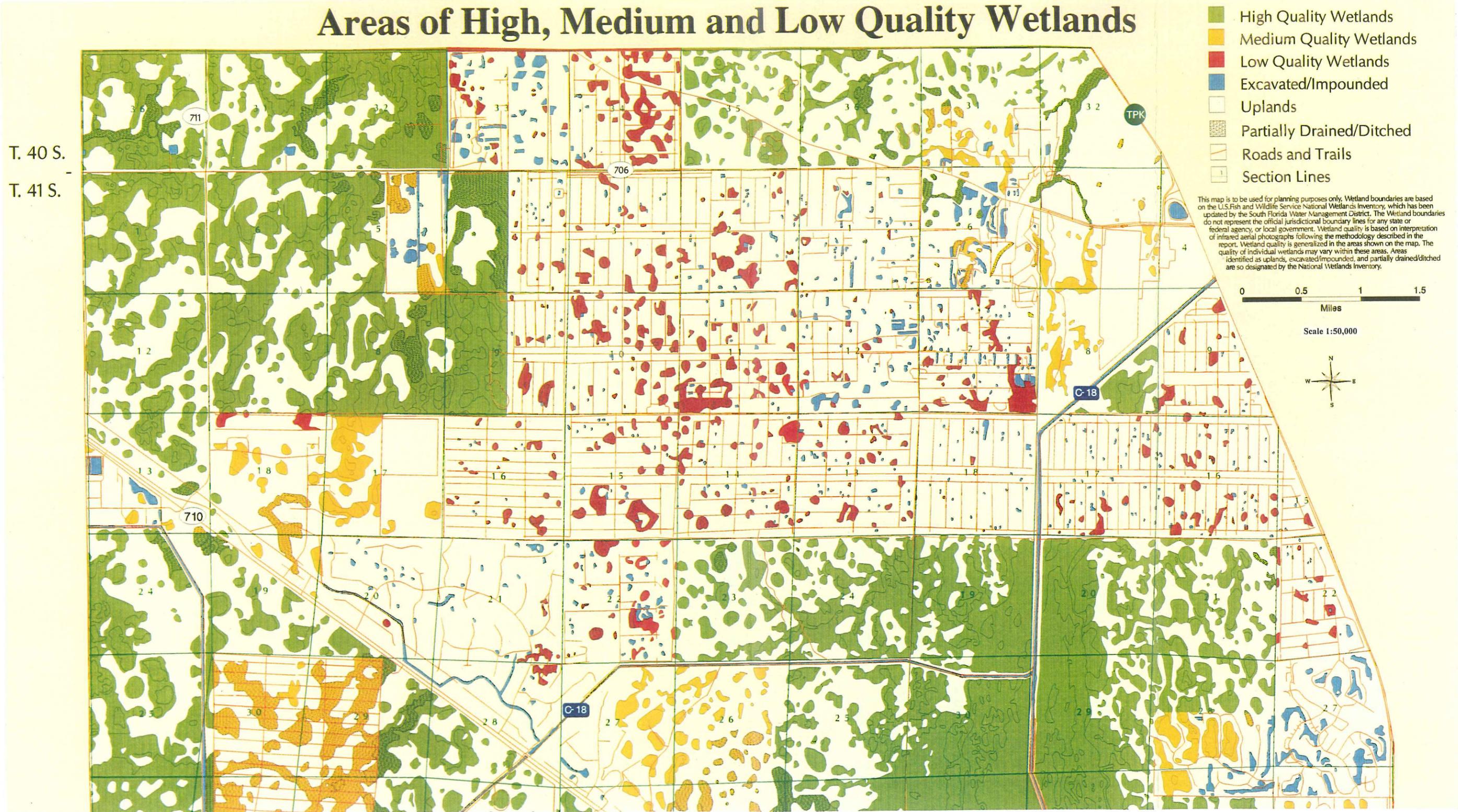
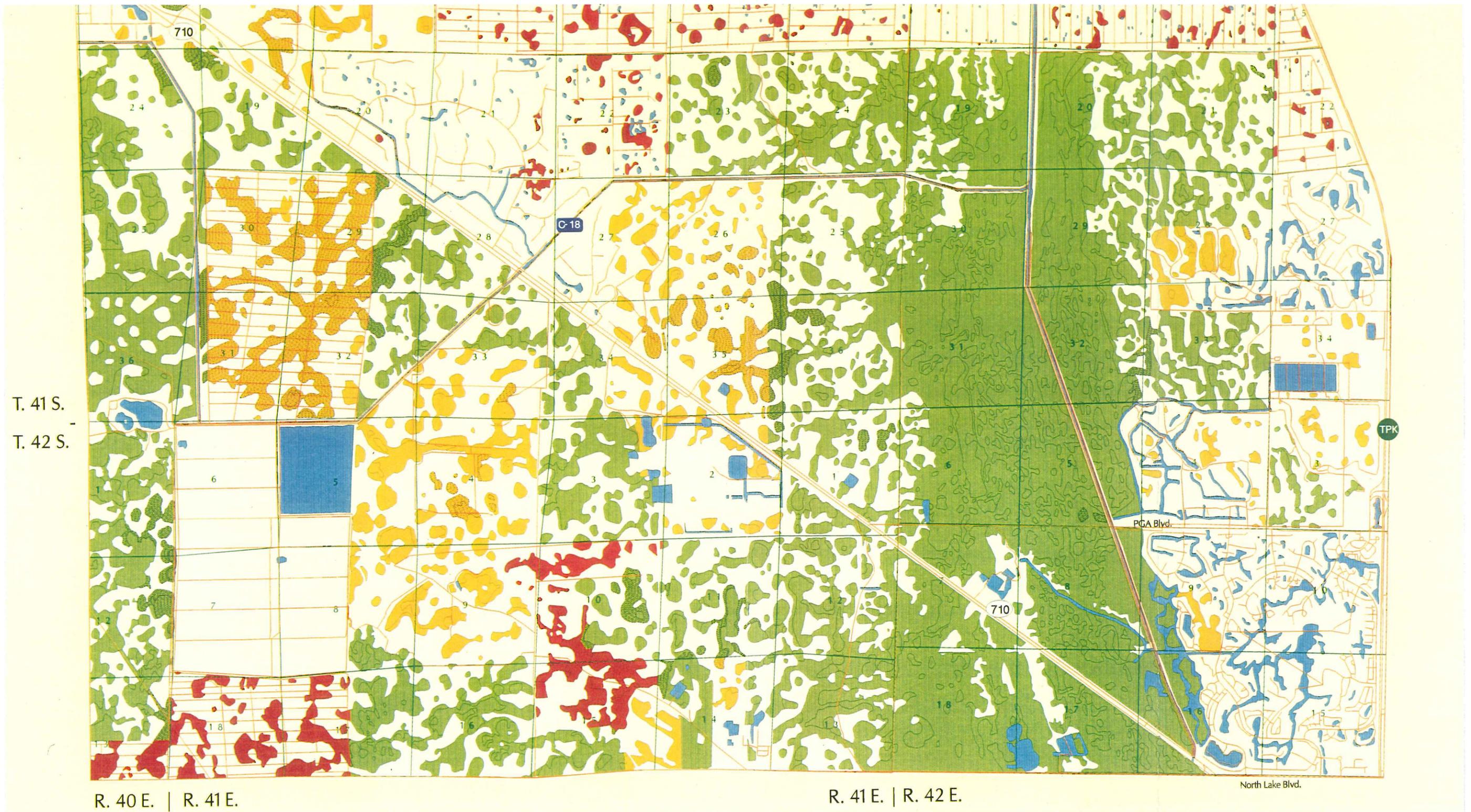


Figure 10a. Areas of High, Medium, and Low Quality Wetlands North Half of the Project Area



Areas of High, Medium, and Low Quality Wetlands



Production Source: SFWMD
Refer to Legend in Figure 10a



Figure 10b. Areas of High, Medium, and Low Quality Wetlands South Half of the Project Area

APPENDIX 1 FLORIDA NATURAL AREAS INVENTORY

This appendix contains brief descriptions of the natural communities in the project area following the Florida Natural Areas Inventory classification system. Refer to FNAI and FDNR (1990) for a more detailed description of these communities.

Uplands

Terrestrial - upland habitats dominated by plants that are not adapted to anaerobic soil conditions imposed by saturation or inundation for more than 10% 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.

Wetlands

Palustrine - Wetlands dominated by plants adapted to anaerobic substrate conditions imposed by substrate saturation or inundation during 10% or more of the growing season. Includes nontidal wetlands; tidal wetlands with ocean derived salinity less than 0.5 ppt and dominance by salt-

intolerant species; small (less than 8 ha), shallow (less than 2 m 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, mixed herbs.

Seepage Wetlands - Sloped or flat sands or peat with high moisture levels maintained by downslope seepage; wetland and mesic woody and/or herbaceous vegetation.

Baygall - Wetland with peat substrate at base of slope; maintained by downslope 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 downslope 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 and/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/Marsh 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 HYDRIC SOILS IN PALM BEACH COUNTY

This list of hydric soils in Palm Beach County is taken from the Hydric Soils of Florida Handbook (Carlisle 1995). Each mapunit represents one or more soil delineations. The hydric portions of each mapunit are identified. Refer to the Palm Beach County Soil Survey (USDA NRCS 1978) and Carlisle (1995) for more information.

Symbol	Mapunit	Soil Types	Hydric	Landform
ASF	Arents, very steep	90% Arents 10% Basinger	No Yes	Slough
AU	Arents-Urban Land Complex	60% Arents 35% Urban Land 5% Basinger	No No Yes	Slough
An	Anclote Fine Sand	100% Anclote	Yes	Depression
Ba	Basinger Fine Sand	90% Basinger 10% Myakka	Yes No	Slough
Bc	Basinger-Urban Land Complex	35% Basinger 35% Urban Land 10% Basinger 20% Myakka	No No Yes No	Marine Terrace
Be	Beaches	90% Beaches 10% Canaveral	Yes No	Beach
Bm	Basinger and Myakka Sands, Depressional	60% Basinger 40% Myakka	Yes Yes	Depression Depression
Bo	Boca Fine Sand	60% Boca 20% Boca 20% Hallandale	No Yes No	Slough
Cc	Canaveral-Urban Land Complex	55% Canaveral 40% Urban Land 5% Beaches	No No Yes	Beach
Ch	Chobee Fine Sandy Loam	100% Chobee	Yes	Depression

Appendix 2

Symbol	Mapunit	Soil Types	Hydric	Landform
Da	Dania Muck	100% Dania	Yes	Marsh
Fa	Floridana Fine Sand	50% Floridana 50% Floridana	Yes Yes	Slough Depression
Ha	Hallandale Sand	70% Hallandale 30% Hallandale	No Yes	Slough
Ho	Holopaw Fine Sand	45% Holopaw 45% Holopaw 10% Oldsmar	Yes Yes No	Slough Depression
Im	Immokalee Fine Sand	80% Immokalee 20% Riviera	No Yes	Marine Terrace
Ju	Jupiter Fine Sand	70% Jupiter 10% Hallandale 20% Jupiter	Yes No No	Slough
La	Lauderhill Muck	50% Lauderhill 50% Lauderhill	Yes Yes	Depression Depression
Mk	Myakka Sand	80% Myakka 10% Myakka 10% Riviera	No Yes Yes	Marine Terrace Slough
Mu	Myakka-Urban Land Complex	50% Myakka 40% Urban Land 10% Myakka	No No Yes	Marine Terrace
Oc	Okeechobee Muck	100% Okeechobee	Yes	Marsh
On	Okeelanta Muck	50% Okeelanta 50% Okeelanta	Yes Yes	Marsh Marsh
Os	Oldsmar Sand	80% Oldsmar 20% Riviera	No Yes	Slough
Pa	Pahokee Muck	50% Pahokee 50% Pahokee	Yes Yes	Marsh Marsh

Appendix 2

Symbol	Mapunit	Soil Types	Hydric	Landform
Pd	Pineda Sand	90% Pineda 10% Oldsmar	Yes No	Slough
Pe	Pinellas Fine Sand	80% Pinellas 20% Riviera	No Yes	Slough
Pf	Pits	70% Pits 30% Arents	No Yes	Reshaped
Pg	Placid Fine Sand	50% Placid 50% Placid	Yes Yes	Depression Depression
Po	Pompano Fine Sand	90% Pompano 10% Immokalee	Yes No	Slough
Ra	Riviera Sand	90% Riviera 10% Oldsmar	Yes No	Slough
Rd	Riviera Sand, Depressional	100% Riviera	Yes	Depressional
Ru	Riviera-Urban Land Complex	45% Riviera 35% Urban Land 10% Oldsmar 10% Riviera	No No No Yes	Slough
Sa	Sanibel Muck	50% Sanibel 50% Sanibel	Yes Yes	Swamp Swamp
Ta	Tequesta Muck	50% Tequesta 50% Tequesta	Yes Yes	Swamp Swamp
Tc	Terra Ceia Muck	50% Terra Ceia 50% Terra Ceia	Yes Yes	Marsh Marsh
Tm	Tidal Swamp, Mineral	100% Tidal Swamp	Yes	Tidal Marsh
To	Tidal Swamp, Organic	100% Tidal Swamp	Yes	Tidal Marsh
Tr	Torry Muck	100% Torry	Yes	Marsh

Appendix 2

Symbol	Mapunit	Soil Types	Hydric	Landform
UD	Udorthents	90% Udorthents 10% Riviera	No Yes	Slough
Wa	Wabasso Fine Sand	70% Wabasso 15% Riviera 15% Wabasso	No Yes Yes	Slough Marine Terrace
Wn	Winder Fine Sand	90% Winder 10% Wabasso	Yes No	Slough

APPENDIX 3

LAND COVER CLASSIFICATION SYSTEM

The following list includes a description of land cover classification system developed for the FGFWFC landsat habitat mapping project. The Landsat classifications were grouped into general categories described below. Refer to Cox et al. (1994) for a more complete description of the community types.

Upland Plant Communities

Coastal Strand. Coastal strand occurs on well drained sandy soils and includes the typical zoned vegetation of the upper beach, nearby dunes, and coastal rock formations.

Dry Prairie. Dry prairies are large native grass and shrub lands that occur on flat terrain interspersed with scattered cypress domes and strands, bayheads, isolated freshwater marshes, and hardwood hammocks. This community is characterized by many species of grasses, sedges, herbs, and shrubs, including saw palmetto, fetterbush, staggerbush, tar flower, gallberry, wiregrass, carpet grasses, and various types of bluestem grasses.

Pinelands. The pinelands category includes north and south Florida pine flatwoods, south Florida pine rocklands, and commercial pine plantations. Pine flatwoods occur on flat sandy terrain where the overstory is characterized by longleaf pine, slash pine, or pond pine. Generally, flatwoods dominated by longleaf pine occur on well drained sites, pond pine is found in poorly drained areas, and slash pine occupies intermediate or moderately moist areas.

Sand Pine Scrub. Sand pine scrub occurs on well-drained, sandy soils deposited along former shorelines and islands of ancient seas. This xeric plant community is dominated by an overstory of sand pine and has an understory of myrtle oak, Chapman's oak, sand-live oak, and scrub holly.

Sandhill. Sandhill communities occur in areas of rolling terrain on deep, well drained, white to yellow, sterile sands. This xeric community is dominated by an overstory of scattered longleaf pine, along with an understory of turkey oak and bluejack oak.

Xeric Oak Scrub. Oak scrub is a hardwood community typically consisting of clumped patches of low growing oaks interspersed with bare areas of white sand. This community occurs on areas of deep, well-washed, sterile sands, and it is the same understory complex of scrubby oaks and other ground cover species that occurs in the sand pine scrub community.

Mixed Hardwood-Pine Forest. This community is the southern extension of the Piedmont southern mixed hardwoods, and occurs mainly on the clay soils on the northern panhandle.

Hardwood Hammocks and Forests. This class includes the major upland hardwood associations that occur statewide on fairly rich sandy soils. Variations in species composition, and the local or spatial distributions of these communities are due in part to differences in soil moisture regimes, soil types, and geographic location within the state. The major variations within this association are mesic hammocks, xeric hammocks, coastal and hydric hammocks, and live oak or cabbage palm hammocks.

Tropical Hardwood Hammock. These upland hardwood forests occur in extreme south Florida and are characterized by tree and shrub species on the northern edge of a range which extends southward into the Caribbean. These communities are sparsely distributed along coastal uplands south of a line from about Vero Beach on the Atlantic coast to Sarasota on the Gulf coast. They occur on many tree islands in the Everglades and on uplands throughout the Florida Keys.

Wetland Plant Communities

Coastal Salt Marshes. These herbaceous and shrubby wetland communities occur statewide in brackish waters along protected low energy estuarine shorelines of the Atlantic and Gulf coasts. The largest continuous areas of salt marsh occur north of the range of mangroves, and border tidal creeks, bays, and sounds.

Freshwater Marsh and Wet Prairie. These wetland communities are dominated by a wide assortment of herbaceous plant species growing on sand, clay, marl, and organic soils in areas of variable water depths and inundation regimes. Generally, freshwater marshes occur in deeper, more strongly inundated situations and are characterized by tall emergent and floating-leaved species. Freshwater marshes occur within depressions, along broad, shallow lake and river shorelines, and are scattered in open areas within hardwood and cypress swamps.

Cypress Swamp. These regularly inundated wetlands form a forest border along large rivers, creeks, and lakes, or occur in depressions as circular domes or linear strands. These communities are strongly dominated by either bald cypress or pond cypress, with a very low number of scattered black gum, red maple, and sweetbay.

Mixed Hardwood Swamp. These wooded wetland communities are composed of either pure stands of hardwoods, or occur as a mixture of hardwoods and cypress. This association of wetland-adapted trees occurs throughout the state on organic soils and forms the forested floodplain of non-alluvial rivers, creeks, and broad lake basins. Tree species include a mixed overstory containing black gum, water tupelo, bald cypress, dahoon holly, red maple, swamp ash, cabbage palm, and sweetbay.

Bottomland Hardwood Forest. These wetland forests are composed of a diverse assortment of hydric hardwoods which occur on the rich alluvial soils of silt and clay deposited along several panhandle rivers including the Apalachicola.

Bay Swamp. These hardwood swamps contain broadleaf evergreen trees that occur in shallow, stagnant depressions often found within pine flatwoods, or at the base of sandy ridges where seepage maintains constantly wet soils. The soils, which are usually covered by an abundant layer of leaf litter, are mostly acidic peat or muck which remain saturated for long periods but over which little water level fluctuation occurs. Overstory trees within bayheads are dominated by sweetbay, swamp bay, and loblolly bay.

Shrub Swamp. Shrub swamps are wetland communities dominated by dense, low-growing, woody shrubs or small trees. Shrub swamps are usually characteristic of wetland areas that are experiencing environmental change, and are early to mid-successional in species complement and structure. These changes are a result of natural or man-induced perturbations due to increased or decreased hydroperiod, fire, clear cutting or land clearing, and siltation.

Mangrove Swamp. These dense, brackish water swamps occur along low-energy shorelines and in protected, tidally influenced bays of southern Florida. This community is composed of freeze-sensitive tree species that are distributed south of a line from Cedar Key on the Gulf coast to St. Augustine on the Atlantic coast. These swamp communities are usually dominated by red, black, and white mangroves that progress in a sere from seaward to landward areas, respectively, while buttonwood trees occur in areas above high tide.

Open Water

Open Water. This community is comprised of the open water areas of inland freshwater lakes, ponds, rivers and creeks, and the brackish and saline waters of estuaries, bays, tidal creeks, the Gulf of Mexico, and the Atlantic Ocean.

Disturbed Communities

Grassland and Agriculture. These areas are dominated by low-growing herbaceous vegetative cover on intensively managed sites such as row crops, improved pastures, lawns, golf courses, road shoulders, cemeteries, or weedy, fallow agricultural fields, etc. This very early succession category includes all sites with herbaceous vegetation during the time period between bare ground, and the shrub and brush stage as well as agricultural fields of all types.

Shrub and Brushland. This association includes a variety of situations where natural upland community types have been recently disturbed through clear-cutting commercial pinelands, land clearing, or fire, and are recovering through natural succession processes. This type could be characterized as an early condition of old field succession, and the community is dominated by various shrubs, tree saplings, and lesser amounts of grasses and herbs.

Exotic Plant Communities. Upland and wetland areas dominated by non-native trees that were planted or have escaped and invaded native plant communities. These exotics include melaleuca, Australian pine, Brazilian pepper, and eucalyptus.

Barren and Urban Land. This class includes highly reflective unvegetated areas such as roads, beaches, active strip mines, tilled agricultural sites, and cleared land on sandy soils. Unvegetated sites in urban areas which include rooftops of buildings, athletic fields, landfills, and parking lots, etc., are also included in this category.

APPENDIX 4 NATIONAL WETLANDS INVENTORY

This appendix contains a summary of the NWI wetland classification system. The majority of the wetlands in the project area are comprised of palustrine (shallow, vegetated, nontidal) wetlands. Details concerning the classification of estuarine (estuaries), riverine (rivers), and lacustrine wetland systems are not provided because they are not abundant in the project area. The symbols are combined into classification codes for each wetland shown on NWI maps (Figures 8a and 8b). For example, a typical code for a wetland in the project area is PEM1F, indicating that the wetland is palustrine (P), emergent (EM), persistent (1), and semipermanently flooded (F). Refer to Cowardin et al. (1979) and the original NWI maps published by the USFWS for additional information regarding the NWI classification system.

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 (ppt).

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% aerial coverage; and (3) total area exceeds 20 acres.

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 - woody gymnosperm with green, needle-shaped, or scale-like leaves that are retained by plants throughout the year; e.g., black spruce (*Picea mariana*).
- 5 - Dead - Dead wood plants less than six meters tall.
- 6 - Deciduous - a condition where the foliage drops off annually.
- 7 - Evergreen - having foliage that remains on the plant throughout the year.

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

- 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 - woody gymnosperm with green, needle-shaped, or scale-like leaves that are retained by plants throughout the year; e.g., black spruce (*Picea mariana*).
- 5 - Dead - Dead wood plants less than six meters tall.
- 6 - Deciduous - a condition where the foliage drops off annually.
- 7 - Evergreen - having foliage that remains on the plant throughout the year.

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

Water Regime Modifiers:

- A - Temporarily Flooded - Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season.
- B - Saturated - The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.
- C - Seasonally Flooded - Surface water is present for extended period especially early in the growing season, but is absent by the end of the season in most years.
- D - Seasonally Flooded/Well Drained - See above.

- E - Seasonally Flooded/Saturated - See above.
- F - Semipermanently Flooded - Surface water persists throughout the growing season in most years.
- G - Intermittently Exposed - Surface water is present throughout the year except in years of extreme drought.
- H - Permanently Flooded - Water covers the land surface throughout the year in all years.
- J - Intermittently Flooded - Surface water is present throughout the year except in years of extreme drought.
- K - Artificially Flooded - The amount and duration of flooding is controlled by means of pumps or siphons in combination with dikes or dams.
- W - Intermittently Flooded/Temporary - See above.
- Y - Saturated/Semipermanent/Seasonal - See above.
- Z - Intermittently Exposed/Permanent - See above.
- U - Unknown

Special Modifiers:

- d - Partially Drained/Ditched - The water level has been artificially lowered, but the area is still classified as wetland because soil moisture is sufficient to support hydrophytes. Drained areas are not considered wetland if they can no longer support hydrophytes.
- f - Farmed - The soil surface has been mechanically or physically altered for production of crops, but hydrophytes will become reestablished if farming is discontinued.
- h - Diked/Impounded - Created or modified by a man-made barrier or dike designed to obstruct the inflow of water.
- r - Artificial substrate - Refers to substrates classified as rock bottom, unconsolidated bottom, rocky shore, and unconsolidated shore that were deposited by man, using either natural materials such as dredge spoil or synthetic materials such as concrete.
- s - Spoil - Earth and rock excavated or dredged.
- x - Excavated - Lies within a basin or channel excavated by man.

APPENDIX 5 WRAP SUMMARY

This appendix includes a one-page summary for each of the 66 wetlands in the project area where WRAP was applied. Additional details are available about each wetland in the original field notes. The wetland number on each page corresponds with the site of the field visit shown in Figure 5. Refer to the Methods section of this report and Miller and Gunsalus (1997) for a detailed description of the field methodology and scoring procedures. Note that a number of the properties are identified as being owned by the MacArthur Foundation. Since the time of the fieldwork, these properties have been sold to Watermark Communities Inc., SFWMD, or a third party.

Wetland Number: 1

Property: Sandhill Crane Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: December 5, 1996

Assessment Team Members Present:

Boyd E. Gunsalus, SFWMD

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Gary N. Roderick, Martin County

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

NWI Wetland Classification: PEM1Fd - palustrine, emergent, persistent, semipermanently flooded, partially drained/ditched

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: agricultural - pasture

Wildlife Utilization: score = 2.5; observed sandhill cranes, great blue heron, boat-tailed grackles, heard numerous cricket frogs, saw numerous wildlife trails in wetland; cover lacking in adjacent upland

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; mostly natural but slightly impacted in some areas; pickeral weed along fence running through wetland

Adjacent Upland/Wetland Buffer: score = 1.5; 75% pasture > 300 ft; 25% natural > 300 ft; only a portion of the buffer contains desirable plant species

Exotic and Nuisance Plant Species: score = 2.5; few exotics in the wetland; adjacent uplands have Brazilian pepper and climbing fern

Field Indicators of Wetland Hydrology: score = 2.5; plants appear healthy; berms and swales nearby are probably altering natural hydrology

Water Quality Inputs and Treatment: score = 1.5; land use = 100% pasture; treatment = 60% grass swale and 40% berms; $.6 \times 1 + .4 \times 2.5 = 1.6$; $1.6 + 1 = 2.6$; $2.6 \div 2 = 1.3$, round up to 1.5

Overall WRAP Score: $(2.5 + 2.5 + 1.5 + 2.5 + 2.5 + 1.5) \div 6 = 0.72$

Wetland Number: 2

Property: Sandhill Crane Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: December 5, 1996

Assessment Team Members Present:

Boyd E. Gunsalus, SFWMD

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Gary N. Roderick, Martin County

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

NWI Wetland Classification: PEM1Ad - palustrine, emergent, persistent, temporarily flooded, partially drained/ditched

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: agricultural - pasture

Wildlife Utilization: score = 1.5; because of ditch there is no chance for drydown to concentrate fish; limited protective cover available for wildlife

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 1.5; outer area drained and has inappropriate species (wax myrtle, broomsedge); center has pickeral weed, spike rush, and sawgrass; muck soil

Adjacent Upland/Wetland Buffer: score = 1.5; buffer is > 300 ft; mostly inappropriate species

Exotic and Nuisance Plant Species: score = 2.5; limited Brazilian pepper in adjacent uplands; <15% exotics

Field Indicators of Wetland Hydrology: score = 1; ditch running through center of wetland

Water Quality Inputs and Treatment: score = 1; pasture-agriculture and grass swales

Overall WRAP Score: $(1.5 + 1.5 + 1.5 + 2.5 + 1 + 1) \div 6 = 0.5$

Wetland Number: 3

Property: Sandhill Crane Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: December 5, 1996

Assessment Team Members Present:

Boyd E. Gunsalus, SFWMD

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Gary N. Roderick, Martin County

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

NWI Wetland Classification: PEM1/FO2C - palustrine, emergent, persistent, forested, needle-leaved deciduous, seasonally flooded

FNAI Community Type: depression marsh/strand swamp

Soil Type: Rd - Riviera sand, depressional

Land Use: agricultural - unimproved

Wildlife Utilization: score = 2.5, raccoon tracks, cricket frog, crayfish, wolf spider

Wetland Overstory/Shrub Canopy: score = 2; overstory dominated by cypress and/or melaleuca in places; score reduced because of melaleuca

Vegetative Ground Cover: score = 2.5; algal mat in dry areas

Adjacent Upland/Wetland Buffer: score = 2.5; low density residential (Caloosa) on west side of wetland; natural on other sides >300 ft

Exotic and Nuisance Plant Species: score = 1.5; abundant large and small melaleuca trees; climbing fern in several patches

Field Indicators of Wetland Hydrology: score = 2.5; reduced because of nearby ditches

Water Quality Inputs and Treatment: score = 2.5; unimproved pasture score = 2; treatment score = 2.5 because the area is undeveloped with agriculture; $(2 + 2.5) \div 2 = 2.25$; round up to 2.5

Overall WRAP Score: $(2.5 + 2 + 2.5 + 2.5 + 1.5 + 2.5 + 2.5) \div 21 = 0.76$

Wetland Number: 4

Property: Sandhill Crane Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: December 5, 1996

Assessment Team Members Present:

Boyd E. Gunsalus, SFWMD

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Gary N. Roderick, Martin County

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: agricultural - unimproved

Wildlife Utilization: score = 3; observed great blue heron; heard numerous cricket frogs; adjacent upland and wetland appear relatively undisturbed; good cover availability

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 3; hypericum; wet prairie with marsh center

Adjacent Upland/Wetland Buffer: score = 3; all natural >300 ft

Exotic and Nuisance Plant Species: score = 2.5; mostly natural; a small number of melaleuca trees present

Field Indicators of Wetland Hydrology: score = 3; no ditching

Water Quality Inputs and Treatment: score = 2.5; unimproved pasture score = 2; treatment score = 2.5 because the area is undeveloped with agriculture; $(2 + 2.5) \div 2 = 2.25$; round up to 2.5

Overall WRAP Score: $(3 + 3 + 3 + 2.5 + 3 + 2.5) \div 18 = 0.94$

Wetland Number: 5

Property: Sandhill Crane Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: December 12, 1996

Assessment Team Members Present:

Tori Agramonte, COE
Steve Krupa, SFWMD
Peter G. Merritt, TCRPC
Raymond E. Miller, SFWMD
Terry Morgan, COE
Brad Rieck, USFWS
Richard E. Roberts, FDEP
Doug Strom, FDEP
Kevin Sullivan, USDA NRCS
John Wrublik, FGFWFC

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

FNAI Community Type: depression marsh/wet prairie

Soil Type: Rd - Riviera sand, depression

Land Use: agricultural - pasture

Wildlife Utilization: score = 1.5; minimal to moderate evidence of wildlife utilization; crayfish burrows, armadillo burrow, meadowlark heard singing, deer tracks, rabbit scat, warbler, blue-gray gnatcatcher

Wetland Overstory/Shrub Canopy: score = 1; few desirable species present; mostly wax myrtle

Vegetative Ground Cover: score = 2; slightly impacted ground cover which provides some functional habitat

Adjacent Upland/Wetland Buffer: score = 1.5; greater than 300 ft but primarily inappropriate species

Exotic and Nuisance Plant Species: score = 2; area displays less than 25% exotic and nuisance species; some melaleuca, Brazilian pepper, and climbing fern

Field Indicators of Wetland Hydrology: score = 1.5; hydrolic regime partially adequate to maintain a viable wetland system; wetland is ditched E-W and N-S; dikes along ditches

Water Quality Inputs and Treatment: score = 1; land use = 100% pasture; treatment = 100% grass swale; $(1+1) \div 2 = 1$

Overall WRAP Score: $(1.5 + 1 + 2 + 1.5 + 2 + 1.5 + 1) \div 7 = 1.5$

Wetland Number: 6

Property: Sandhill Crane Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: December 12, 1996

Assessment Team Members Present:

Tori Agramonte, COE
Steve Krupa, SFWMD
Peter G. Merritt, TCRPC
Raymond E. Miller, SFWMD
Terry Morgan, COE
Brad Rieck, USFWS
Richard E. Roberts, FDEP
Doug Strom, FDEP
Kevin Sullivan, USDA NRCS
John Wrublik, FGFWFC

NWI Wetland Classification: PEM1Ad - palustrine, emergent, persistent, temporarily flooded, partially drained/ditched

FNAI Community Type: depression marsh/wet prairie

Soil Type: Rd - Riviera sand, depresional

Land Use: agricultural - unimproved

Wildlife Utilization: score = 2; crayfish burrows, wildlife trails in wetlands, great blue heron, great egret, fire ant nest in tree, cricket frog

Wetland Overstory/Shrub Canopy: score = 1; few desirable canopy trees present; wetland full of wax myrtle; some pine

Vegetative Ground Cover: score = 2; vegetative ground cover slightly impacted, providing some functional habitat

Adjacent Upland/Wetland Buffer: score = 2; road to the south; adjacent area to west is natural; adjacent area to north and east is largely inappropriate due to agriculture

Exotic and Nuisance Plant Species: score = 2; Brazilian pepper, climbing fern; < 25% exotics

Field Indicators of Wetland Hydrology: score = 1; large ditch and berm bisects this wetland; swale near road may also be altering natural hydrology; hydrology inadequate to maintain a viable wetland

Water Quality Inputs and Treatment: score = 1.5; land use is 20% highway, 30% unimproved-ag, and 50% improved-ag; treatment is 70% grass swale and 30% natural; $(.2 \times 1) + (.3 \times 2) + (.5 \times 1) = 1.3$; $(.7 \times 1) + (.3 \times 3) = 1.6$; $(1.3 + 1.6) \div 2 = 1.5$

Overall WRAP Score: $(2 + 1 + 2 + 2 + 2 + 1 + 1.5) \div 21 = 0.55$

Wetland Number: 7

Property: Sandhill Crane Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: December 12, 1996

Assessment Team Members Present:

Tori Agramonte, COE
Steve Krupa, SFWMD
Peter G. Merritt, TCRPC
Raymond E. Miller, SFWMD
Terry Morgan, COE
Brad Rieck, USFWS
Richard E. Roberts, FDEP
Doug Strom, FDEP
Kevin Sullivan, USDA NRCS
John Wrublik, FGFWFC

NWI Wetland Classification: PEM1Ad - palustrine, emergent, persistent, temporarily flooded, partially drained/ditched

FNAI Community Type: depression marsh/wet prairie

Soil Type: Rd - Riviera sand, depressional

Land Use: agriculture - pasture

Wildlife Utilization: score = 2.5; strong evidence of wildlife utilization; observed white ibis, tree swallows, sandhill crane, black racer, cricket frog, crayfish, mosquito fish, least killifish, bobcat scat, shrimp, mayfly larvae, wildlife tracts

Wetland Overstory/Shrub Canopy: score = 2; moderate amount of desirable canopy species; some areas framing wax myrtle thicket; some cabbage palm and pine

Vegetative Ground Cover: score = 2; ground cover primarily appropriate native species; cow trails and berms and ditches have had some impact

Adjacent Upland/Wetland Buffer: score = 2; good natural buffer to the east; agricultural to the west includes a variety of undesirable species

Exotic and Nuisance Plant Species: score = 2.5; some Brazilian pepper, but not extensive

Field Indicators of Wetland Hydrology: score = 1.5; hydrology affected by berms and ditches; hydrologic regime partially adequate to maintain the system

Water Quality Inputs and Treatment: score = 1.5; land use is 25% unimproved pasture and 75% pasture; treatment is 25% natural and 75% grass swale; $(.25 \times 2) + (.75 \times 1) = 1.25$; $(.25 \times 3) + (.75 \times 1) = 1.5$; $(1.25 + 1.55) \div 2 = 1.4$; round up to 1.5

Overall WRAP Score: $(2.5 + 2 + 2 + 2 + 2.5 + 1.5 + 1.5) \div 21 = 0.67$

Wetland Number: 8

Property: Sandhill Crane Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: December 12, 1996

Assessment Team Members Present:

Tori Agramonte, COE
Steve Krupa, SFWMD
Peter G. Merritt, TCRPC
Raymond E. Miller, SFWMD
Terry Morgan, COE
Brad Rieck, USFWS
Richard E. Roberts, FDEP
Doug Strom, FDEP
Kevin Sullivan, USDA NRCS
John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/FO2C - palustrine, emergent, persistent, forested, needle-leaved deciduous, seasonally flooded

FNAI Community Type: dome swamp

Soil Type: Rd - Riviera sand, depressionnal

Land Use: agricultural - unimproved

Wildlife Utilization: score = 3; observed red-shouldered hawk, hairy woodpecker, crayfish, black racer, raccoon scat

Wetland Overstory/Shrub Canopy: score = 2.5; primarily desirable overstory dominated by cypress trees, but some wax myrtle invading.

Vegetative Ground Cover: score = 2.5; all native, some effects of drainage from nearby C-18 canal

Adjacent Upland/Wetland Buffer: score = 2.5; C-18 canal to the north, otherwise primarily desirable vegetation > 300 ft

Exotic and Nuisance Plant Species: score = 2.5; very small amount of melaleuca and climbing fern

Field Indicators of Wetland Hydrology: score = 2.0; wetland hydrology appears to be affected by C-18 canal to the north; no ditches, but wetland appears dryer than others away from the canal

Water Quality Inputs and Treatment: score = 1.5; land use is 100% unimproved pasture; treatment is 100% grass swale; $(2 + 1) \div 2 = 1.5$

Overall WRAP Score: $(3 + 2.5 + 2.5 + 2.5 + 2.5 + 2.0 + 1.5) \div 21 = 0.79$

Wetland Number: 9

Property: Sandhill Crane Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: December 12, 1996

Assessment Team Members Present:

Peter G. Merritt, TCRPC

Raymond E. Miller, SFWMD

Brad Rieck, USFWS

Richard E. Roberts, FDEP

Doug Strom, FDEP

Kevin Sullivan, USDA NRCS

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/FO2C - palustrine, emergent, persistent, forested, needle-leaved deciduous, seasonally flooded

FNAI Community Type: depression marsh/dome swamp

Soil Type: Rd - Riviera sand, depression

Land Use: agricultural-pasture

Wildlife Utilization: score = 2.5; observed white ibis, great egret, robins, raccoon tracks, green tree frog, crayfish, mosquitofish

Wetland Overstory/Shrub Canopy: score = 2.5; four small cypress heads within this wetland; primarily desirable species present, but some cypress heads had Brazilian pepper understory

Vegetative Ground Cover: score = 2.5; primarily all natural, but some areas of disturbance by cattle and a small ditch and berm

Adjacent Upland/Wetland Buffer: score = 1.5; largely inappropriate species in pasture > 300 ft

Exotic and Nuisance Plant Species: score = 2; < 25% exotic, mainly Brazilian pepper

Field Indicators of Wetland Hydrology: score = 2; several small ditches in wetland, large ditch and berm near wetland on east side; south end held more water, less disturbed

Water Quality Inputs and Treatment: score = 1; land use = 100% pasture; treatment = 100% grass swale; $(1 + 1) \div 2 = 1$

Overall WRAP Score: $(2.5 + 2.5 + 2.5 + 1.5 + 2 + 2 + 1) \div 21 = 0.67$

Wetland Number: 10

Property: Pal-Mar (MacArthur Foundation Parcel No. 37)

Date of Site Visit: January 16, 1997

Assessment Team Members Present:

David Ferrell, USFWS
Denise Janson, FDEP
Peter G. Merritt, TCRPC
Terry Morgan, COE
Brad Rieck, USFWS
Richard E. Roberts, FDEP
Kevin Sullivan, USDA NRCS
John Wrublik, FGFWFC
Alyssa Zahorcak, FDEP

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: depression marsh/wet prairie

Soil Type: Rd - Riviera sand, depression

Land Use: recreational/open space

Wildlife Utilization: score = 2.5; cricket frogs, great egret, sandhill cranes, turtle egg, small fish, woodstork, white ibis, king fisher, raccoon scat; reduced because next to development on one side

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; good variety of native species; some impacts from vehicles; slight to minimal impacts

Adjacent Upland/Wetland Buffer: score = 2.5; race track - 20% of perimeter (no buffer); 80% > 300 ft natural buffer

Exotic and Nuisance Plant Species: score = 2.5; very little melaleuca, some climbing fern

Field Indicators of Wetland Hydrology: score = 2.5; no ditching but berm on one side altering hydrology; hydrologic regime adequate

Water Quality Inputs and Treatment: score = 2.5; land use = 80% recreational/open and 20% highway; treatment = 80% natural and 20% no treatment, land use score = $(0.8 \times 3) + (0.2 \times 1) = 2.6$; treatment score = $(0.8 \times 3) + (0.2 \times 0) = 2.4$; $(2.6 + 2.4) \div 2 = 2.5$

Overall WRAP Score: $(2.5 + 2.5 + 2.5 + 2.5 + 2.5 + 2.5 + 2.5) \div 7 = 2.5$

Wetland Number: 11

Property: Pal-Mar (MacArthur Foundation Parcel No. 37)

Date of Site Visit: January 16, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Richard E. Roberts, FDEP

Kevin Sullivan, USDA NRCS

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: depression marsh

Soil Type: Rd/On - Riviera sand, depression/Okeelanta muck

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; >50 herons and white ibises; red-winged blackbirds, muskrat nests, numerous small fish, leopard frog, cricket frog, tree swallows

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 3.0; natural mix of native species; extensive vegetative ground cover with minimal disturbance

Adjacent Upland/Wetland Buffer: score = 3.0; >300 ft all natural

Exotic and Nuisance Plant Species: score = 3.0; no exotic species observed

Field Indicators of Wetland Hydrology: score = 3.0; no disturbances to hydrology observed

Water Quality Inputs and Treatment: score = 3.0; land use = recreational/open space;
Treatment Category = natural undeveloped; $(3 + 3) \div 2 = 3$

Overall WRAP Score: $(3.0 + 3.0 + 3.0 + 3.0 + 3.0 + 3.0) \div 18 = 1.0$

Wetland Number: 12

Property: Pal-Mar (MacArthur Foundation Parcel No. 37)

Date of Site Visit: January 16, 1997

Assessment Team Members Present:

David Ferrell, USFWS
Denise Janson, FDEP
Peter G. Merritt, TCRPC
Terry Morgan, COE
Brad Rieck, USFWS
Richard E. Roberts, FDEP
Kevin Sullivan, USDA NRCS
John Wrublik, FGFWFC
Alyssa Zahorcak, FDEP

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: depression marsh/wet prairie

Soil Type: Rd/On - Riviera sand, depressional/Okeelanta muck

Land Use: recreational/open space

Wildlife Utilization: score = 2.0; great blue heron, mosquito fish, killifish, white ibis, pig frog, frog eggs, apple snail, cricket frog

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.0; primarily appropriate native species, but is impacted by vehicles, ditches, nearby road

Adjacent Upland/Wetland Buffer: score = 2.0; 60% natural and 40% road; $(0.6 \times 3) + (0.4 \times 0) = 1.8$; round up to 2.0

Exotic and Nuisance Plant Species: score = 2.0; melaleuca, Brazilian pepper, climbing fern present; less than 25% exotics

Field Indicators of Wetland Hydrology: score = 2.0; culvert under road leading from wetland; ditch at north end of wetland; wetland being maintained

Water Quality Inputs and Treatment: score = 2.0; land use = 60% recreational/open space and 40% highway; treatment category = 60% natural and 40% grass swale only; $(0.6 \times 3) + (0.4 \times 1) = 2.2$; $(0.6 \times 3) + (0.4 \times 1) = 2.2$; $(2.2 + 2.2) \div 2 = 2.2$; round down to 2.0

Overall WRAP Score: $(2.0 + 2.0 + 2.0 + 2.0 + 2.0 + 2.0) \div 18 = 0.67$

Wetland Number: 13

Property: Pal-Mar (MacArthur Foundation Parcel No. 37)

Date of Site Visit: January 16, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Richard E. Roberts, FDEP

Kevin Sullivan, USDA NRCS

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

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

FNAI Community Type: wet flatwoods

Soil Type: Pd - Pineda sand

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; eastern coachwhip snake, palm warbler, tree swallows, crayfish

Wetland Overstory/Shrub Canopy: score = 2.0; pine overstory with wax myrtle understory, few signs of new canopy recruitment; few undesirable species

Vegetative Ground Cover: score = 2.5; mostly grasses and St. John's-wort; primarily appropriate native species

Adjacent Upland/Wetland Buffer: score = 2.5; 80% all natural and 20% highway; $(0.8 \times 3) + (0.2 \times 0) = 2.4$; round up to 2.5

Exotic and Nuisance Plant Species: score = 2.0; melaleuca thick near road, but mostly small trees; less than 25% exotics

Field Indicators of Wetland Hydrology: score = 2.0; deep ditch near road; road may be blocking natural flow; hydrology adequate to maintain wetland

Water Quality Inputs and Treatment: score = 2.5; land use = 80% natural and 20% highway; treatment category = 80% natural and 20% grass swale; $(0.8 \times 3) + (0.2 \times 1) = 2.6$; $(0.8 \times 3) + (0.2 \times 1) = 2.6$; $(2.6 + 2.6) \div 2 = 2.6$; round to 2.5

Overall WRAP Score: $(3.0 + 2.0 + 2.5 + 2.5 + 2.0 + 2.0 + 2.5) \div 7 = 0.79$

Wetland Number: 14

Property: Pal-Mar (MacArthur Foundation Parcel No. 37)

Date of Site Visit: January 23, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Richard E. Roberts, FDEP

Doug Strom, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, seasonally flooded

FNAI Community Type: wet prairie

Soil Type: Rd/Wa - Riviera sand, depressional/Wabasso fine sand

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; crayfish, killifish, wood storks, cricket frogs, palm warbler, pig frog, bobcat signs, osprey, red-shouldered hawk

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; variety of appropriate native species; slight impacts from melaleuca and vehicles

Adjacent Upland/Wetland Buffer: score = 2.5; buffer is primarily natural >300 ft but has some areas of melaleuca

Exotic and Nuisance Plant Species: score = 1.0; 25% to 50% of the area has melaleuca; serious invasion of melaleuca

Field Indicators of Wetland Hydrology: score = 3.0; no signs of alteration of natural hydroperiod

Water Quality Inputs and Treatment: score = 3.0; all natural areas surrounding the wetland

Overall WRAP Score: $(3.0 + 2.5 + 2.5 + 1.0 + 3.0 + 3.0) \div 18 = 0.83$

Wetland Number: 15

Property: Pal-Mar (MacArthur Foundation Parcel No. 37)

Date of Site Visit: January 23, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Richard E. Roberts, FDEP

Doug Strom, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; greater yellowlegs, sunfish, killifish, shrimp, anhinga, cricket frog, red-winged blackbirds, common yellow throat, tree swallows, catbird, pine warbler

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 3.0; variety of native species; disturbances minimal

Adjacent Upland/Wetland Buffer: score = 3.0; all natural > 300 ft

Exotic and Nuisance Plant Species: score = 2.5; a small amount of melaleuca near edge of wetland

Field Indicators of Wetland Hydrology: score = 3.0; no alterations to natural hydrology noted

Water Quality Inputs and Treatment: score = 3.0; all natural area surrounding the wetland

Overall WRAP Score: $(3.0 + 3.0 + 3.0 + 2.5 + 3.0 + 3.0) \div 6 = 0.97$

Wetland Number: 16

Property: Jupiter Farms (Hayne Lane)

Date of Site Visit: January 30, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

NWI Wetland Classification: PEM1Cd - palustrine, emergent, persistent, seasonally flooded, partially drained/ditched

FNAI Community Type: depression marsh/wet prairie

Soil Type: Rd - Riviera sand, depressionnal

Land Use: recreational/open space

Wildlife Utilization: score = 1.5; killdeer, tricolored heron, white-eyed vireo, blue-gray gnatcatcher, common yellowthroat, black racer, snipe, red-shouldered hawk, osprey, great egret, white ibis, green-backed heron, raccoon tracks; most species were seen flying over the wetland or were in the upland buffer; no fish

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 1.5; extensive vehicle impacts in parts of the wetland; small area of sawgrass

Adjacent Upland/Wetland Buffer: score = 2.0; buffer contains primarily desirable pine flatwoods species

Exotic and Nuisance Plant Species: score = 2.5; melaleuca, climbing fern, Brazilian pepper, Java plum; not extensive coverage of exotics, but potential for future invasion

Field Indicators of Wetland Hydrology: score = 2.0; appears to be drained by general lowering of the water table; no ditches connected to wetland

Water Quality Inputs and Treatment: score = 3.0; all natural drainage into wetland.

Overall WRAP Score: $(1.5 + 1.5 + 2.0 + 2.5 + 2.0 + 3.0) \div 6 = 0.69$

Wetland Number: 17

Property: Jupiter Farms (Randolph Siding Road)

Date of Site Visit: January 30, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

NWI Wetland Classification: PEM1/FO4Ad - palustrine, emergent, persistent/forested, needle-leaved evergreen, temporarily flooded, partially drained/ditched.

FNAI Community Type: cypress strand/wet flatwoods

Soil Type: Ra/Rd/Pd - Riviera sand/Riviera sand, depressionnal/Pineda sand

Land Use: low density residential

Wildlife Utilization: score = 0.5; only upland species observed; low potential for wetland dependent species

Wetland Overstory/Shrub Canopy: not applicable.

Vegetative Ground Cover: score = 2.5; remnant wetland species mixed with upland species

Adjacent Upland/Wetland Buffer: score = 1.0; many adjacent lots built on; road and back yards < 30 ft

Exotic and Nuisance Plant Species: score = 2.5; some Brazilian pepper; < 25% exotic species

Field Indicators of Wetland Hydrology: score = 1.0; few signs of hydrology; water table has been lowered to allow pines and other upland species to invade the wetland

Water Quality Inputs and Treatment: score = 2.0; land use category = low density residential; treatment category = 50% natural and 50% grass swales; $[2+(0.5 \times 3) + (0.5 \times 1)] \div 2 = 2$

Overall WRAP Score: $(0.5 + 2.5 + 2.5 + 1.0 + 2.5 + 1.0 + 2.0) \div 21 = 0.57$

Wetland Number: 18

Property: Jupiter Farms (Heagerty Drive)

Date of Site Visit: January 30, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

NWI Wetland Classification: PSS6/7C - palustrine, scrub-shrub, deciduous/evergreen, seasonally flooded

FNAI Community Type: depression marsh

Soil Type: On/Rd - Okeelanta muck/Riviera sand, depressional

Land Use: low density residential

Wildlife Utilization: score = 2.5; tadpoles, shrimp, crayfish, mosquito fish, apple snails, leopard frog, red-winged blackbirds, boat-tailed grackles, cricket frog

Wetland Overstory/Shrub Canopy: score = 2.0; willow, wax myrtle, maple, melaleuca; drainage impacts have allowed high level of wax myrtle and melaleuca in certain areas

Vegetative Ground Cover: score = 2.5; primarily appropriate species; large area of sawgrass and bullrush

Adjacent Upland/Wetland Buffer: score = 1.0; buffer averages < 30 ft; buffer has road, houses, and exotics

Exotic and Nuisance Plant Species: score = 2.0; Brazilian pepper, climbing fern, melaleuca, primrose willow; about 25% exotics

Field Indicators of Wetland Hydrology: score = 2.0; road through wetland is blocking flow to smaller parts of the wetland; adequate hydroperiod to maintain large part of wetland

Water Quality Inputs and Treatment: score = 1.5; land use category = low density residential; treatment category = grass swales; $(2 + 1) \div 2 = 1.5$

Overall WRAP Score: $(2.5 + 2.0 + 2.5 + 1.0 + 2.0 + 2.0 + 1.5) \div 7 = 0.64$

Wetland Number: 19

Property: Jupiter Farms (133 Drive)

Date of Site Visit: January 30, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

NWI Wetland Classification: PEM1Ad - palustrine, emergent, persistent, temporarily flooded, partially drained/ditched

FNAI Community Type: wet prairie

Soil Type: Rd - Riviera sand, depressionnal

Land Use: low density residential

Wildlife Utilization: score = 1.0; snipe; minimal opportunity for wildlife utilization

Wetland Overstory/Shrub Canopy: score = 1.0; pine and some melaleuca, mostly as a result of drainage; primarily inappropriate species.

Vegetative Ground Cover: score = 1.5; a large portion of the wetland now has upland and wetland species.

Adjacent Upland/Wetland Buffer: score = 2.0; melaleuca; less than 25% exotics

Exotic and Nuisance Plant Species: score = 2.0; melaleuca; < 25% exotics

Field Indicators of Wetland Hydrology: score = 0.5; part of wetland appears to have been dredged; hydrology not adequate to maintain the wetland.

Water Quality Inputs and Treatment: score = 1.5; land use category = low density residential; treatment category = grass swales; $(2 + 1) \div 2 = 1.5$

Overall WRAP Score: $(1.0 + 1.0 + 1.5 + 1.0 + 2.0 + 0.5 + 1.5) \div 7 = 1.21$

Wetland Number: 20

Property: Jupiter Farms (Whip-poor-will Trail)

Date of Site Visit: January 30, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

Alyssa Zahorcak, FDEP

NWI Wetland Classification: PSS6/EM1Cd - palustrine, scrub-shrub, deciduous/emergent, persistent, seasonally flooded, partially drained/ditched

FNAI Community Type: unable to determine because of extensive melaleuca coverage

Soil Type: Wn - Winder fine sand

Land Use: low density residential

Wildlife Utilization: score = 1.0; raccoon scat; minimal opportunity for wetland species to utilize this wetland

Wetland Overstory/Shrub Canopy: score = 0.5; few desirable species present; primarily melaleuca canopy

Vegetative Ground Cover: score = 0.5; some remnant wetland species; ground cover is severely impacted by melaleuca and over drainage

Adjacent Upland/Wetland Buffer: score = 0.5; buffer < 30 ft; road and residential property, exotic species

Exotic and Nuisance Plant Species: score = 0; dense stand of melaleuca; > 75% exotic species; also climbing fern, Australian pine, Brazilian pepper, and earleaf acacia

Field Indicators of Wetland Hydrology: score = 1.0; watermarks on melaleuca 4 inches above ground; area is close to C-18 Canal, which probably has some draining effect on this wetland; hydrology inadequate to maintain wetland

Water Quality Inputs and Treatment: score = 1.5; land use category = low density residential; treatment category = grass swales; $(2 + 1) \div 2 = 1.5$

Overall WRAP Score: $(1.0 + 0.5 + 0.5 + 0.5 + 0 + 1.0 + 1.5) \div 7 = 0.24$

Wetland Number: 21

Property: The Acreage (Unit 11)

Date of Site Visit: February 6, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/SS3Ad - palustrine, emergent, persistent/scrub-shrub, broad-leaved evergreen, temporarily flooded, partially drained/ditched

FNAI Community Type: wet prairie/depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 2.5; cricket frogs, raccoon scat, crayfish burrows, green tree frog, green-backed heron, great blue heron, red-winged blackbird, tricolored heron

Wetland Overstory/Shrub Canopy: score = 1.5; > 20% wax myrtle, some melaleuca and dahoon holly; large to moderate amount of inappropriate species - wax myrtle

Vegetative Ground Cover: score = 2.5; primarily appropriate native species

Adjacent Upland/Wetland Buffer: score = 2.5; primarily pine flatwoods; some disturbance by roads and exotic species

Exotic and Nuisance Plant Species: score = 2.0; melaleuca and Brazilian pepper < 25%

Field Indicators of Wetland Hydrology: score = 2.0; canals and roads in the area have altered the natural hydroperiod; hydrological effects of the roads and canals appear to have stabilized; hydrology appears to be adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 3.0; land use category = recreational/open space; Treatment category = natural undeveloped; the roads do not have swales and are traveled very little; $(3 + 3) \div 2 = 3$

Overall WRAP Score: $(2.5 + 1.5 + 2.5 + 2.5 + 2.0 + 2.0 + 3.0) \div 7 = 2.14$

Wetland Number: 22

Property: The Acreage (Unit 11)

Date of Site Visit: February 6, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/SS3Ad - palustrine, emergent, persistent/scrub-shrub, broad-leaved evergreen, temporarily flooded, partially drained/ditched

FNAI Community Type: wet prairie/depression marsh

Soil Type: Fa - Floridana fine sand

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; apple snails, mosquito fish, crayfish, raccoon tracks, cricket frog, wildlife trails, red-winged blackbird, snipe, killdeer

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; large sawgrass area and extensive cover of native species; roads are main impacts

Adjacent Upland/Wetland Buffer: score = 2.5; primarily pine flatwoods; roads are main impacts

Exotic and Nuisance Plant Species: score = 2.5; small amount of melaleuca and Brazilian pepper

Field Indicators of Wetland Hydrology: score = 2.0; canals and roads in the area have altered the natural hydroperiod; hydrological effects of the roads and canals appear to have stabilized; hydrology appears to be adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 3.0; land use category = recreational/open space; Treatment category = natural undeveloped; the roads do not have swales and are traveled very little; $(3 + 3) \div 2 = 3$

Overall WRAP Score: $(3.0 + 2.5 + 2.5 + 2.5 + 2.0 + 3.0) \div 6 = 0.86$

Wetland Number: 23

Property: The Acreage (Unit 11)

Date of Site Visit: February 6, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/SS3Ad - palustrine, emergent, persistent/scrub-shrub, broad-leaved evergreen, temporarily flooded, partially drained/ditched

FNAI Community Type: wet prairie/depression marsh

Soil Type: Rd - Riviera sand, depressionnal

Land Use: recreational/open space

Wildlife Utilization: score = 2.5; apple snails, crayfish burrows, cricket frogs, red-winged blackbirds, oak toad

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; primarily appropriate native species

Adjacent Upland/Wetland Buffer: score = 2.5; primarily pine flatwoods; some disturbance by roads and exotic species

Exotic and Nuisance Plant Species: score = 2.5; melaleuca and Brazilian pepper < 25%

Field Indicators of Wetland Hydrology: score = 2.5; canals and roads in the area have altered the natural hydroperiod; hydrological effects of the roads and canals appear to have stabilized; hydrology appears to be adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 3.0; land use category = recreational/open space; Treatment category = natural undeveloped; the roads do not have swales and are traveled very little; $(3 + 3) \div 2 = 3$

Overall WRAP Score: $(2.5 + 2.5 + 2.5 + 2.5 + 2.0 + 3.0) \div 18 = 0.83$

Wetland Number: 24

Property: The Acreage (Unit 11)

Date of Site Visit: February 6, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Terry Morgan, COE

Brad Rieck, USFWS

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM/SS1Ad - palustrine, emergent, persistent/scrub-shrub, broad-leaved deciduous, temporarily flooded, partially drained/ditched

FNAI Community Type: wet prairie/depression marsh

Soil Type: Rd/Ta - Riviera sand, depressional/Tequesta muck

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; alligator, great blue heron, mottled ducks, crayfish, apple snails, raccoon scat, turtle eggs, kingfisher

Wetland Overstory/Shrub Canopy: score = 1.5; excessive amount of wax myrtle, desirable but not appropriate

Vegetative Ground Cover: score = 2.5; primarily appropriate native species

Adjacent Upland/Wetland Buffer: score = 2.5; primarily pine flatwoods; some disturbance by roads and exotic species

Exotic and Nuisance Plant Species: score = 2.0; melaleuca and Brazilian pepper < 25%

Field Indicators of Wetland Hydrology: score = 2.0; canals and roads in the area have altered the natural hydroperiod; hydrological effects of the roads and canals appear to have stabilized; hydrology appears to be adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 3.0; land use category = recreational/open space; Treatment category = natural undeveloped; the roads do not have swales and are traveled very little; $(3 + 3) \div 2 = 3$

Overall WRAP Score: $(3.0 + 1.5 + 2.5 + 2.5 + 2.0 + 1.5 + 3.0) \div 7 = 2.14$

Wetland Number: 25

Property: MacArthur Foundation Parcel No. 19

Date of Site Visit: February 20, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PSS6Cd - palustrine, scrub-shrub, deciduous, seasonally flooded, partially drained/ditched

FNAI Community Type: dome swamp

Soil Type: Ta - Tequesta muck

Land Use: agricultural - pasture

Wildlife Utilization: score = 1.5; no fish, eastern phoebe, blue-gray gnatcatcher, painted bunting, green-backed heron; minimal to moderate potential for wildlife utilization

Wetland Overstory/Shrub Canopy: score = 1.5; cypress ring around central part of wetland; willow and wax myrtle in center; Brazilian pepper dominates outer part of wetland; few to moderate amount of desirable species

Vegetative Ground Cover: score = 1.5; variety of species in central portion of wetland; impacted by ditches and exotic vegetation

Adjacent Upland/Wetland Buffer: score = 0.5; extensive Brazilian pepper and open pasture; no native buffer

Exotic and Nuisance Plant Species: score = 1.0; area has 25-50% exotics; climbing fern, primrose willow; Brazilian pepper, Java plum, strawberry guava

Field Indicators of Wetland Hydrology: score = 1.0; ditches all around wetland; hydrology inadequate to maintain portions of the wetland

Water Quality Inputs and Treatment: score = 2.0; land use category = pasture; treatment category = berm; $(1 + 2.5) \div 2 = 1.75$; round up to 2.0

Overall WRAP Score: $(1.5 + 1.5 + 1.5 + 0.5 + 1.0 + 1.0 + 2.0) \div 7 = 1.43$

Wetland Number: 26

Property: MacArthur Foundation Parcel No. 19

Date of Site Visit: February 20, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PSS6C - palustrine, scrub-shrub, deciduous, seasonally flooded

FNAI Community Type: strand swamp

Soil Type: Rd - Riviera sand, depressional

Land Use: agricultural - pasture

Wildlife Utilization: score = 2.5; cricket frogs, small fish, snipe, wood ducks, great egret, rabbit scat; trails from pigs and cattle; adjacent road has negative affect on wildlife potential

Wetland Overstory/Shrub Canopy: score = 2.5; many small cypress throughout; moderate to abundant desirable species

Vegetative Ground Cover: score = 2.5; abundant amount of desirable species; some impacts by cattle

Adjacent Upland/Wetland Buffer: score = 1.0; pine flatwoods 30 - 300 ft; many exotics, including Australian pine, melaleuca, climbing fern

Exotic and Nuisance Plant Species: score = 2.5; most of the exotics are in the buffer, not the wetland; small amount of melaleuca in wetland

Field Indicators of Wetland Hydrology: score = 2.5; appears adequate to maintain wetland; nearby road has some affects

Water Quality Inputs and Treatment: score = 1.0; land use category = pasture; treatment category = grass swales only; $(1 + 1) \div 2 = 1$

Overall WRAP Score: $(2.5 + 2.5 + 2.5 + 1.0 + 2.5 + 2.5 + 1.0) \div 7 = 2.14$

Wetland Number: 27

Property: MacArthur Foundation Parcel No. 19

Date of Site Visit: February 20, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/FO6F - palustrine, emergent, persistent/forested, deciduous, semipermanently flooded

FNAI Community Type: depression marsh/strand swamp

Soil Type: Rd - Riviera sand, depression

Land Use: recreational/open space

Wildlife Utilization: score = 2.5; small fish; cricket frog, red-shouldered hawk, scratch marks on tree; strong potential for wildlife utilization, but area is separated from other major wildlife areas

Wetland Overstory/Shrub Canopy: score = 2.5; pine flatwoods > 300 ft; has some melaleuca in buffer

Vegetative Ground Cover: score = 3.0; essentially all natural

Adjacent Upland/Wetland Buffer: score = 2.5; pine flatwoods > 300 ft; has some melaleuca in buffer

Exotic and Nuisance Plant Species: score = 2.5; melaleuca, climbing fern, downy myrtle; < 10% exotic vegetation

Field Indicators of Wetland Hydrology: score = 2.5; hydrology appears adequate to maintain the wetland, but nearby C-18 canal probably has some drawdown effects

Water Quality Inputs and Treatment: score = 3.0; all natural surrounding the wetland

Overall WRAP Score: $(2.5 + 2.5 + 3 + 2.5 + 2.5 + 2.5 + 3) \div 21 = 0.88$

Wetland Number: 28

Property: MacArthur Foundation Parcel No. 19

Date of Site Visit: February 20, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PF06F - palustrine, forested, deciduous, semipermanently flooded

FNAI Community Type: dome swamp/strand swamp

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 2.5; heron feathers, small fish, cricket frog; strong potential for wildlife utilization, but area is separated from other major wildlife areas

Wetland Overstory/Shrub Canopy: score = 2.5; abundant cypress with small amount of melaleuca

Vegetative Ground Cover: score = 3.0; essentially all natural

Adjacent Upland/Wetland Buffer: score = 2.5; 25% backyards and canal buffer; > 300 ft of pine flatwoods in 75% of the buffer

Exotic and Nuisance Plant Species: score = 2.5; melaleuca and climbing fern; < 10% in wetland

Field Indicators of Wetland Hydrology: score = 2.5; hydrology appears adequate, but C-18 canal probably has some drawdown effects

Water Quality Inputs and Treatment: score = 2.5; land use category = 25% single family residential, 75% recreational/open space; treatment category = 25% grass swales only, 75% natural undeveloped; $(0.25 \times 1.5) + (0.75 \times 3) = 2.63$; $(0.25 \times 1) + (0.75 \times 3) = 2.5$; $(2.63 + 2.5) \div 2 = 2.57$; rounded to 2.5

Overall WRAP Score: $(2.5 + 2.5 + 3.0 + 2.5 + 2.5 + 2.5 + 2.5) \div 7 = 2.5$

Wetland Number: 29

Property: Loxahatchee Slough Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: February 27, 1997

Assessment Team Members Present:

David K. Gillings, Palm Beach County DERM

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Doug Strom, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PSS6/EM1F - palustrine, scrub-shrub, deciduous/emergent, persistent, semipermanently flooded

FNAI Community Type: strand swamp/basin marsh

Soil Type: Wn - Winder fine sand

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; rough green snake, wildlife trails, crayfish, deer scat, eastern phoebe, red-shouldered hawk, small fish, many invertebrates, green treefrog; strong evidence of wildlife utilization

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; ground cover is primarily appropriate native species

Adjacent Upland/Wetland Buffer: score = 2.5; hammock on east side; some exotic vegetation in buffer; primarily natural buffer > 300, but road impacts buffer on north side of wetland

Exotic and Nuisance Plant Species: score = 2.0; scattered melaleuca, some primrose willow; some cattail; < 25% exotic species

Field Indicators of Wetland Hydrology: score = 2.5; hydrology adequate to maintain the wetland; nearby road probably affects hydrology

Water Quality Inputs and Treatment: score = 2.5; land use category = 25% highway and 75% recreational/open space; treatment category = 25% grass swale only and 75% natural undeveloped area; $(0.25 \times 1) + (0.75 \times 3) = 2.5$; $(0.25 \times 1) + (0.75 \times 3) = 2.5$; $(2.5 + 2.5) \div 2 = 2.5$

Overall WRAP Score: $(3.0 + 2.5 + 2.5 + 2.0 + 2.5 + 2.5) \div 6 = 2.5$

Wetland Number: 30

Property: Loxahatchee Slough Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: February 27, 1997

Assessment Team Members Present:

David K. Gillings, Palm Beach County DERM

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Doug Strom, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/SS6F - palustrine, emergent, persistent/scrub-shrub, deciduous, semipermanently flooded

FNAI Community Type: basin marsh

Soil Type: Wn - Winder fine sand

Land Use: recreational/open space

Wildlife Utilization: score = 2.0; apple snail, bobcat scat, raccoon tracts, box turtle shell, crayfish burrows, red-tailed hawk; drainage of part of the wetland has reduced the potential for abundant wildlife usage

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; primarily appropriate native species; band around wetland with reduced ground cover due to drainage

Adjacent Upland/Wetland Buffer: score = 2.5; > 300 ft; primarily pine flatwoods and other wetlands with some melaleuca and Australian pine

Exotic and Nuisance Plant Species: score = 2.0; melaleuca, climbing fern, < 25% exotic vegetation

Field Indicators of Wetland Hydrology: score = 1.5; ditch on northeast side draining the wetland; water flowing out of wetland to ditch; hydrology only partially adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 3.0; all natural areas draining into the wetland

Overall WRAP Score: $(2.0 + 2.5 + 2.5 + 2.0 + 1.5 + 3.0) \div 6 = 2.5$

Wetland Number: 31

Property: Loxahatchee Slough Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: February 27, 1997

Assessment Team Members Present:

David K. Gillings, Palm Beach County DERM

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Doug Strom, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/SS6F - palustrine, emergent, persistent/scrub-shrub, deciduous, semipermanently flooded

FNAI Community Type: basin marsh

Soil Type: Wn - Winder fine sand

Land Use: recreational/open space

Wildlife Utilization: score = 2.0; apple snail, clams, killdeer, cricket frogs, bobcat scat, crayfish burrows; wildlife potential reduced by proximity to road and by drainage

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.0; extensive algal mat, scattered melaleuca, disturbances from drainage and road side swale

Adjacent Upland/Wetland Buffer: score = 2.0; buffer is 30-300 ft; impacted by road on one side; melaleuca and Australian pine in buffer

Exotic and Nuisance Plant Species: score = 2.0; melaleuca and Australian pine; < 25% exotic vegetation

Field Indicators of Wetland Hydrology: score = 1.5; ditch on east side of wetland; roadside swale on north side of wetland; hydrology only partially adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 2.5; land use category = 33% highway and 67% recreational/open space; treatment category = 33% grass swale only and 67% natural undeveloped area; $(0.33 \times 1) + (0.67 \times 3) = 2.34$; $(2.34 + 2.34) \div 2 = 2.34$; rounded to 2.5

Overall WRAP Score: $(2.0 + 2.0 + 2.0 + 2.0 + 1.5 + 2.5) \div 18 = 0.67$

Wetland Number: 32

Property: Loxahatchee Slough Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: February 27, 1997

Assessment Team Members Present:

David K. Gillings, Palm Beach County DERM

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Doug Strom, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: basin marsh

Soil Type: Wn - Winder fine sand

Land Use: agricultural/open space

Wildlife Utilization: score = 3.0; apple snail, small fish, grass shrimp, great egret, cricket frog, raccoon tracks, wildlife trails, crayfish burrows, oak toad; strong evidence of wildlife utilization

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; primarily appropriate native species; some melaleuca

Adjacent Upland/Wetland Buffer: score = 2.5; Australian pine, melaleuca in some locations; > 300 ft except for side near road

Exotic and Nuisance Plant Species: score = 2.5; melaleuca is less than 10%

Field Indicators of Wetland Hydrology: score = 3.0; no negative impacts noted; roadside swale separated from wetland by a berm

Water Quality Inputs and Treatment: score = 2.5; land use category = 25% highway and 75% recreational/open space; treatment category = 25% berm and 75% natural undeveloped area; $(0.25 \times 1) + (0.75 \times 3) = 2.5$; $(0.25 \times 2.5) + (0.75 \times 3) = 2.875$; $(2.5 + 2.875) \div 2 = 2.69$; round to 2.5

Overall WRAP Score: $(3.0 + 2.5 + 2.5 + 2.5 + 3.0 + 2.5) \div 18 = 0.89$

Wetland Number: 33

Property: Loxahatchee Slough Addition (MacArthur Foundation Parcel No. 18)

Date of Site Visit: February 27, 1997

Assessment Team Members Present:

David K. Gillings, Palm Beach County DERM

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Doug Strom, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PSS6/EM1F - palustrine, scrub-shrub, deciduous/emergent, persistent, semipermanently flooded

FNAI Community Type: strand swamp

Soil Type: Wn - Winder fine sand

Land Use: recreational/open space

Wildlife Utilization: score = 2.5; small fish, numerous insects, green anole, wildlife trails; difficult to see wildlife because of heavy tree growth; moderate to strong potential for wildlife utilization

Wetland Overstory/Shrub Canopy: score = 1.5; wax myrtle, willow, cypress, melaleuca; large amounts of undesirable species in portions of the wetland; drainage impacts have allowed melaleuca and wax myrtle dominate certain areas

Vegetative Ground Cover: score = 2.0; primarily appropriate native species, but some areas affected by heavy melaleuca coverage

Adjacent Upland/Wetland Buffer: score = 1.5; road on one side and filled area to the southeast; buffer is 30-300 ft but contains significant melaleuca

Exotic and Nuisance Plant Species: score = 1.0; Brazilian pepper, melaleuca, climbing fern; 25-50% exotic species

Field Indicators of Wetland Hydrology: score = 2.0; hydrology altered by road, culverts, small ditches, and fill in buffer area to the southeast; hydrology adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 2.5; land use category = 25% highway and 75% recreational/open space; treatment category = 25% grass swale only and 75% natural undeveloped area; $(0.25 \times 1) + (0.75 \times 3) = 2.5$; $2.5 + 2.5 \div 2 = 2.5$

Overall WRAP Score: $(2.5 + 1.5 + 2.0 + 1.5 + 1.0 + 2.0 + 2.5) \div 7 = 0.62$

Wetland Number: 34

Property: Cypress Creek Area (MacArthur Foundation Parcel No. 20)

Date of Site Visit: March 6, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PF06C - palustrine, forested, deciduous, seasonally flooded

FNAI Community Type: strand swamp

Soil Type: Rd - Riviera sand, depressional

Land Use: agricultural - unimproved pasture

Wildlife Utilization: score = 1.5; ribbon snake, green-backed heron, armadillo, pigs; no fish; minimal evidence of wildlife utilization

Wetland Overstory/Shrub Canopy: score = 1.5; primarily cypress; large amounts of climbing fern in canopy and strawberry guava in understory

Vegetative Ground Cover: score = 1.0; vegetative ground cover extensively impacted and dominated by large amounts of inappropriate plant species

Adjacent Upland/Wetland Buffer: score = 2.5; > 300 ft primarily pine flatwoods with some exotic vegetation; road in eastern side of buffer

Exotic and Nuisance Plant Species: score = 0.5; 50-75% exotic vegetation infestation; abundant climbing fern and strawberry guava; some melaleuca and Australian pine

Field Indicators of Wetland Hydrology: score = 1.0; ditch in wetland; berm blocking flow on west side of wetland; no signs of flooding; hydrology inadequate to maintain a viable wetland

Water Quality Inputs and Treatment: score = 2.5; land use category = unimproved pasture; treatment category = natural undeveloped areas; $(2 + 3) \div 2 = 2.5$

Overall WRAP Score: $(1.5 + 1.5 + 1.0 + 2.5 + 0.5 + 1.0 + 2.5) \div 7 = 1.5$

Wetland Number: 35

Property: Cypress Creek Area (MacArthur Foundation Parcel No. 20)

Date of Site Visit: March 6, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/F06Cd - palustrine, emergent, persistent/forested, deciduous, seasonally flooded, partially drained/ditched

FNAI Community Type: strand swamp

Soil Type: Rd - Riviera sand, depressional

Land Use: agricultural - unimproved pasture

Wildlife Utilization: score = 2.0; crayfish burrows, rabbit scat, scratch marks on tree, apple snail eggs; moderate potential for wildlife utilization

Wetland Overstory/Shrub Canopy: score = 1.5; cypress, wax myrtle; few to moderate amount of desirable species; climbing fern in canopy

Vegetative Ground Cover: score = 2.0; vegetative ground cover slightly impacted; primarily appropriate native species

Adjacent Upland/Wetland Buffer: score = 2.5; > 300 ft primarily desirable plant species, but with some exotics

Exotic and Nuisance Plant Species: score = 1.0; 25-50% of area with climbing fern and strawberry guava; old citrus in wetland

Field Indicators of Wetland Hydrology: score = 1.5; major ditch extending through a portion of the wetland; hydrology only partially adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 2.5; land use category = unimproved pasture; treatment category - natural undeveloped areas; $(2 + 3) \div 2 = 2.5$

Overall WRAP Score: $(2.0 + 1.5 + 2.0 + 2.5 + 1.0 + 1.5 + 2.5) \div 7 = 1.86$

Wetland Number: 36

Property: Cypress Creek Area (MacArthur Foundation Parcel No. 20)

Date of Site Visit: March 6, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; sandhill crane nest with egg, otter scat, frog eggs, muskrat nest, small fish, common yellowthroat, red-shouldered hawk; strong evidence of wildlife utilization

Wetland Overstory/Shrub Canopy: Not applicable

Vegetative Ground Cover: score = 3.0; sawgrass center; vegetative ground cover is extensive with minimal disturbances; old fire lane, wire and poles, and fence cut through wetland, but these impacts are so minimal that the vegetation does not show signs of significant alteration

Adjacent Upland/Wetland Buffer: score = 3.0; pine flatwoods, oaks; > 300 ft; predominantly desirable species; small amount of climbing fern and strawberry guava in buffer

Exotic and Nuisance Plant Species: score = 3.0; no exotics in wetland

Field Indicators of Wetland Hydrology: score = 3.0; water level adequate to maintain the wetland; no apparent impacts

Water Quality Inputs and Treatment: score = 3.0; all natural areas drain into the wetland

Overall WRAP Score: $(3.0 + 3.0 + 3.0 + 3.0 + 3.0) \div 18 = 1.0$

Wetland Number: 37

Property: Cypress Creek Area (MacArthur Foundation Parcel No. 20)

Date of Site Visit: March 6, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depression

Land Use: recreational/open space/unimproved pasture

Wildlife Utilization: score = 3.0; great egret, numerous muskrat nests, sandhill crane, little blue heron, cricket frog, crayfish burrows, small fish, frog eggs; strong evidence of wildlife utilization

Wetland Overstory/Shrub Canopy: Not applicable

Vegetative Ground Cover: score = 2.5; primarily appropriate native species; center of wetland is all pickerelweed with some open water, suggesting some previous disturbance

Adjacent Upland/Wetland Buffer: score = 2.0; 30-300 ft; road to the east and unimproved pasture to the north of the wetland; remainder of buffer contains primarily desirable species

Exotic and Nuisance Plant Species: score = 3.0; small amount of primrose willow in wetland; no exotic species

Field Indicators of Wetland Hydrology: score = 2.5; open area in center of wetland may have been created for cattle; road and berm on east side affect hydrology; hydrology adequate to maintain wetland

Water Quality Inputs and Treatment: score = 2.5; land use category = 50% recreational and open space ($0.5 \times 3 = 1.5$) and 50% unimproved pasture ($0.5 \times 2 = 1$); treatment category = 50% natural undeveloped areas ($0.5 \times 3 = 1.5$), 30% berm ($0.3 \times 2.5 = 0.75$), and 20% grass swale ($0.20 \times 1 = 0.2$); $(1.5 + 1 + 1.5 + 0.75 + 0.2) \div 2 = 2.47$; round up to 2.5

Overall WRAP Score: $(3.0 + 2.5 + 2.0 + 3.0 + 2.5 + 2.5) \div 6 = 0.86$

Wetland Number: 38

Property: Cypress Creek Area (MacArthur Foundation Parcel No. 20)

Date of Site Visit: March 6, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Richard E. Roberts, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PFO2/EM1F - palustrine, forested, needle-leaved deciduous/emergent, persistent, semipermanently flooded

FNAI Community Type: dome swamp/depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 2.0; white ibis, wood duck, apple snails, cricket frogs, small fish; abundant Australian pine in portion of the buffer reduces the wildlife value; moderate potential for wildlife usage

Wetland Overstory/Shrub Canopy: score = 3.0; the portion of the wetland with a cypress canopy appears all natural

Vegetative Ground Cover: score = 2.0; primarily appropriate native species in 75% of the wetland; Australian pine has shaded out vegetation in 25% of the wetland; > 300 ft buffer

Adjacent Upland/Wetland Buffer: score = 1.5; 50% Australian pine and 50% appropriate species; extensive impact by Australian pine

Exotic and Nuisance Plant Species: score = 2.0; climbing fern and Australian pine in edges of the wetland; < 25% exotic species in wetland; most of the exotics are in the buffer

Field Indicators of Wetland Hydrology: score = 2.5; ditch on east side of wetland in buffer; wetland appears to exhibit adequate hydroperiod

Water Quality Inputs and Treatment: score = 3.0; land use category = recreational/open space (3.0); treatment category = 50% natural undeveloped area ($0.5 \times 3 = 1.5$) and 50% berm ($0.5 \times 2.5 = 1.25$); $(3.0 + 1.5 + 1.25) \div 2 = 2.875$; round up to 3.0

Overall WRAP Score: $(2.0 + 3.0 + 2.0 + 1.5 + 2.0 + 2.5 + 3.0) \div 7 = 2.36$

Wetland Number: 39

Property: Cypress Creek Area (MacArthur Foundation Parcel No. 20)

Date of Site Visit: March 13, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Peter G. Merritt, TCRPC

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depression

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; otter scat with crayfish remains, crayfish burrows, small fish, 2 box turtles on island in wetland, apple snail eggs, wildlife trails, cricket frog, raccoon tracks, leopard frog, snipe, partial sandhill crane nest; strong evidence of wildlife utilization

Wetland Overstory/Shrub Canopy: Not applicable

Vegetative Ground Cover: score = 3.0; clear zonation of vegetation; extensive ground cover with minimal disturbance

Adjacent Upland/Wetland Buffer: score = 2.5; < 10% Australian pine and melaleuca in buffer; road in buffer on north side; buffer is primarily desirable species and extends > 300 ft

Exotic and Nuisance Plant Species: score = 3.0; no exotics in wetland, only in the buffer

Field Indicators of Wetland Hydrology: score = 3.0; berm and ditch on side near road but no detectable negative affects on the wetland; hydrology adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 3.0; land use category - recreational and open space (3.0); treatment category = $(3.0 + 2.4 + 0.5) \div 2 = 2.95$; round up to 3.0

Overall WRAP Score: $(3.0 + 3.0 + 2.5 + 3.0 + 3.0 + 3.0) \div 6 = 2.92$

Wetland Number: 40

Property: Cypress Creek Area (MacArthur Foundation Parcel No. 20)

Date of Site Visit: March 13, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Peter G. Merritt, TCRPC

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/SS6C - palustrine, emergent, persistent/scrub-shrub, deciduous, seasonally flooded

FNAI Community Type: depression marsh

Soil Type: Rd/Ta - Riviera sand, depressional/Tequesta muck

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; cricket frog, otter scat with crayfish remains, grass shrimp, muskrat nests, small fish, wildlife trails; strong evidence of wildlife utilization

Wetland Overstory/Shrub Canopy: Not applicable

Vegetative Ground Cover: score = 3.0; ground cover is extensive with minimal disturbances

Adjacent Upland/Wetland Buffer: score = 2.5; > 300 ft containing predominantly desirable plant species; some areas with Australian pine

Exotic and Nuisance Plant Species: score = 2.5; one melaleuca tree observed

Field Indicators of Wetland Hydrology: score = 2.5; small ditch on east side appears to be draining the wetland a small amount

Water Quality Inputs and Treatment: score = 3.0; land use category - recreational/open space (3.0); treatment category - natural undeveloped areas (3.0); $(3.0 + 3.0) \div 2 = 3.0$

Overall WRAP Score: $(3.0 + 3.0 + 2.5 + 2.5 + 2.5 + 3.0) \div 6 = 0.92$

Wetland Number: 41

Property: Cypress Creek Area (MacArthur Foundation Parcel No. 20)

Date of Site Visit: March 13, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Peter G. Merritt, TCRPC

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 2.5; cricket frog, small fish, great blue heron, sandhill crane nests, muskrat nests; strong evidence of wildlife utilization, but adjacent road has a negative effect on wildlife

Wetland Overstory/Shrub Canopy: Not applicable

Vegetative Ground Cover: score = 3.0; ground cover is extensive with minimal disturbances

Adjacent Upland/Wetland Buffer: score = 2.0; 30 - 300 ft primarily pine flatwoods; road in one third of the buffer; Australian pine in parts of the buffer

Exotic and Nuisance Plant Species: score = 2.5; < 10% melaleuca and Australian pine

Field Indicators of Wetland Hydrology: score = 2.0; ditch and berm on north side; road on western side of wetland; hydrology appears adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 2.0; land use category = 66% recreational open space ($0.6 \times 3.0 = 2.0$) and 33% highway ($0.33 \times 1.0 = 0.33$); treatment category = 33% berm ($0.33 \times 2.5 = 0.83$), 33% grass swale ($0.33 \times 1.0 = 0.33$), and 33% natural undeveloped areas ($0.33 \times 3.0 = 1.0$); $(2.0 + 0.33 + 0.83 + 0.33 + 1.0) \div 2 = 2.24$; round down to 2.0

Overall WRAP Score: $(2.5 + 3.0 + 2.0 + 2.5 + 2.0 + 2.0) \div 6 = 0.78$

Wetland Number: 42

Property: Cypress Creek Area (MacArthur Foundation Parcel No. 20)

Date of Site Visit: March 13, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Peter G. Merritt, TCRPC

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/F06/3F - palustrine, emergent, persistent/forested, deciduous/broad-leaved evergreen, semipermanently flooded

FNAI Community Type: depression marsh/dome swamp

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; cricket frog, great blue heron, small fish; strong potential for wildlife utilization

Wetland Overstory/Shrub Canopy: Not applicable; central portion of wetland has cypress and bay; < 20% coverage

Vegetative Ground Cover: score = 3.0; ground cover extensive with minimal disturbances

Adjacent Upland/Wetland Buffer: score = 3.0; > 300 ft all natural pine flatwoods

Exotic and Nuisance Plant Species: score = 2.5; climbing fern located in cypress dome in the center of the wetland; < 10% coverage

Field Indicators of Wetland Hydrology: score = 3.0; hydrology adequate; no impacts observed

Water Quality Inputs and Treatment: score = 3.0; land use category - recreational/open space (3.0); treatment category - natural undeveloped areas (3.0); $(3.0 + 3.0) \div 2 = 3.0$

Overall WRAP Score: $(3.0 + 3.0 + 3.0 + 2.5 + 3.0 + 3.0) \div 6 = 0.97$

Wetland Number: 43

Property: Loxahatchee Slough

Date of Site Visit: April 17, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Cheryl McKee, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

Richard E. Roberts, FDEP

Kevin Sullivan, USDA NRCS

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/FO6F - palustrine, emergent, persistent, forested, deciduous, semipermanently flooded

FNAI Community Type: slough

Soil Type: Wn - Winder fine sand

Land Use: recreational/open space

Wildlife Utilization: score = 2.5; small fish, cricket frog, rabbit scat, red-winged blackbird, crayfish, burrows, large bird nest, wildlife tracks; effects of nearby canal reduces wildlife value

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; some offroad vehicle tracks; ground cover is slightly impacted and provides some functional habitat

Adjacent Upland/Wetland Buffer: score = 2.5; pine flatwoods to the west; Australian pine in buffer along canal to the east; small amount of climbing fern; buffer is >300 ft and all natural to north, west and south

Exotic and Nuisance Plant Species: score = 2.5; some climbing fern, Australian pine and melaleuca; area has less than 25% exotic species

Field Indicators of Wetland Hydrology: score = 2.0; water 1 ft deep; water flowing to the north; C-18 canal nearby affects hydrology

Water Quality Inputs and Treatment: score = 3.0; land use category = recreational/open space (3.0); treatment category = 75% natural ($0.75 \times 3.0 = 2.25$) and 25% bermed ($0.25 \times 2.5 = 0.56$); $(3.0 + 2.25 + 0.56) \div 2 = 2.91$; round up to 3.0

Overall WRAP Score: $(2.5 + 2.5 + 2.5 + 2.5 + 2.0 + 3.0) \div 6 = 0.83$

Wetland Number: 44

Property: Hungryland Slough

Date of Site Visit: April 17, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Cheryl McKee, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

Richard E. Roberts, FDEP

Kevin Sullivan, USDA NRCS

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/SS6C - palustrine, emergent, persistent, scrub-shrub, deciduous, seasonally flooded

FNAI Community Type: slough

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; apple snail eggs, cricket frog, small fish, bass, great blue heron, animal trails, high numbers of fish, great-crested flycatcher, pine warbler, grass shrimp, mosquito fish

Wetland Overstory/Shrub Canopy: score = 3.0; primarily small scrubby cypress trees with some wax myrtle; abundant amount of desirable species

Vegetative Ground Cover: score = 3.0; ground cover is extensive with minimal disturbances

Adjacent Upland/Wetland Buffer: score = 3.0; pine flatwoods and wetlands; buffer > 300 ft containing predominantly desirable species

Exotic and Nuisance Plant Species: score = 2.5; area displays less than 25% exotic and nuisance species; one melaleuca tree

Field Indicators of Wetland Hydrology: score = 3.0; water 1-2 ft deep; no ditches or other disturbances that would affect hydroperiod

Water Quality Inputs and Treatment: score = 3.0; land use category = recreational/open space (3.0); treatment category = natural undeveloped areas (3.0); $(3.0 + 3.0) \div 2 = 3.0$

Overall WRAP Score: $(3.0 + 3.0 + 3.0 + 3.0 + 2.5 + 3.0 + 3.0) \div 7 = 3.0$

Wetland Number: 45

Property: Hungryland Slough

Date of Site Visit: April 17, 1997

Assessment Team Members Present:

Denise Janson, FDEP

Cheryl McKee, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

Richard E. Roberts, FDEP

Kevin Sullivan, USDA NRCS

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1/SS6C - palustrine, emergent, persistent, scrub-shrub, deciduous, seasonally flooded

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; cricket frog, wood stork (flyover), sun fish, mosquito fish; strong potential for wildlife usage.

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 3.0; floating mats of algae; extensive cover with little or no disturbances

Adjacent Upland/Wetland Buffer: score = 3.0; pine flatwoods >300 ft; all natural

Exotic and Nuisance Plant Species: score = 2.5; less than 25% exotics; some melaleuca and climbing fern along edge

Field Indicators of Wetland Hydrology: score = 3.0; water 1-2 ft deep; no ditches or other disturbances that would affect hydroperiod

Water Quality Inputs and Treatment: score = 3.0; land use category = recreational/open space (3.0); treatment category = natural undeveloped areas (3.0); $(3.0 + 3.0) \div 2 = 3.0$

Overall WRAP Score: $(3.0 + 3.0 + 3.0 + 2.5 + 3.0 + 3.0) \div 18 = 0.97$

Wetland Number: 46

Property: Old Marsh Golf Club

Date of Site Visit: April 24, 1997

Assessment Team Members Present:

David K. Gillings, Palm Beach County DERM

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

John Wrublik, FGFWFC

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

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depression

Land Use: single-family residential

Wildlife Utilization: score = 3.0; sandhill crane, apple snail eggs, red-winged blackbird, cricket frog, great egret, boat-tailed grackle, little blue heron, several muskrat nests, mosquito fish, wildlife trails, snake, frog eggs

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 3.0; extensive ground cover with minimal disturbances

Adjacent Upland/Wetland Buffer: score = 1.5; buffer has some houses, golf course and pine flatwoods; buffer averages greater than 30 ft but less than 300 ft; buffer has Brazilian pepper in patches

Exotic and Nuisance Plant Species: score = 2.5; climbing fern in dry part of wetland; less than 10% exotics

Field Indicators of Wetland Hydrology: score = 3.0; water 1-2 ft deep; no negative impacts to hydrology noted; hydrology adequate to maintain a viable wetland system

Water Quality Inputs and Treatment: score = 1.0; land use category = 50% single-family residential ($0.50 \times 1.5 = 0.75$) and 50% golf course ($0.5 \times 1.5 = 0.75$); treatment category = 50% berm ($0.5 \times 2.5 = 1.25$) and 50% grass swale ($0.5 \times 1 = 0.5$); ($0.75 + 0.75 + 1.25 + 0.5$) $\div 2 = 1.6$; round down to 1.5

Overall WRAP Score: $(3.0 + 3.0 + 1.5 + 2.5 + 3.0 + 1.5) \div 18 = 0.81$

Wetland Number: 47

Property: Palm Beach Country Estates (165th Street and 75th Avenue)

Date of Site Visit: April 24, 1997

Assessment Team Members Present:

David K. Gillings, Palm Beach County DERM

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

John Wrublik, FGFWFC

NWI Wetland Classification: PFO6Fd - palustrine, forested, deciduous, semipermanently flooded, partially drained/ditched

FNAI Community Type: dome swamp

Soil Type: BM - Basinger and Myakka sands, depressional

Land Use: low density residential

Wildlife Utilization: score = 1.5; white-eyed vireo, black-and-white warbler, Carolina wren, wood ducks, large bird nest, small fish, green anole, red-winged blackbird, prairie warbler leeches

Wetland Overstory/Shrub Canopy: score = 2.0; cypress dome, one lot cleared, another filled and built on; willow, button bush, wax myrtle; cypress has been cut on part of the lot

Vegetative Ground Cover: score = 2.0; vegetated ground cover is slightly impacted and provides some functional habitat; some cut areas highly disturbed

Adjacent Upland/Wetland Buffer: score = 0; no adjacent buffer, only roads and filled areas

Exotic and Nuisance Plant Species: score = 1.5; climbing fern and Brazilian pepper; 25-50% exotics

Field Indicators of Wetland Hydrology: score = 2.0; 1-2 feet of water in wetland; higher water marks on trees; hydrology adequate to maintain a viable wetland

Water Quality Inputs and Treatment: score = 1.0; land use category = single-family residential (1.5); treatment category = no treatment (0); $(1.5 + 0) \div 2 = 0.75$; round up to 1.0

Overall WRAP Score: $(1.5 + 2.0 + 2.0 + 0 + 1.5 + 2.0 + 1.0) \div 7 = 1.5$

Wetland Number: 48

Property: Palm Beach Country Estates (85th Way)

Date of Site Visit: April 24, 1997

Assessment Team Members Present:

David K. Gillings, Palm Beach County DERM

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

John Wrublik, FGFWFC

NWI Wetland Classification: PFO6Ad - palustrine, forested, deciduous, temporarily flooded, partially drained/ditched

FNAI Community Type: depression marsh/dome swamp/wet prairie

Soil Type: Rd - Riviera sand, depression

Land Use: low density residential

Wildlife Utilization: score = 1.5; cricket frog, apple snail eggs, crayfish, wildlife trails, little blue heron; minimal to moderate wildlife potential

Wetland Overstory/Shrub Canopy: score = 1.5; many wax myrtles and shrubs; some cypress, pine and melaleuca; few to a moderate amount of desirable species

Vegetative Ground Cover: score = 2.0; vegetative ground cover slightly impacted and provides some functional habitat

Adjacent Upland/Wetland Buffer: score = 0.5; adjacent buffer is primarily residential and filled road areas

Exotic and Nuisance Plant Species: score = 1.0; melaleuca, Australian pine, climbing fern; 25-50% exotic species

Field Indicators of Wetland Hydrology: score = 1.5; 6-12 inches of water in wetland; hydrology partially inadequate to maintain the wetland

Water Quality Inputs and Treatment: score = 1.0; land use category = single-family residential (1.5); treatment category = grass swales only (1.0); $(1.5 + 1.0) \div 2 = 1.25$; round down to 1.0

Overall WRAP Score: $(1.5 + 1.5 + 2.0 + 0.5 + 1.0 + 1.5 + 1.0) \div 21 = 0.43$

Wetland Number: 49

Property: Whispering Trails (168th Road)

Date of Site Visit: April 24, 1997

Assessment Team Members Present:

David K. Gillings, Palm Beach County DERM

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

John Wrublik, FGFWFC

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

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: low density residential

Wildlife Utilization: score = 1.5; oak toad, cricket frog, crayfish, palm warbler, small fish, wildlife trails; minimal to moderate wildlife utilization expected due to filling and draining of wetland

Wetland Overstory/Shrub Canopy: score = 1.0; slash pine, melaleuca, wax myrtle, Carolina willow; few desirable overstory/shrub canopy species due to drainage and filling

Vegetative Ground Cover: score = 2.0; variety of species; ground cover is slightly impacted and provides some functional habitat

Adjacent Upland/Wetland Buffer: score = 2.0; pine flatwoods; buffer greater than 30 feet but less than 300 feet containing predominantly desirable species

Exotic and Nuisance Plant Species: score = 2.0; Australian pine, melaleuca, climbing fern, Brazilian pepper; less than 25% exotic species

Field Indicators of Wetland Hydrology: score = 1.5; partly filled and dredged; 0-6 inches in parts of the wetland; hydrology partially adequate to maintain a viable wetland

Water Quality Inputs and Treatment: score = 1.5; land use category = low density residential (2.0); treatment category = grass swales only (1.0); $(2.0 + 1.0) \div 2 = 1.5$

Overall WRAP Score: $(1.5 + 1.0 + 2.0 + 2.0 + 2.0 + 1.5 + 1.5) \div 7 = 1.71$

Wetland Number: 50

Property: Whispering Trails (142nd Ct.)

Date of Site Visit: April 24, 1997

Assessment Team Members Present:

David K. Gillings, Palm Beach County DERM

Denise Janson, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: low density residential

Wildlife Utilization: score = 2.5; cricket frogs, ribbon snake, tadpoles, Carolina wren, crayfish, wildlife trails; moderate to strong evidence of wildlife utilization

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; variety of species; ground cover only slightly impacted

Adjacent Upland/Wetland Buffer: score = 2.0; primarily pine flatwoods; averages greater than 30 feet but less than 300 feet

Exotic and Nuisance Plant Species: score = 2.5; melaleuca, climbing fern; less than 10% exotic species

Field Indicators of Wetland Hydrology: score = 2.0; about 6 inches of water in wetland; hydrology adequate to maintain a viable wetland

Water Quality Inputs and Treatment: score = 2.0; land use category = low density residential (2.0); treatment category = 50% natural undeveloped (0.5 x 3), 25% grass swales only (0.25 x 1), 25% no treatment (0); $(2.0 + 1.75) \div 2 = 1.875$; round up to 2.0

Overall WRAP Score: $(2.5 + 2.5 + 2.0 + 2.5 + 2.0 + 2.0) \div 18 = 0.75$

Wetland Number: 51

Property: Golf Digest Site (proposed for development)

Date of Site Visit: May 15, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Linda Ferrell, COE

Boyd E. Gunsalus, SFWMD

Cheryl McKee, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

Doug Strom, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: wet prairie

Soil Type: Rd - Riviera sand, depressional

Land Use: agricultural - unimproved; recreational/open space

Wildlife Utilization: score = 3.0; small fish, cricket frog, pinewoods treefrog, night hawks (fly over) tricolored heron (fly over), fish crow (fly over), common grackles (fly over), ribbon snake, raccoon tracks, great egret, bobcat tracks, crayfish, armadillo tracks

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; ground cover is primarily appropriate native species; some trampling from cows; some off road vehicle tracks

Adjacent Upland/Wetland Buffer: score = 3.0; buffer > 300 ft containing primarily desirable species; pine flatwoods

Exotic and Nuisance Plant Species: score = 2.0; melaleuca 10-15% coverage; climbing fern in buffer

Field Indicators of Wetland Hydrology: score = 3.0; 6-8 inches of water in much of wetland; 2 ft deep in center at south end

Water Quality Inputs and Treatment: score = 2.5; cows in uplands; land use category = agricultural - unimproved (2.0); treatment category = natural undeveloped (3.0);
 $(2.0 + 3.0) \div 2 = 2.5$

Overall WRAP Score: $(3.0 + 2.5 + 3.0 + 2.0 + 3.0 + 2.5) \div 18 = 0.89$

Wetland Number: 52

Property: Golf Digest Site (proposed for development)

Date of Site Visit: May 15, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Cheryl McKee, FDEP

Peter G. Merritt, TCRPC

John Wrublik, FGFWFC

NWI Wetland Classification: PEM1A - palustrine, emergent, persistent, temporarily flooded

FNAI Community Type: wet prairie

Soil Type: AU - Arents-Urban land complex

Land Use: agricultural - unimproved; recreational/open space

Wildlife Utilization: score = 1.5; many small tadpoles, red-shouldered hawk (fly over), raccoon tracks, two little blue herons foraging, crayfish, oak toad

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 1.5; ground cover extensively impacted by off road vehicles and hogs; invasion by upland species; soils have many shells, appear unnatural

Adjacent Upland/Wetland Buffer: score = 1.5; buffer > 300 feet but predominantly undesirable and inappropriate species; pinelands with Australian pine; Brazilian pepper, canals, piles of spoil

Exotic and Nuisance Plant Species: score = 1.5; about 25% coverage by melaleuca; extensive invasion by pine; Brazilian pepper in island

Field Indicators of Wetland Hydrology: score = 1.0; small ditch draining wetland at west side; 0-2 inches of water in much of the wetland; extensive canals nearby; hydrologic regime appears inadequate

Water Quality Inputs and Treatment: score = 3.0; no cows in area; land use category = recreational/open space (3.0); treatment category = natural undeveloped areas (3.0); $(3.0 + 3.0) \div 2 = 3.0$

Overall WRAP Score: $(1.5 + 1.5 + 1.5 + 1.5 + 1.0 + 3.0) \div 6 = 1.83$

Wetland Number: 53

Property: Golf Digest Site (proposed for development)

Date of Site Visit: May 15, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Cheryl McKee, FDEP

Peter G. Merritt, TCRPC

John Wrublik, FGFWFC

NWI Wetland Classification: upland

FNAI Community Type: mesic flatwoods

Soil Type: Rd - Riviera sand, depressional

Land Use: agricultural - unimproved; recreational/open space

Wildlife Utilization: score = 0; wetland is heavily impacted by drainage and filling; no evidence of wildlife utilization by wetland dependent species; wildlife usage appears to be restricted to upland species

Wetland Overstory/Shrub Canopy: score = 0; heavily forested; dominated by mature pine, many of which are 6-8 inches dbh; most of the pine canopy covered with climbing fern

Vegetative Ground Cover: score = 0.5; area covered with climbing fern; some swamp fern and several native species growing through the climbing fern; ground cover severely impacted

Adjacent Upland/Wetland Buffer: score = 1.5; buffer > 300 feet pineland, but contains many undesirable species, including Brazilian pepper, melaleuca, and climbing fern

Exotic and Nuisance Plant Species: score = 0; > 75% coverage by climbing fern, some melaleuca

Field Indicators of Wetland Hydrology: score = 0; hydrology severely altered; no signs of flooding; area drained by nearby canals; fill deposited in wetland

Water Quality Inputs and Treatment: not applicable; stormwater does not appear to drain into this area; it is likely that stormwater drains from this "former wetland" to the surrounding canals

Overall WRAP Score: $(0 + 0 + 0.5 + 1.5 + 0 + 0) \div 18 = 0.11$

Note: This area can best be described as a former wetland. The soil maps show that a wetland existed here, but the NWI and field verification reveal that it now has primarily upland characteristics.

Wetland Number: 54

Property: Golf Digest Site (proposed for development)

Date of Site Visit: May 15, 1997

Assessment Team Members Present:

David Ferrell, USFWS

Linda Ferrell, COE

Cheryl McKee, FDEP

Peter G. Merritt, TCRPC

Brad Rieck, USFWS

Doug Strom, FDEP

John Wrublik, FGFWFC

NWI Wetland Classification: PFO3C - palustrine, forested, broad-leaved evergreen, seasonally flooded

FNAI Community Type: wet prairie

Soil Type: Rd - Riviera sand, depressional

Land Use: agricultural - unimproved; recreational/open space

Wildlife Utilization: score = 1.5; tadpoles, small fish, wildlife trails, extensive shrub layer makes it difficult to view wildlife; wetland has minimal to moderate potential for wildlife utilization

Wetland Overstory/Shrub Canopy: score = 1.0; extensive coverage by wax myrtle, willow, Brazilian pepper; some pine and melaleuca; site exhibits large amounts of undesirable and inappropriate species

Vegetative Ground Cover: score = 1.0; very disturbed by previous agricultural activities; ditches and growth of shrubs have caused the ground cover to be extensively impacted

Adjacent Upland/Wetland Buffer: score = 2.0; buffer 30-300 ft, partially disturbed pineland

Exotic and Nuisance Plant Species: score = 1.0; 25-50% Brazilian pepper, climbing fern, and melaleuca

Field Indicators of Wetland Hydrology: score = 1.0; some areas flooded with 6-8 inches of water, other areas filled with no signs of flooding; numerous ditches; hydrology inadequate to maintain a viable wetland over the entire area

Water Quality Inputs and Treatment: score = 3.0; no cows in area; land use category = recreational/open space (3.0); treatment category = natural undeveloped area (3.0); $(3.0 + 3.0) \div 2 = 3.0$

Overall WRAP Score: $(1.5 + 1.0 + 1.0 + 2.0 + 1.0 + 1.0 + 3.0) \div 7 = 1.5$

Wetland Number: 55

Property: Golf Digest Site (proposed for development)

Date of Site Visit: May 15, 1997

Assessment Team Members Present:

Linda Ferrell, COE

Boyd E. Gunsalus, SFWMD

Brad Rieck, USFWS

Doug Strom, FDEP

NWI Wetland Classification: PEM1A - palustrine, emergent, persistent, temporarily flooded

FNAI Community Type: wet prairie

Soil Type: Os - Oldsmar sand

Land Use: agricultural - unimproved; recreational/open space

Wildlife Utilization: score = 3.0; wildlife trails, rabbit scat, cricket frog; strong potential for wildlife utilization, especially seasonal use by wading birds

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; primarily appropriate native species with minimal impacts

Adjacent Upland/Wetland Buffer: score = 2.0; pine flatwoods; buffer averages greater than 30 feet but less than 300 feet

Exotic and Nuisance Plant Species: score = 2.0; melaleuca and climbing fern; less than 25% exotic species

Field Indicators of Wetland Hydrology: score = 2.5; standing water in center, algal mat; hydrology adequate to maintain a viable wetland

Water Quality Inputs and Treatment: score = 2.5; cows in uplands; land use category = agricultural - unimproved (2.0); treatment category = natural undeveloped (3.0); $(2.0 + 3.0) \div 2 = 2.5$

Overall WRAP Score: $(3.0 + 2.5 + 2.0 + 2.0 + 2.5 + 2.5) \div 6 = 2.5$

Wetland Number: 56

Property: Golf Digest Site (proposed for development)

Date of Site Visit: May 15, 1997

Assessment Team Members Present:

Linda Ferrell, COE

Boyd E. Gunsalus, SFWMD

Brad Rieck, USFWS

Doug Strom, FDEP

NWI Wetland Classification: PEM1A - palustrine, emergent, persistent, temporarily flooded

FNAI Community Type: wet prairie

Soil Type: BM - Basinger and Myakka sands, depressional

Land Use: agricultural - unimproved; recreational/open space

Wildlife Utilization: score = 1.5; deer pellets, rabbit scat, common yellowthroat, gopher tortoise

Wetland Overstory/Shrub Canopy: score = 1.0; slash pine, wax myrtle, melaleuca; few desirable wetland overstory/shrub canopy trees present

Vegetative Ground Cover: score = 1.5; limited in heavy melaleuca areas; ground cover is extensively impacted by large amounts of inappropriate species

Adjacent Upland/Wetland Buffer: score = 2.0; pine flatwoods; adjacent buffer averages greater than 30 feet but less than 300 feet

Exotic and Nuisance Plant Species: score = 0.5; melaleuca, Brazilian pepper, climbing fern; 50-75% coverage by exotic species

Field Indicators of Wetland Hydrology: score = 1.0; no standing water; ditch directly connecting to wetland; hydrology inadequate to maintain a viable wetland

Water Quality Inputs and Treatment: score = 2.5; cows in uplands; land use category = agricultural - unimproved (2.0); treatment category = natural undeveloped (3.0); $(2.0 + 3.0) \div 2 = 2.5$

Overall WRAP Score: $(1.5 + 1.0 + 1.5 + 2.0 + 0.5 + 1.0 + 2.5) \div 7 = 0.48$

Wetland Number: 57

Property: Golf Digest Site (proposed for development)

Date of Site Visit: May 15, 1997

Assessment Team Members Present:

Linda Ferrell, COE

Boyd E. Gunsalus, SFWMD

Brad Rieck, USFWS

Doug Strom, FDEP

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: wet prairie

Soil Type: BM - Basinger and Myakka sands, depressional

Land Use: agricultural - unimproved; recreational/open space

Wildlife Utilization: score = 3.0; crayfish, tadpoles, rabbit scat, green treefrog, small fish, green-backed heron, boat-tailed grackle

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; ground cover is primarily appropriate species and is only slightly impacted

Adjacent Upland/Wetland Buffer: score = 2.5; pine flatwoods; 60% greater than 300 ft and 40% greater than 30 feet but less than 300 feet buffer; $(0.60 \times 3.0) + (0.40 \times 2.0) = 2.6$; round down to 2.5

Exotic and Nuisance Plant Species: score = 2.5; melaleuca; less than 25% exotic species

Field Indicators of Wetland Hydrology: score = 2.5; 6-10 inches of water in wetland; hydrology adequate to maintain a viable wetland

Water Quality Inputs and Treatment: score = 2.5; cows in uplands; land use category = agricultural - unimproved (2.0); treatment category = natural undeveloped (3.0); $(2.0 + 3.0) \div 2 = 2.5$

Overall WRAP Score: $(3.0 + 2.5 + 2.5 + 2.5 + 2.5 + 2.5) \div 6 = 2.5$

Wetland Number: 58

Property: Country Lakes of Jupiter Site (proposed for development)

Date of Site Visit: May 22, 1997

Assessment Team Members Present:

Tori Agramonte, COE
Denise Janson, FDEP
Peter G. Merritt, TCRPC
Brad Rieck, USFWS
Richard E. Roberts, FDEP
Kevin Sullivan, USDA NRCS
Doug Strom, FDEP
John Wrublik, FGFWFC

NWI Wetland Classification: POWHx - palustrine, open water, permanently flooded, excavated

FNAI Community Type: not applicable (borrow pit)

Soil Type: Pf - pits

Land Use: agricultural - pasture

Wildlife Utilization: score = 2.5; cricket frogs, great blue heron, apple snails and eggs, leopard frog, pig frog, green-backed heron, bass, killifish, bluegill/sunfish, grass shrimp, mosquito fish

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.0; spoil piles, cattails, much algae; vegetative ground cover is slightly impacted and provides some functional habitat

Adjacent Upland/Wetland Buffer: score = 1.0; no buffer on south side; 60% > 300 ft but predominantly undesirable or inappropriate species (1.5); 40% no buffer (0); $0.6 \times 1.5 = 0.9$; round up to 1.0

Exotic and Nuisance Plant Species: score = 2.5; Australian pine, melaleuca, cattails; area displays less than 25% exotic and nuisance plant species

Field Indicators of Wetland Hydrology: score = 2.0; 2 ft deep in parts; hydrology adequate to maintain a viable wetland system

Water Quality Inputs and Treatment: score = 2.0; land use category = pasture-ag (1.0); treatment category = berms (2.5); $(1.0 + 2.5) \div 2 = 1.75$; round up to 2.0

Overall WRAP Score: $(2.5 + 2.0 + 1.0 + 2.5 + 2.0 + 2.0) \div 6 = 0.67$

Wetland Number: 59

Property: Country Lakes of Jupiter Site (proposed for development)

Date of Site Visit: May 22, 1997

Assessment Team Members Present:

Tori Agramonte, COE
Denise Janson, FDEP
Peter G. Merritt, TCRPC
Brad Rieck, USFWS
Richard E. Roberts, FDEP
Kevin Sullivan, USDA NRCS
Doug Strom, FDEP
John Wrublik, FGFWFC

NWI Wetland Classification: PEM1Cd - palustrine, emergent, persistent, seasonally flooded, partially drained/ditched

FNAI Community Type: wet prairie/depression marsh

Soil Type: Soil survey indicates Pf (pits), but soil type is probably Rd (Riviera sand, depressional)

Land Use: agricultural - pasture

Wildlife Utilization: score = 2.5; green-backed heron (fly over), fish crow (fly over), muskrat nests, apple snail eggs, cricket frog, crayfish, wildlife trails, least killifish, grass shrimp

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; trails from cattle, some impacts from vehicles; vegetative ground cover is slightly impacted

Adjacent Upland/Wetland Buffer: score = 2.0; 25% all natural (3.0); 75% > 300 ft predominantly undesirable (1.5); $(0.25 \times 3.0) + (0.75 \times 1.5) = 1.87$; round up to 2.0

Exotic and Nuisance Plant Species: score = 3.0; no exotics in wetland; some Australian pine in buffer

Field Indicators of Wetland Hydrology: score = 2.5; ditch on north side drains wetland; 1.5 ft of water in outer of wetland; hydrology adequate to maintain a viable wetland

Water Quality Inputs and Treatment: score = 1.0; land use category = pasture - ag (1.0); treatment category = grass swales only (1.0); $(1.0 + 1.0) \div 2 = 1.0$

Overall WRAP Score: $(2.5 + 2.5 + 2.0 + 3.0 + 2.5 + 1.0) \div 6 = 2.5$

Wetland Number: 60

Property: Country Lakes of Jupiter Site (proposed for development)

Date of Site Visit: May 22, 1997

Assessment Team Members Present:

Tori Agramonte, COE
Denise Janson, FDEP
Peter G. Merritt, TCRPC
Brad Rieck, USFWS
Richard E. Roberts, FDEP
Kevin Sullivan, USDA NRCS
Doug Strom, FDEP
John Wrublik, FGFWFC

NWI Wetland Classification: PEM1F - palustrine, emergent, persistent, semipermanently flooded

FNAI Community Type: wet prairie

Soil Type: Soil survey indicates Pf (pits), but soil type is probably Rd (Riviera sand, depression)

Land Use: agricultural - pasture

Wildlife Utilization: score = 2.0; great egret perched nearby, rabbit scat, wildlife trails, cricket frog, crayfish, apple snail

Wetland Overstory/Shrub Canopy: not applicable

Vegetative Ground Cover: score = 2.5; road in wetland, invasion by young pine and wax myrtle; ground cover is slightly impacted

Adjacent Upland/Wetland Buffer: score = 2.0; 20% cypress (3.0); 80% pasture (1.5); $(0.20 \times 3.0) + (0.8 \times 1.5) = 1.8$; round up to 2.0

Exotic and Nuisance Plant Species: score = 2.5; < 10% Brazilian pepper

Field Indicators of Wetland Hydrology: score = 2.0; 0-2 inches of water in most of wetland; water marks indicate water was 18 inches deep previously; hydrology adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 1.0; land use category = pasture - ag (1.0); treatment category = grass swales only (1.0); $(1.0 + 1.0) \div 2 = 1.0$

Overall WRAP Score: $(2.0 + 2.5 + 2.0 + 2.5 + 2.0 + 1.0) \div 6 = 0.67$

Wetland Number: 61

Property: Country Lakes of Jupiter Site (proposed for development)

Date of Site Visit: May 22, 1997

Assessment Team Members Present:

Tori Agramonte, COE
Denise Janson, FDEP
Peter G. Merritt, TCRPC
Brad Rieck, USFWS
Richard E. Roberts, FDEP
Kevin Sullivan, USDA NRCS
Doug Strom, FDEP
John Wrublik, FGFWFC

NWI Wetland Classification: PFO2F - palustrine, forested, needle-leaved deciduous, semipermanently flooded

FNAI Community Type: dome swamp

Soil Type: Soil survey indicates Pf (pits), but soil type is probably Rd (Riviera sand, depressional)

Land Use: agricultural - pasture

Wildlife Utilization: score = 2.5; Carolina wren, great-crested flycatchers (nesting in cavity), apple snail eggs, blue jay, box turtle, snake, small fish, frog

Wetland Overstory/Shrub Canopy: score = 2.5; some exotics in the shrub layer; Brazilian pepper and strawberry guava; cypress canopy; abundant amount of desirable species present

Vegetative Ground Cover: score = 3.0; vegetative cover is extensive with minimal or no disturbances

Adjacent Upland/Wetland Buffer: score = 2.0; 75% 30-300 ft (2.0); 25% pasture (1.5); $(0.75 \times 2.0) + (0.25 \times 1.5) = 1.875$; round up to 2.0

Exotic and Nuisance Plant Species: score = 2.5; small amount of strawberry guava, Brazilian pepper, and climbing fern

Field Indicators of Wetland Hydrology: score = 3.0; 1-2 ft of water in most of the wetland; signs on trees that water gets much higher; no impacts noticed; hydrology adequate to maintain the wetland

Water Quality Inputs and Treatment: score = 1.0; land use category = pasture - ag (1.0); treatment category = grass swales only (1.0); $(1.0 + 1.0) \div 2 = 1.0$

Overall WRAP Score: $(2.5 + 2.5 + 3.0 + 2.0 + 2.5 + 3.0 + 1.0) \div 7 = 2.5$

Wetland Number: 62

Property: Golf Digest Site (proposed for development; proposed mitigation area)

Date of Site Visit: July 8, 1997

Assessment Team Members Present:

Brad Rieck, USFWS

Linda Ferrell, COE

John Wrublik, FGFWFC

Bill Cox, Kevin L. Erwin Consulting, Inc.

Craig Smith, Kevin L. Erwin Consulting, Inc.

NWI Wetland Classification: PEM1F/A - palustrine, emergent, persistent, semi-permanently flooded/temporarily flooded

FNAI Community Type: wet prairie

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 2.5; four species of small fish, green-backed heron, great egrets, leopard frog, tadpoles, deer tracks. Area used for hunting occasionally.

Wetland Overstory/Shrub Canopy: score = 1.5; slash pine and wax myrtle; both inappropriate for this wetland

Vegetative Ground Cover: score = 2.0; primarily St. John's wort, beakrush, yellow-eyed grass; disturbance evident.

Adjacent Upland/Wetland Buffer: score = 2.25; 50% = 1.5 and 50% = 3.0

Exotic and Nuisance Species: score = 2.0; melaleuca, lygodium, one australian pine

Field Indicators of Wetland Hydrology: score = 1.5; bordered on two sides by canals, two breaches along E-W canal. Site historically wetter. Pine and myrtle coming in.

Water Quality Inputs and Treatment: score = 2.25; land use category = 2; treatment category = 2.5; open to cattle.

Overall WRAP Score: $(2.5 + 1.5 + 2.0 + 2.25 + 2.0 + 1.5 + 2.25) \div 21 = 0.67$

Wetland Number: 63

Property: Golf Digest Site (proposed for development; proposed mitigation area)

Date of Site Visit: July 8, 1997

Assessment Team Members Present:

Brad Rieck, USFWS

Linda Ferrell, COE

John Wrublik, FGFWFC

Bill Cox, Kevin L. Erwin Consulting, Inc.

Craig Smith, Kevin L. Erwin Consulting, Inc.

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

Community Type: depression marsh

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; includes snail kite, heron, egrets, crayfish, four species small fish, apple snail, cricket frog, dragonflies, damselflies

Wetland Overstory/Shrub Canopy: N/A - willow and myrtle less than 20% cover

Vegetative Ground Cover: score = 2.5; primarily St. John's wort, beakrush, yellow-eyed grass, *Eleocharis*

Adjacent Upland/Wetland Buffer: score = 2.5

Exotic and Nuisance Species: score = 2.5; sparse scattered melaleuca

Field Indicators of Wetland Hydrology: score = 2.5; Old Marsh Golf Club drains from the north; water levels historically higher

Water Quality Inputs and Treatment: score = 3.0; land use category = 3; treatment category = 3

Overall WRAP Score: $(3.0 + 2.5 + 2.5 + 2.5 + 2.5 + 3.0) \div 6 = 2.5$

Wetland Number: 64

Property: Golf Digest Site (proposed for development; proposed mitigation area)

Date of Site Visit: July 8, 1997

Assessment Team Members Present:

Brad Rieck, USFWS

Linda Ferrell, COE

John Wrublik, FGFWFC

Bill Cox, Kevin L. Erwin Consulting, Inc.

Craig Smith, Kevin L. Erwin Consulting, Inc.

NWI Wetland Classification: PEM1Ad - palustrine, emergent, persistent, temporarily flooded, partially drained/ditched

Community Type: wet pine flatwoods

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 1.5; includes leopard and cricket frog, pig scat

Wetland Overstory/Shrub Canopy: score = 1.5; slash pine, melaleuca, scattered cypress

Vegetative Ground Cover: score = 1.5; St. John's wort, beakrush, redroot, club moss

Adjacent Upland/Wetland Buffer: score = 2.4; (20%)(1) + (40%)(2.5) + (40%)(3.0)

Exotic and Nuisance Species: score = 0.5; significant melaleuca infestation, plus downy rose myrtle.

Field Indicators of Wetland Hydrology: score = 1.5; drainage has altered character

Water Quality Inputs and Treatment: score = 2.8; land use category = (20%)(1.5) + (80%)(3.0) = 2.7; treatment category = (20%)(2.5) + (80%)(3.0) = 2.9

Overall WRAP Score: $(1.5 + 1.5 + 1.5 + 2.4 + 0.5 + 1.5 + 2.8) \div 21 = 0.56$

Wetland Number: 65

Property: Golf Digest Site (proposed for development; proposed mitigation area)

Date of Site Visit: July 8, 1997

Assessment Team Members Present:

Brad Rieck, USFWS

Linda Ferrell, COE

John Wrublik, FGFWFC

Bill Cox, Kevin L. Erwin Consulting, Inc.

Craig Smith, Kevin L. Erwin Consulting, Inc.

NWI Wetland Classification: PEM1Ad - palustrine, emergent, persistent, temporarily flooded, partially drained/ditched

Community Type: Depression marsh (with included cypress dome)

Soil Type: Rd - Riviera sand, depressional

Land Use: recreational/open space

Wildlife Utilization: score = 3.0; includes gambusia, gold top minnow, killifish, sunfish, flagfish, crayfish, snails, leopard frog. High potential.

Wetland Overstory/Shrub Canopy: N/A - not 20% of marsh

Vegetative Ground Cover: score = 2.5; includes maidencane, pickerelweed, swamp lily, spike rush, St. John's wort, xyris, young pines

Adjacent Upland/Wetland Buffer: score = 2.5; predominately greater than 300 feet, but with some exotics

Exotic and Nuisance Species: score = 1.5; melaleuca infestation

Field Indicators of Wetland Hydrology: score = 2.0; canal and Old Marsh Golf Club drains from the north

Water Quality Inputs and Treatment: score = 2.75; land use category = 2.5; treatment category = 3.0

Overall WRAP Score: $(3.0 + 2.5 + 2.5 + 1.5 + 2.0 + 2.75) \div 6 = 0.79$

Wetland Number: 66

Property: Loxahatchee Slough (proposed mitigation area for Golf Digest Site)

Date of Site Visit: July 8, 1997

Assessment Team Members Present:

Brad Rieck, USFWS

Linda Ferrell, COE

John Wrublik, FGFWFC

Bill Cox, Kevin L. Erwin Consulting, Inc.

Craig Smith, Kevin L. Erwin Consulting, Inc.

NWI Wetland Classification: P SS6/EM1 F

Community Type: wet prairie

Soil Type: Wn/Ta - Winder fine sand/Tequesta muck

Land Use: recreational/open space

Wildlife Utilization: score = 1.5; includes gambusia, flagfish, crayfish, apple snail

Wetland Overstory/Shrub Canopy: score = 1.0; young melaleuca, wax myrtle, scattered pine. Inappropriate.

Vegetative Ground Cover: score = 1.0; includes St. John's wort, beakrush, xyris. Impacted.

Adjacent Upland/Wetland Buffer: score = 2.0

Exotic and Nuisance Species: score = 0.5; heavy melaleuca infestation

Field Indicators of Wetland Hydrology: score = 2.0; three inches standing water. Canal and surface water diversion.

Water Quality Inputs and Treatment: score = 3.0

Overall WRAP Score: $(1.5 + 1.0 + 1.0 + 2.0 + 0.5 + 2.0 + 3.0) \div 7 = 1.57$

APPENDIX 6
LIST OF ANIMALS IDENTIFIED IN THE
WRAP FIELD EVALUATIONS

This appendix includes a list of animal species that were identified through direct observation or through signs (e.g., scat, tracks, etc.) by the assessment team members 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 include: Page and Brooks (1991) for fishes; National Audubon Society (1979) for amphibians and reptiles; National Geographic Society (1987) for birds; National Geographic Society (1980) for mammals; and Borrer and White (1970), National Audubon Society (1980) and Pennak (1978) for invertebrates.

<u>Scientific Name</u>	<u>Common Name</u>
<i>Fishes</i>	
<i>Elassoma</i> sp.	pigmy sunfish
<i>Enneacanthus</i> spp.	sunfish
<i>Enneacanthus gloriosus</i>	bluespotted sunfish
<i>Fundulus chrysotus</i>	golden topminnow
<i>Fundulus lineolatus</i>	lined topminnow
<i>Fundulus</i> spp.	killifish
<i>Gambusia holbrooki</i>	mosquito fish
<i>Heterandria formosa</i>	least killifish
<i>Jordonella floridae</i>	flagfish
<i>Lepomis macrochirus</i>	bluegill
<i>Lepomis microlophus</i>	redeer sunfish
<i>Mycopterus salmoides</i>	largemouth bass
<i>Pteronotropis signipinnis</i>	sailfin shiner
<i>Amphibians</i>	
<i>Acris gryllus</i>	southern cricket frog
<i>Bufo quercicus</i>	oak toad
<i>Hyla squirella</i>	squirrel treefrog
<i>Hyla cinerea</i>	green treefrog
<i>Pseudacris ocularlis</i>	little grass frog
<i>Rana grylio</i>	pig frog
<i>Sphenocephala utricularia</i>	southern leopard frog
<i>Reptiles</i>	
<i>Agkistrodon piscivorus</i>	water moccasin
<i>Alligator mississippiensis</i>	American alligator

Scientific Name

Anolis carolinensis
Coluber constrictor
Gopherus polyphemus
Masticophis flagellum
Nerodia sp.
Opheodrys aestivus
Pseudemys nelsoni
Pseudemys floridana
Terrapene carolina
Thamnophis sauritus

Common Name

green anole
black racer
gopher tortoise
coachwhip
water snake
rough green snake
Florida red-bellied turtle
river cooter
box turtle
ribbon snake

Birds

<i>Agelaius phoeniceus</i>	red-winged blackbird
<i>Aix sponsa</i>	wood duck
<i>Anas fulvigula</i>	mottled duck
<i>Anhinga anhinga</i>	anhinga
<i>Ardea herodias</i>	great blue heron
<i>Bombycilla cedrorum</i>	cedar waxwing
<i>Bubulcus ibis</i>	cattle egret
<i>Butea jamaicensis</i>	red-tailed hawk
<i>Buteo lineatus</i>	red-shouldered hawk
<i>Butorides striatus</i>	green-backed heron
<i>Cardinalis cardinalis</i>	northern cardinal
<i>Casmerodius albus</i>	great egret
<i>Cathartes aura</i>	turkey vulture
<i>Ceryle alcyon</i>	belted kingfisher
<i>Charadrius vociferus</i>	killdeer
<i>Chordeiles minor</i>	common nighthawk
<i>Coragyps atratus</i>	black vulture
<i>Corvus ossifragus</i>	fish crow
<i>Cyanocitta cristata</i>	blue jay
<i>Dendroica discolor</i>	prairie warbler
<i>Dendroica palmarum</i>	palm warbler
<i>Dendroica pinus</i>	pine warbler
<i>Drycopus pileatus</i>	pileated woodpecker
<i>Dumetella carolinensis</i>	catbird
<i>Egretta caerulea</i>	little blue heron
<i>Egretta tricolor</i>	tricolored heron
<i>Elanoides forficatus</i>	American swallow-tailed kite
<i>Eudocimus albus</i>	white ibis
<i>Falco sparverius</i>	American kestrel
<i>Gallinago gallinago</i>	common snipe
<i>Geothlypis trichas</i>	common yellowthroat
<i>Grus canadensis</i>	sandhill crane

Scientific Name**Common Name**

<i>Ixobrychus exilis</i>	least bittern
<i>Lanius ludovicianus</i>	loggerhead shrike
<i>Melanerpes carolinus</i>	red-bellied woodpecker
<i>Melospiza melodia</i>	song sparrow
<i>Mimus polyglottos</i>	mockingbird
<i>Mniotilta varia</i>	black-and-white warbler
<i>Mycteria americana</i>	wood stork
<i>Myiarchus crinitus</i>	great-crested flycatcher
<i>Pandion haliaetus</i>	osprey
<i>Passerculus sandwichensis</i>	savannah sparrow
<i>Passerina ciris</i>	painted bunting
<i>Picoides pubescens</i>	downy woodpecker
<i>Picoides villosus</i>	hairy woodpecker
<i>Plegadis falcinellus</i>	glossy ibis
<i>Polioptila caerulea</i>	blue-gray gnatcatcher
<i>Quiscalus quiscula</i>	common grackle
<i>Quiscalus major</i>	boat-tailed grackle
<i>Rostrhamus sociabilis</i>	snail kite
<i>Sayornis phoebe</i>	eastern phoebe
<i>Sturnella magna</i>	eastern meadowlark
<i>Tachycineta bicolor</i>	tree swallow
<i>Thryothorus ludovicianus</i>	Carolina wren
<i>Tringa melanoleuca</i>	greater yellowlegs
<i>Turdus migratorius</i>	American robin
<i>Vireo griseus</i>	white-eyed vireo
<i>Zenaida macroura</i>	mourning dove

Mammals

<i>Dasypus novemcinctus</i>	armadillo
<i>Felis rufus</i>	bobcat
<i>Lutra canadensis</i>	river otter
<i>Neofiber alleni</i>	round-tailed muskrat
<i>Odocoileus virginianus</i>	white-tailed deer
<i>Procyon lotor</i>	raccoon
<i>Sus scrofa</i>	wild hog
<i>Sylvilagus floridanus</i>	eastern cottontail rabbit
<i>Sylvilagus palustris</i>	marsh rabbit

Invertebrates

Acrididae	grasshoppers (various sp.)
Anisoptera	dragonflies and larvae (various sp.)
Araneae	spiders (various sp.)
<i>Belostoma</i> sp.	giant waterbug
Cicadidae	cicada

<u>Scientific Name</u>	<u>Common Name</u>
Coleoptera	beetles (various sp.)
Corixidae	water boatman
Culicidae	mosquitoes
<i>Dolomedes</i> sp.	fishing spider
Dytiscidae	predaceous diving beetles
Ephemeroptera	mayfly (unidentified sp.)
Gastropoda	snails (various sp.)
Gerridae	water striders
Gyrinidae	whirligig beetles
<i>Heliconius chritarius</i>	zebra butterfly
Hemiptera	aquatic bugs (various sp.)
Hirudinea	leeches
Hydracarina	water mites
Hydrophilidae	water scavenger beetles
Hymenoptera	wasps
Lepidoptera	butterflies (unidentified sp.)
Lepidoptera	aquatic moths
<i>Lycosa</i> sp.	wolf spider
Oligochaeta	aquatic earthworm
<i>Palaemonetes paludosus</i>	grass shrimp
Pelecypoda	fresh-water clam
<i>Pelocaris femoratus</i>	gator flea
Phasmatidae	walkingsticks
<i>Planorbella</i> sp.	ram's horn snail
<i>Pomacea paludosus</i>	apple snail
<i>Procambarus alleni</i>	crayfish
<i>Romalea microptera</i>	lubber grasshopper
<i>Solenopsis invicta</i>	red imported fire ant
Tettigoniidae	katydid (unidentified sp.)
<i>Tramea</i> sp.	dancing glider dragonflies
Veliidae	little water striders
Zygoptera	damselies and larvae (various sp.)

APPENDIX 7
LIST OF PLANTS OBSERVED IN THE
WRAP FIELD EVALUATIONS

This appendix includes a list of plant species that were observed by the assessment team members 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 include: Small (1933), Godfrey and Wooten (1979, 1981), Dressler et al. (1987), COE (1988), Reed (1988), Wunderlin (1982), and Wunderlin et al. (1996).

<u>Scientific Name</u>	<u>Common Name</u>
<i>Acer rubrum</i>	red maple
<i>Aletris</i> sp.	colic-root
<i>Amphicarpum muhlenbergianum</i>	blue maidencane
<i>Andropogon virginicus</i>	broomsedge
<i>Andropogon glomeratus</i>	chalky blue-stem
<i>Annona glabra</i>	pond apple
<i>Aristida beyrichiano</i>	wiregrass (pineland three-awn)
<i>Asclepias</i> sp.	milkweed
<i>Ascyrum</i> sp.	St. Andrews cross
<i>Aster</i> spp.	aster
<i>Axonopus furcatus</i>	big carpet grass
<i>Baccharis</i> spp.	saltbush
<i>Bacopa</i> spp.	water-hyssops
<i>Blechnum serrulatum</i>	swamp fern
<i>Bromeliaceae</i>	bromeliads
<i>Callicarpa americana</i>	beautyberry
<i>Carex</i> spp.	sedges
<i>Cassytha filiformis</i>	love vine
<i>Casuarina equisetifolia</i>	Australian pine
<i>Centella asiatica</i>	coinwort
<i>Cephalanthus occidentalis</i>	buttonbush
<i>Ceratophyllum</i> sp.	hornwort
<i>Ceratopteris</i> sp.	mermaid fern
<i>Chara</i> spp.	musk-grasses
<i>Chrysobalanus icaco</i>	cocoplum
<i>Citrus</i> sp.	orange tree
<i>Cladium jamaicense</i>	saw-grass
<i>Commelina</i> sp.	day-flower
<i>Coreopsis</i> sp.	tickseed

<u>Scientific Name</u>	<u>Common Name</u>
<i>Crinum americanum</i>	swamp-lily
<i>Cyanobacteria</i>	blue-green algae
<i>Diospyros virginiana</i>	persimmon
<i>Drosera capillaris</i>	sundew
<i>Eleocharis</i> spp.	spikerush
<i>Elodea canadensis</i>	elodea
<i>Epipremnum pinnatum</i>	pothos
<i>Eriocaulon</i> spp.	hat-pins
<i>Eriocaulon compressum</i>	pipewort
<i>Eryngium</i> sp.	coyote-thistle
<i>Eupatorium capillifolium</i>	dogfennel
<i>Ficus aurea</i>	strangler fig
<i>Ficus citrifolia</i>	wild banyan tree
<i>Flavaria linearis</i>	yellowtop
<i>Fuirena scirpoidea</i>	rush fuirena
<i>Hydrilla verticillata</i>	hydrilla
<i>Hydrocotyle umbellata</i>	marsh pennywort
<i>Hydrolea corymbosum</i>	sky flower
<i>Hymenocallis palmeri</i>	alligator lily
<i>Hypericum</i> spp.	St. John's-wort
<i>Ilex cassine</i>	dahoon holly
<i>Ilex glabra</i>	gallberry
<i>Juncus</i> spp.	rushes
<i>Lachnanthes caroliniana</i>	red-root
<i>Lachnocaulon</i> spp.	bog buttons
<i>Lemna</i> spp.	duckweed
<i>Ludwigia</i> spp.	ludwigia
<i>Ludwigia peruviana</i>	primrose willow
<i>Ludwigia repens</i>	creeping seedbox
<i>Lycopodium</i> spp.	clubmoss
<i>Lygodium microphyllum</i>	old world climbing fern
<i>Lyonia lucida</i>	fetterbush
<i>Melaleuca quinquenervia</i>	punk tree
<i>Myrica cerifera</i>	wax-myrtle
<i>Najas quadalupensis</i>	southern naiad
<i>Nephtrolepis</i> sp.	Boston fern
<i>Nuphar lutea</i>	spatterdock
<i>Nymphaea odorata</i>	white water-lily
<i>Orchidaceae</i>	orchids
<i>Osmunda cinnamomea</i>	cinnamon fern
<i>Osmunda regalis</i>	royal fern
<i>Oxypolis filiformis</i>	water-dropwort
<i>Panicum hemitomom</i>	maidencane
<i>Panicum repens</i>	torpedograss

<u>Scientific Name</u>	<u>Common Name</u>
<i>Panicum</i> spp.	various species
<i>Persea palustris</i>	swamp bay
<i>Persea borbonia</i>	red bay
<i>Phlebodium aureum</i>	golden polypody
<i>Phragmites australis</i>	giant reed
<i>Pinus elliotii</i>	slash pine
<i>Pluchea</i> spp.	marsh fleabane
<i>Poinsettia cyathophora</i>	painted-leaf
<i>Polygala cymosa</i>	milkwort
<i>Polygala grandiflora</i>	candy root
<i>Polygonum hydropiperoides</i>	smartweed
<i>Pontederia cordata</i>	pickerelweed
<i>Proserpinaca pectinata</i>	mermaid-weed
<i>Psidium catteianum</i>	cattley guava
<i>Pteridium aquilinum</i>	bracken fern
<i>Quercus laurifolia</i>	laurel oak
<i>Rapanea punctata</i>	myrsine
<i>Rhynchospora colorata</i>	star-rush
<i>Rhynchospora</i> spp.	beak-rushes
<i>Rhynchospora inundata</i>	inundated beak-rush
<i>Sabal palmetto</i>	cabbage palm
<i>Sabatia</i> spp.	sabatia
<i>Saccharum giganteum</i>	sugar cane plume grass
<i>Sagittaria latifolia</i>	duck-potato
<i>Sagittaria</i> spp.	arrowheads
<i>Salix caroliniana</i>	Carolina willow
<i>Salvinia minima</i>	water fern
<i>Sanicula</i> sp.	snakeroot
<i>Sarcostemma clausum</i>	white vine
<i>Schinus terebinthifolius</i>	Brazilian pepper
<i>Scirpus</i> sp.	bulrush
<i>Serenoa repens</i>	saw palmetto
<i>Setaria</i> sp.	bristle grass
<i>Sisyrinchium</i> sp.	blue-eyed grass
<i>Smilax laurifolia</i>	bamboo vine
<i>Smilax bono-nox</i>	greenbriar
<i>Solanum</i> sp.	nightshade
<i>Solanum carolinense</i>	horse-nettle
<i>Spiranthes odorata</i>	ladie's tresses
<i>Stillingia aquatica</i>	corkwood
<i>Syzygium cumini</i>	java plum
<i>Taxodium distichum</i>	bald cypress
<i>Tillandsia</i> spp.	air-plants
<i>Toxicodendron radicans</i>	poison ivy

Scientific Name

Typha spp.
Urena lobata
Urochloa mutica
Utricularia spp.
Viola lanceolata
Vitis spp.
Vittaria lineata
Woodwardia spp.
Xyris spp.

Common Name

cat-tails
caesar's weed
paragrass
bladderworts
violet
grape vines
shoestring fern
chain ferns
yellow-eyed grasses

APPENDIX 8 WETLAND POLICIES

The following represents wetland protection policies adopted in the Strategic Regional Policy Plan (TCRPC 1995), and comprehensive plans of Palm Beach County (1989), and the three municipalities with jurisdiction in the project area (Town of Jupiter 1990, City of Palm Beach Gardens 1990, City of West Palm Beach 1989). The policies for Palm Beach County have been revised and were recently adopted.

Treasure Coast Regional Planning Council

Regional Goal 6.6: Protection of wetlands and deepwater habitats

Strategy 6.6.1: Maintain the functions and values provided by wetlands and deepwater habitats.

Policy 6.6.1.1: No activity should be allowed that results in the alteration, degradation, or destruction of wetlands and deepwater habitats, except when:

1. Such an activity is necessary to prevent or eliminate a public hazard;
2. Such an activity would provide direct public benefits which would exceed those lost to the public as a result of habitat alteration, degradation, or destruction;
3. Such an activity is proposed for habitats in which the functions and values currently provided are significantly less than those typically associated with such habitats and cannot be reasonably restored;
4. Such an activity is water dependent or, due to the unique geometry of the site, minimal impact is the unavoidable consequence of development for uses which are appropriate given site characteristics.

Policy 6.6.1.2: Whenever any wetland or deepwater habitat is degraded or destroyed, mitigation should be provided through the creation of new wetland and deepwater habitat, through the restoration of degraded habitat, or through the enhancement of functions and values provided by existing habitats.

Policy 6.6.1.3: A buffer zone of native upland edge vegetation should be provided and maintained around wetland and deepwater habitats which are constructed or preserved on new development sites. The buffer zone may consist of preserved or planted vegetation but should include canopy, understory, and ground cover of native species only. The edge habitat should begin at the upland limit of any wetland or deepwater habitat.

Policy 6.6.1.4: To the maximum extent consistent with protection of functions and values, natural systems should be utilized in lieu of structural alternatives (e.g., channelization,

construction of discharge canals, etc.). In water management systems where use of canals is necessary, any modifications to, or construction of, canals should take into consideration water and habitat quality enhancement features such as planted littoral zones on shallow shelves, other appropriate Best Management Practices, and immediate stabilization of any bare ground adjacent to the canal with vegetation.

Policy 6.6.1.5: All affected local governments in the region should cooperate and participate in ongoing efforts to improve or restore Lake Okeechobee, the Everglades, Water Conservation Areas, Holey Land Wildlife Management Area, Loxahatchee Slough, St. John's Marsh, Indian River Lagoon, Lake Worth Lagoon, and the St. Lucie and Loxahatchee River systems.

Policy 6.6.1.6: Implement wetland policy that assures no net loss and fosters a net gain of wetland and deepwater habitat functions and values.

Policy 6.6.1.7: Retrofit substandard stormwater management systems.

Policy 6.6.1.8: Establish regional mitigation banks to protect wetland systems.

Policy 6.6.1.9: Use of off-road recreational vehicles should be limited to those areas designated for such use and should be strictly regulated to assure that adverse environmental impacts do not occur.

Policy 6.6.1.10: Support measures to eliminate and control the spread of invasive exotic aquatic weeds in the region's canals, waterbodies, and natural wetland systems.

Palm Beach County

Goal 2: Protection of Native Communities and Ecosystems. It is the goal of the county to conserve, appropriately use, and protect the natural functions of native communities and ecosystems.

Objective 2.2: The County shall maintain the functions and values provided by freshwater and marine wetlands so there will be no net loss of wetland functions and values due to development or other activities.

Policy 2.2-a: The County shall continue to implement the Wetlands Protection Section of the Unified Land Development Code and shall continue to review and comment on wetland alteration applications being reviewed by other agencies to ensure that no activity results in the net loss of wetland values and functions. The County shall ensure that the following steps are taken, in order, when assessing proposed activities that may result in wetland impacts:

1. Avoidance of wetland impacts
2. Minimization of unavoidable wetland impacts
3. Compensation for wetland impacts through mitigation

Policy 2.2-b: The County shall require, for any wetland that is degraded or destroyed, that mitigation be provided through the creation of new wetland habitat, through the restoration of degraded habitat, or through the enhancement of functions and values provided by existing habitat. Mitigation efforts that include creating new wetland habitats shall be designed, constructed, and maintained in a manner which will reflect the habitat being altered, degraded or destroyed.

Policy 2.2-c: The County shall designate appropriate and inappropriate uses for wetlands, including the use of wetlands for wastewater treatment, to ensure that the functions and values of existing wetland systems are maintained or enhanced.

Policy 2.2-d: The County shall not allow activities that would diminish the functions and values of wetlands by altering the quantity or timing of water availability to existing wetland or altering their water regimes.

Policy 2.2-e: The County shall require, when reviewing development activities adjacent to or within wetland areas, that a buffer zone of native vegetation, which may include canopy, understory and ground cover, as appropriate be provided and maintained around all wetlands. The area requirements for the buffer zone shall be consistent with the Treasure Coast Strategic Regional Policy Plan.

Policy 2.2-f: The County shall support wetland creation, restoration, enhancement, and preservation and shall encourage public and private sector initiatives for these efforts.

Objective 2.3: The County shall coordinate with the South Florida Water Management District, the lead agency, as well as the Florida Department of Protection and municipalities in the river area, to preserve and protect the Loxahatchee Slough/River Corridor, including the federally-designated Wild and Scenic River portion of the Northwest Fork of the Loxahatchee River through administration of the Unified Land Development Code, enforcement of environmental regulations, and implementation of the Recreation and Open Space Element.

Policy 2.3-a: The County shall participate in the Loxahatchee River Management Coordinating Council to assist the Florida Department of Environmental Protection and the South Florida Water Management District in the development and review of the river management plan, for the formulation of policies addressing the conservation of the slough and river system.

Policy 2.3-b: The county shall continue to designate as conservation on the county's Land Use Plan Map any acquired conservation areas within the area defined as the "Corridor" by the South Florida Water Management District, as well as all slough and river natural areas acquired or managed by the county.

Policy 2.3-c: The County shall continue to work with the South Florida Water Management District and other agencies to ensure that a passive recreational uses allowed within the Corridor are limited to those that are compatible with and preserve the natural character of the area.

Policy 2.3-d: The County shall work with other agencies to ensure that public access to the Corridor shall be available, but limited so that the environmental values of the system can be enjoyed, but no overburdened, by users.

Policy 2.3-e: The County shall participate in funding the design and development of the Loxahatchee Trail nature and recreation system, which will traverse the Corridor. The trail will provide passive recreational uses within the Corridor, creating a major natural recreation area in Palm Beach County.

Policy 2.3-f: The County shall participate with the South Florida Water Management District and other appropriate agencies to re-establish the historic hydrologic connections between the Water Catchment Area, the Slough and the Wild and Scenic River segments of the Corridor.

Town of Jupiter

Goal 1: To conserve, protect and enhance the functions and values of the natural resources within Jupiter to ensure the highest environmental quality possible.

Objective 1.2: To cooperate with and assist the South Florida Water Management District (SFWMD) and the Department of Environmental Regulation (DER) in protecting and preserving the Loxahatchee Slough/River Corridor which borders on the Town of Jupiter to ensure that the quality of estuarine water is maintained at current levels as determined by the SFWMD and the DER using DER established criteria for water quality classifications as reported in Chapter 17-3 F.A.C.

Policy 1.2.1: Areas within the Loxahatchee Slough/River Corridor shall be designated as Conservation in the Future Land Use Element.

Policy 1.2.2: Uses allowed within the Town of Jupiter shall be limited to those which will be compatible with and preserve the natural character of the area, such as passive recreation, observation areas, hiking and nature trails, canoeing, primitive camping and environmental education facilities. Active recreation uses, such as playing fields, tennis courts, etc. shall be prohibited. All residential, commercial, industrial and community service uses shall be prohibited.

Policy 1.2.3: Public access to the river corridor shall be available, but managed so that the environmental values of the system can be enjoyed, but not overburdened, by users.

Policy 1.2.4: The Town shall participate with the South Florida Water Management District, Palm Beach County, Jupiter Inlet District, Loxahatchee River Environmental Control District and other appropriate agencies to re-establish the historic hydrologic connections between three segments of the corridor.

Objective 1.5: To protect and conserve all ecological communities and wildlife, especially endangered and rare species, for present and future generations through adoption of the Local

Development Regulations by May of 1990 which shall include the establishment of environmentally sensitive zoning districts in which regulations will be established for the protection of Ecological Communities and Wildlife.

Policy 1.5.1: Protection and management of wetland and deepwater habitats shall be in a manner consistent with the adopted policies of the Treasure Coast Regional Planning Council, and the South Florida Water Management District, as well as, the Loxahatchee River Aquatic Preserve Management Plan, and the Loxahatchee River Management Plan.

Policy 1.5.2: The Town will encourage the re-establishment of wetlands in previously drained areas where feasible, and will encourage future development and use of wetlands only for purposes which are compatible with their natural values and functions.

Policy 1.5.6: New transportation and utilities development should take place in areas that avoid wetlands and ecotones. Where wetlands cannot be avoided, bridging rather than filling should be utilized to the maximum degree feasible.

Policy 1.5.11: Wetlands shall be avoided by all development, unless proven to be of overriding public interest.

Policy 1.5.12: Any development that does occur in wetlands shall take special care to avoid unnecessary ecological or hydrological damage to the area.

Policy 1.5.13: Wetlands shall have a development potential of 1/2 dwelling unit per acre, with density transferred to the adjacent non-wetland area of the site.

Policy 1.5.16: A buffer zone of native upland edge (i.e., transitional) vegetation shall be provided and maintained around wetland and deepwater habitats which are constructed or preserved on new development sites. The buffer zone may consist of preserved or planted vegetation, but shall include canopy, understory and ground cover of native species only. The edge habitat shall begin at the upland limit of any wetland or deepwater habitat. As a minimum, ten square feet of such buffer shall be provided for each linear foot of wetland or deepwater habitat perimeter that lies adjacent to uplands. This upland edge habitat shall be located such that no less than 50 percent of the total shoreline is buffered by a minimum width of ten feet of upland habitat.

The upland buffer requirement does not apply to those created deepwater habitats (e.g., stormwater management ponds) less than one-half acre in size nor to drainage canals or stormwater conveyance requiring periodic maintenance.

Objective 1.6: To protect the surface and ground water supply, prevent erosion and prevent the loss of life and property through the restriction of building in the flood zone areas of Jupiter the Town shall continue to enforce its adopted flood zone Ordinance and shall adopt further ordinances for flood protection as part of the Drainage Master Plan by the end of 1991.

Policy 1.6.1: The Town promotes and urges continued efforts by the Florida Department of Natural Resources and the South Florida Water Management District to purchase all parcels within the Northwest Fork of the Loxahatchee River.

City of Palm Beach Gardens

Goal 6.1: The natural resource of the City of Palm Beach Gardens shall be preserved or managed in a manner which maximizes their protection, functions, and values.

Objective 6.1.2: Consistent with the time frame provided by Section 163.3202 (1), F.S., the city shall adopt development regulations to manage surface and sub-surface water resources in a manner which ensures their viability as natural habitats and utility for recreational and potable water uses. Furthermore, the regulations shall protect the quality and quantity of waters that flow into estuarine waters in the city.

Policy 6.1.2.2: In accordance with section 163.3202, F.S., the City shall review, and revise where necessary, land development regulations to ensure that:

- a. Site plans for new development identify the location and extent of wetlands located on the property;
- b. Site plans provide measures to assure that normal flows and quality of water will be provided to maintain wetlands after development;
- c. Where alteration of wetlands is necessary in order to allow reasonable use of property, either the restoration of disturbed wetlands will be provided or additional wetlands will be created to mitigate any wetland destruction;
- d. Site plans for developments within the proposed Loxahatchee Slough restoration area work watershed are consistent with SFWMD policies and plans for the area;
- e. Proposed developments comply with the Wellfield Protection Program adopted by the county; and
- f. Site plans identify floodplain areas and incorporate appropriate flood mitigating measures that comply with regulations promulgated by the Federal Emergency Management Agency Flood Insurance Program.

Policy 6.1.2.3: The city shall require the review of all proposed wetlands development with the Florida DER, Florida DNR, SFWMD, TCRPC, and the U.S. Army Corps of Engineers to ensure compliance with dredge and fill permitting processes.

Policy 6.1.2.8: The City shall cooperate with the SFWMD in restoring the Loxahatchee Slough and managing the Loxahatchee Slough Sanctuary. The City in conjunction with the SFWMD, shall review any development adjacent to the Sanctuary for possible adverse impact on the Sanctuary during the development approval process.

Objective 6.1.5: In accordance with section 163.3202, F.S., the city shall review, and revise where necessary, land development regulations to ensure that all ecological communities, wildlife, and marine life, especially endangered and rare species, are identified, managed, and protected.

Policy 6.1.5.3: The city shall continue to cooperate with the SFWMD, and Palm Beach County, through the exchange of technical information and informal coordination, in order to make a concerted effort to protect and conserve unique vegetative communities that exist in the Loxahatchee Slough area and which fall under multiple local jurisdictions.

Policy 6.1.5.8: Wetlands shall be protected by a density transfer program to upland areas. Consistent with SFWMD regulations, a minimum 15-foot upland buffer composed of native vegetation shall be preserved or established around wetland areas. Development will not be allowed in wetlands, except under the following circumstances (consistent with Treasure Coast Regional Planning Council Policy 10.1.1.1): 1) such an activity is necessary to prevent or eliminate a public hazard, 2) such an activity would provide direct public benefit which would exceed those lost as a result of the modification, 3) such an activity is proposed for habitats in which the functions and values currently provided are significantly less than those typically associated with such habitats and cannot be reasonably restored, 4) due to the unique geometry of the site, it is the unavoidable consequence of development for uses which are appropriate given site characteristics, and 5) the functions and values provided by wetland habitats to be destroyed are already completely and fully replaced prior to occurrence of the proposed impact to existing habitat. Examples of situations where these exceptions would apply are found in the Regional Comprehensive Policy Plan (Policy 10.1.1.1). Where development occurs within wetlands, the developer must mitigate the function and value of those wetlands. Development activities shall occur at a density of no more than one dwelling unit per five acres, shall be clustered to the least environmentally sensitive portion of the site and shall include design considerations to protect the wetland functions of the site.

City of West Palm Beach

Goal 1: Preservation and enhancement of the aquifer in the city's water catchment area.

Objective 1.1: Maintain the current policies which restrict the encroachment of incompatible land uses upon the water catchment area.

Policy 1.1.1: Written objections will be submitted to the city regarding restrictions upon encroachment of potentially-detrimental land uses near the water catchment area.

Policy 1.1.2: Continue monitoring water quality in an effort to identify possible deterioration in water supply quality.

Goal 2: The city shall protect the quality of all surface waters.

Objective 2.2: The city's remaining wetlands shall be conserved and protected from physical and hydrologic alterations.

Policy 2.2.1: By 1990, the city shall amend, adopt and implement land development regulations to ensure that:

- a) Site plans for new development identify the location and extent of forests and wetlands located on the property.
- b) Site plans provide measures to assure that normal flows and quality of water will be provided to maintain forests and wetlands after development.
- c) Where alteration of forests and wetlands is necessary in order to allow reasonable use of property, either the restoration of disturbed forests and wetlands will be provided or additional wetlands will be created to mitigate any forest and wetland destruction.

Policy 2.2.2: The city shall cooperate with the Florida Department of Environmental Regulation, Florida Department of Natural Resources, the South Florida Water Management District and the Army Corp of Engineers to improve compliance with dredge and fill state permitting process.

Goal 7: The city shall protect and preserve environmentally significant features, such as the Loxahatchee Slough and river corridor.

Objective 7.1: The city shall preserve and protect that portion of the Loxahatchee Slough and river corridor which lies within its jurisdiction. This segment is the city's Water Catchment Area.

Policy 7.1.1: The city's water catchment area shall be designed as "Conservation" land use category on the Land Use Plan Map.

Policy 7.1.2: Uses allowed within the Water Catchment Area shall be limited to those which will be compatible with and preserve the natural character of the area, such as passive recreation, observation areas, hiking and nature trails, canoeing, primitive camping and environmental education facilities. Active recreation users, such as playing fields, tennis courts, etc. shall be prohibited. All residential, commercial, industrial and community services uses shall be prohibited.

Policy 7.1.3: Public access to the Water Catchment Area shall be available, but managed so that the environmental values of the system can be enjoyed, but not overburdened, by users.

Policy 7.1.4: The City of West Palm Beach shall participate with the South Florida Water Management District, Palm Beach County and other appropriate agencies to re-establish the historic hydrologic connections between the three segments of the corridor.

Policy 7.1.5: The City of West Palm Beach shall cooperate with Palm Beach County, Palm Beach Gardens, the Town of Jupiter and the South Florida Water Management District to ensure that land development activities do not degrade the environmental values and wilderness character of the Loxahatchee Slough and River Corridor and that ambient water quality conditions in the corridor area maintained.

Policy 7.1.6: The City of West Palm Beach shall consider participating with the above organizations and assist in funding a joint study of potential adverse impacts that may result from land development activities on lands draining to the designated river and slough corridor. This study will include an evaluation of the entire C-18 Basin and a delineation of the area draining directly to the corridor where land development activities could directly impact the corridor. Upon completion of this evaluation, the Land Use Plan Map shall be amended to identify this area as the "Loxahatchee Slough and River Corridor Protection Area." The study will address the potential for various degrees and types of impacts on the corridor that may occur in different areas of the C-18 Basin.

Policy 7.1.7: The city shall cooperate with the above organizations to develop Performance Standards that will be met by all land development activities that occur within the C-18 Basin and the designated Loxahatchee Slough and River Corridor Protection Area. The standards may include but not be limited to, the following: lot coverage, ratio of impervious surface to pervious surface, building height, land use, infrastructure requirements, surface water quality and quantity requirements and natural systems/habitats protection. These standards shall be adopted in the Land Development Regulations within one year of the adoption of this Comprehensive Plan.

APPENDIX 9

GLOSSARY OF WETLAND TERMS

This glossary of terms is derived in part from Cowardin et al. (1979) Carlisle (1995), Chapter 62-340, F.A.C. (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 that are appropriate for a given community type (i.e., *Rhynchospora 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 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'), 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% 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* spp.), 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% 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 - are plants which are so widespread in their distribution as to render them inappropriate for indicating inundation or soil saturation.

Facultative wet plants - are 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 an upland.

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 of sources.

Flooding duration - average length of time of inundation per flood occurrence.

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

Floodplain - a flat expanse of land bordering a river.

Floodplain swamp - a wetland natural community occurring on flooded soils along stream channels and in low spots and oxbows within floodplains.

Fresh - term applied to water with salinity less than 0.5% 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 swales - a linear depression, usually designed to capture, store, and convey stormwater runoff.

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

Ground water – water that occupies space below the ground surface.

Hardpan - a very dense soil layer with extremely low permeability caused by compaction of soil particles by organic matter, silica, sesquioxides, or calcium carbonate, for example.

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

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 - indicators 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, aufwach (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 that do not involve physical alteration on-site, 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 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 trees or shrubs 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 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 than 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.

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.

Periodically - 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 at 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* spp.) or bulrushes (*Scirpus* spp.).

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% light penetration and forms the lower boundary of the zone of net metabolic production.

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 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.

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') 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* spp.).

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. Soil 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 the ground is saturated 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 characteristics 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 Palm Beach County was issued on May 17, 1999. 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**

MAY 17 1999

Regulatory Division
South Permits Branch

**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 Palm Beach 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 environ-mentally 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. Currently, only the Palm Beach County portion of the project is complete. A separate public notice will be issued for Martin County at a later date.

The Palm Beach County portion of the Loxahatchee River Basin Wetland Planning Project encompasses approximately 65,000 acres, as shown on the attached map. The project area generally includes wetlands that form the headwaters of the Loxahatchee River Basin. Major waterways within the project area include portions of the Northwest Fork of the Loxahatchee River, Loxahatchee Slough and associated canals and drainage ways.

This area contains a variety of wetland types including hydric hammocks, wet flatwoods, wet prairies, floodplain swamps, freshwater tidal swamps, sloughs, strand swamps, swales, basin marshes and swamps, depression marshes and dome swamps. 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. The project was undertaken to produce a computer database on which local land use decisions could be based. An interagency team of resource agencies developed the resulting report and maps 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 65,000 acre project area contains approximately 25,000 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 the Loxahatchee Slough and Pal-Mar areas, among others. *Medium quality wetlands* are commonly found in Unit 11 of the Acreage, the Sandhill Crane addition to the Loxahatchee Slough Natural area, Vavrus Ranch, and the Loxahatchee River "Save Our Rivers" property south of Indiantown Road, among others. *Low quality wetlands* are commonly found in Jupiter Farms, Palm Beach County Estates, Caloosa and portions of the Acreage south of Mecca Farms, 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 generally exhibit little or no disturbance; approximately 79% of project area wetlands occur in zones that are so designated.

- *Medium quality wetlands*: Wetlands in these zones generally show evidence of moderate levels of impact, intermediate between the high and low quality wetlands; approximately 13% of project area wetlands lie in zones with this designation.

- *Low quality wetlands*: Wetlands in these zones are typically highly disturbed (e.g. wetlands drained by a network of ditches); approximately 8% of project area wetland are in zones with this designation.

The project area also includes approximately 40,000 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 Peter Merritt, Ph.D. of the Treasure Coast Regional Planning Council at (561) 221-4060. Written comments will be accepted for 30 days following publication of this notice. Please submit written comments to:

Veronica Fasselt
Wetlands Section
US Environmental Protection Agency
61 Forsyth Street SW
Atlanta, GA 30303

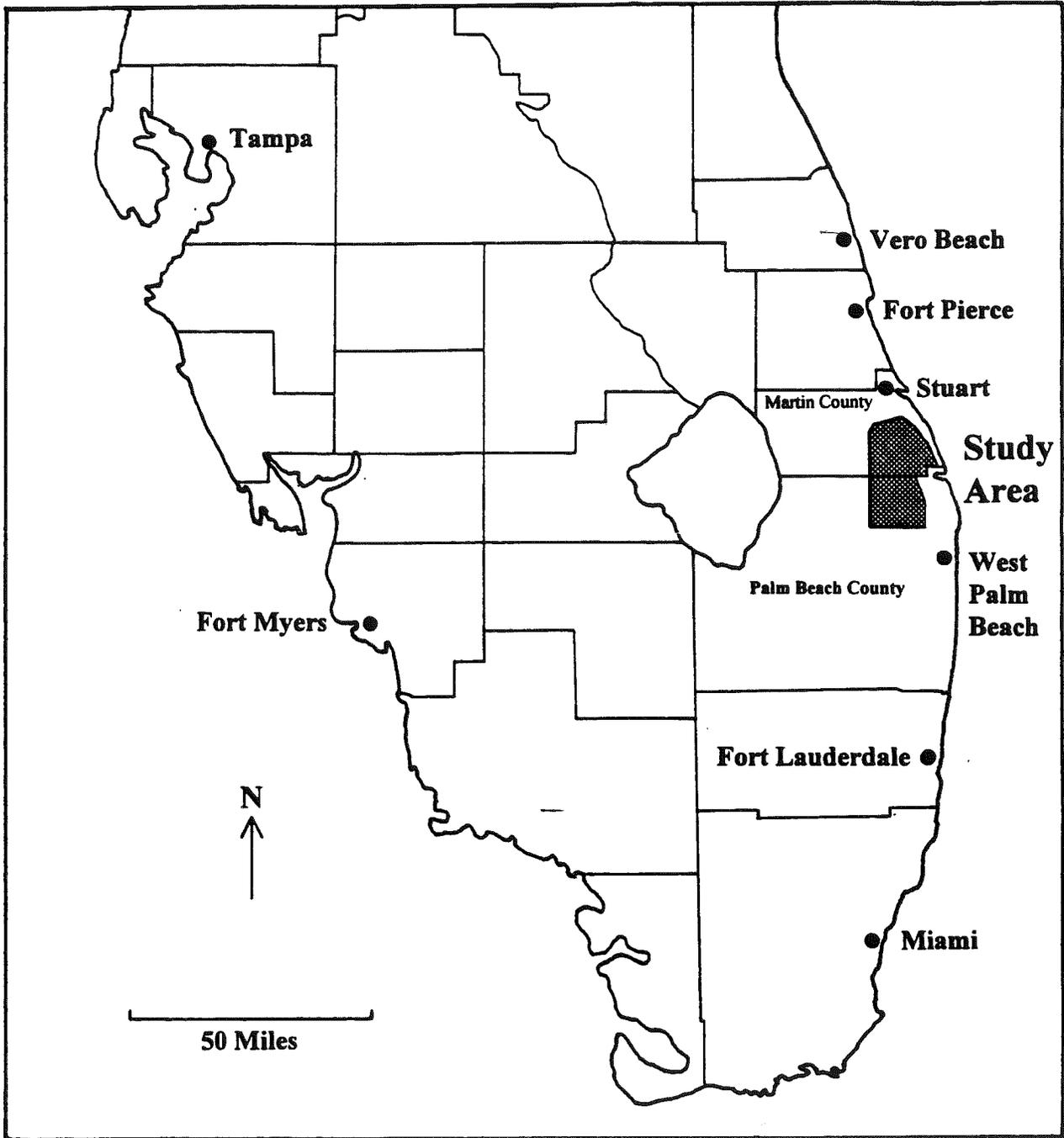
Additional information concerning the Loxahatchee River Basin Wetlands Planning Project determinations may be obtained by contacting Brad Rieck at (561) 562-3909.



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



IMPACT ON NATURAL RESOURCES: Preliminary review of this application indicates that an Environmental Impact Statement will not be required. Coordination with U.S. Fish and Wildlife Service, Environmental Protection Agency, the National Marine Fisheries Service, and other Federal, State, and local agencies, environmental groups, and concerned citizens generally yields pertinent environmental information that is instrumental in determining the impact the proposed action will have on the natural resources of the area. By means of this notice we are soliciting comments on the potential effects of the project on threatened or endangered species or their habitat.

IMPACT ON CULTURAL RESOURCES: Review of the latest published version of the National register of Historic Places indicates that no registered properties, or properties listed as eligible for inclusion therein, are located at the site of the proposed work. Presently unknown archeological, scientific, prehistorical, or historical data may be lost or destroyed by the work to be accomplished.

EVALUATION: The decision whether to issue a permit will be based on an evaluation of the probable impact including cumulative impacts of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered including cumulative impacts thereof; among these are conservation, economics, esthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shoreline erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property ownership, and, in general, the needs and welfare of the people. Evaluation of the impact of the activity on the public interest will also include application of the guidelines promulgated by the Administrator, EPA, under authority of Section 404(b) of the Clean Water Act of the criteria established under authority of Section 102(s) of the Marine, Protection, Research and Sanctuaries Act of 1972. A permit will be granted unless its issuance is found to be contrary to the public interest.

The Corps of Engineers is soliciting comments from the public; Federal, state, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of this proposed activity. Any comments received will be considered by the Corps of Engineers to determine whether to issue, modify, condition or deny a permit for this proposal. To make or deny this decision, comments are used to assess impacts on endangered species, historic properties, water quality, general environmental effects, and the other public interest factors listed above. Comments are used in the preparation of an Environmental Assessment and/or an Environmental Impact Statement pursuant to the National Environmental Policy Act. Comments are also used to determine the need for a public hearing and to determine the overall public interest of the proposed activity.

COASTAL ZONE MANAGEMENT CONSISTENCY: In Florida, the State approval constitutes compliance with the approved Coastal Zone Management Plan. In Puerto Rico, a Coastal Zone Management Consistency Concurrence is required from the Puerto Rico Planning Board. In the Virgin Islands, the Department of Planning and Natural Resources permit constitutes compliance with approved Coastal Zone Management Plan.

REQUEST FOR PUBLIC HEARING: Any person may request a public hearing. The request must be submitted in writing to the District Engineer within the designated comment period of the notice and must state the specific reasons for requesting the public hearing.


JOHN R. HALL
Chief, Regulatory Division

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