United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

August 28, 2007

Colonel Paul L. Grosskruger
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service Activity Code:	41420-2007-FA-0653
Service Consultation Code:	41420-2007-F-0677
Service Log No.:	4-1-04-F-5744
Corps Application No.:	199603501 (IP-TWM)
Date:	April 23, 2007
Applicant:	GL Homes
Project:	Terafina (Saturnia Falls)
County:	Collier

Dear Colonel Grosskruger:

This document transmits the Fish and Wildlife Service's (Service) biological opinion for the April 23, 2007, modification request of the existing Department of the Army Permit Number 1996-3501 issued on June 2, 2006, for the construction and operation of the Terafina (Saturnia Falls) project and its effects on the endangered Florida panther (*Puma concolor coryi*) and the endangered wood stork (*Mycteria americana*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). The modification involves the construction of two water-control structures necessary to accommodate a revised surface water management system. The modification does not result in the additional discharge of fill into or excavation of wetlands or other waters of the United States. The project site is located in Section 16, Township 48 South, Range 26 East; Latitude 26° 17' 42" N, Longitude: 81°42' 48" W, Collier County, Florida (Figure 1).

This biological opinion is based on information provided in the original May 25, 2001, U.S. Army Corps of Engineers (Corps) Public Notice; the revised Public Notice issued on April 23, 2007; the Service's May 9, 2007, response to the Corps April 23, 2007, revised Public Notice; the Service's March 21, 2005, biological opinion for the original Corps May 25, 2001, Public Notice; the Service's June 21, 2001, response to the Corps original Public Notice; the Corps' October 29, 2003, letter to the Service which transmitted a Biological Assessment and Wetlands Rapid Assessment Procedure (WRAP) analysis prepared by Passarella and Associates, Incorporated dated August 2003; additional information submitted by Passarella and Associates, Incorporated dated January 9, 2004; additional information dated May 07, 2007, received from Passarella and Associates on wood stork foraging habitat analysis; information provided by Turrell and Associates, Incorporated; information provided by WilsonMiller, Incorporated; and meetings, telephone conversations, emails, and other sources of information. A complete administrative record of this consultation is on file at the Service's South Florida Ecological Services Office (SFESO), Vero Beach, Florida.

The Corps' original application and issued permit was for fill and excavation in 295.67 acres of wetlands and to alter 66.90 acres of uplands on the 646.55-acre site. The purpose of the project is to construct a residential community known as "Terafina" (Figure 2). The 647-acre project site is comprised of 557.14 acres of jurisdictional wetlands and 89.41 acres of uplands.

Land Use and Habitat Cover Types

Hydric pine flatwoods (*Pinus elliottii*)	180.98 acres
Upland pine flatwoods	86.19 acres
Palmetto prairie (*Serenoa repens)*	2.88 acres
Hydric melaleuca (*Melaleuca quinquenervia*)	314.95 acres
Non-hydric melaleuca	0.34 acre
Shrub swamp	4.15 acres
Pop ash (*Fraxinus caroliniana*),	0.56 acre
Cypress (*Taxodium distichum*)	39.15 acres
Cypress-pine mixed	12.86 acres
Freshwater marsh	1.41 acres
Wet prairie	0.06 acre
Disturbed hydric land	3.02 acres

Exotic vegetation, primarily melaleuca, has infested the majority of the site (600.11 acres) averaging greater than 50 percent of existing vegetative cover. The property is bounded on the north by the proposed Parkland residential golf course community (Corps application number 200106580), on the east by the proposed Mirasol residential golf course community (Corps application number 200001926), on the south by the Old Cypress residential golf course community and to the west by the Cypress Woods residential golf course community (Figure 2).

In the original Public Notice dated May 25, 2001, the Corps determined that the Terafina project "may affect" the endangered wood stork, the endangered red-cockaded woodpecker (RCW) (*Picoides borealis*), the endangered Florida panther, and the threatened eastern indigo snake (*Drymarchon corais couperi*). In a letter dated October 29, 2003, the Corps revised their determinations for the red-cockaded woodpecker and eastern indigo snake to "may affect, but is not likely to adversely affect." On January 16, 2004, the Service concurred with the determination of "may affect, but is not likely to adversely affect" for the eastern indigo snake and red-cockaded woodpecker, and concurred with the Corps' determination of "may affect" for the panther and the wood stork, initiated formal consultation, and stated that a biological opinion would be provided to the Corps. The biological opinion was provided on March 21, 2005.

In the revised Public Notice dated April 23, 2007, the Corps determined that the proposed permit modification does not warrant re-initiation of consultation with the Service. In Service correspondence dated May 9, 2007, the Service did not support this determination for the Florida panther and wood stork, but did support this determination for the RCW and the eastern indigo snake. The Service's letter requested initiation of formal consultation for these two species and notified the Corps that all information necessary to complete formal consultation has been received by the Service.

Project impacts including both wetlands and uplands will be 362.57 acres. The applicant is proposing the restoration and preservation of 74 acres within the development footprint; 210 acres within the project site, but adjacent to the development; 154 acres of lands in the Corkscrew Regional Ecosystem Watershed (CREW); and an additional 107 acres in Hendry County for a total restoration proposal of 545 acres.

In assessing wood stork effects, the Service considers the habitat loss to be only the wetland development footprint and is represented as 295.67 acres. As compensation for wood stork and wetland impacts, the applicant proposes to preserve and enhance 261.47 acres of wetlands and 22.51 acres of uplands onsite (210 acres of wetlands in the adjacent preserve and 51.47 acres of wetlands within the development), and purchase and restore 60.33 acres of wetlands in Hendry County (107 acres site of which 60.33 acres are wetlands) for a total wetland enhancement proposal of 321.80 acres. While not included in the calculation of wood stork mitigation, it is expected that the purchase and restoration of 154 acres within CREW will have an additional long-term benefit for the species. Data on the habitat types and hydroperiods of these wetlands are not available at this time and therefore, were not included.

The onsite preserve is a 210-acre preserve area on the east side of the property that is part of a larger regional flowway that extends off-site. The regional flowway is a north-south component of the wetland corridor that begins in the northern portion of the CREW watershed, receives and transmits surface and ground water discharges southward, and ultimately discharges into the Cocohatchee Canal, which drains into the Wiggins Pass estuary. In previous versions of this application and two adjacent projects, Mirasol (Corps application number 200001926) and Olde Cypress (Corps application number 1989-0960), portions of the north-south flowway were proposed for alteration into a 200-foot wide drainage canal. The proposed design and construction of this canal, a component of the original Mirasol project is no longer a component of this project or the Mirasol project. Within the 210-acre onsite preserve, along with exotic removal, four deeper marsh areas will be excavated to enhance wading bird foraging habitat. Acreage of wetlands to be restored and preserve total 321.8 acres (210+51.47+60.33=321.8)

In assessing Florida panther effects, the Service considers both the development and the internal preserves to be not assessable after development. This habitat loss totals 437 acres. The project is within the boundaries of the Primary Zone (Kautz et al. 2006) (Figure 3) and provides habitat suitable for occasional use for foraging and dispersal. The applicant is proposing the enhancement and preservation of the 210 acres adjacent to the development footprint, as discussed above, the 154 acres of lands within CREW, and the 107 acres of habitat in Hendry County, for a total panther preservation proposal of 471 acres.

The proposed 107-acre compensation site in Hendry County, the 154-acre CREW compensation lands, and the 210-acre onsite preserve are located in the Primary Zone (Kautz et al. 2006) (Figure 4a and 4b). The 107-acre site is currently a mixture of agricultural fields, forested uplands, forested wetlands, and freshwater marsh. It is situated along the western boundary of Okaloacoochee Slough State Forest and Wildlife Management Area. The 154-acre lands are located within CREW, a South Florida Water Management District Save Our Rivers program, located in southeastern Lee County and northern Collier County (Figure 4b). CREW lands are primarily a mixture of forested uplands, forested wetlands and marshes. Restoration of wetlands

and uplands on the 107-acre site and 154-acre CREW lands will consist of the removal of exotic vegetation. Restoration on the 107-acre site will also include planting of native vegetation.

The Use of Best Scientific and Commercial Information by the Service

The Service uses the most current and up-to-date scientific and commercial information available. The nature of the scientific process dictates that information is constantly changing and improving as new studies are completed. The scientific method is an iterative process that builds on previous information. As the Service becomes aware of new information, we will ensure it is fully considered in our decisions, evaluations, reviews, and analyses as it relates to the base of scientific knowledge and any publications cited in our documents.

Specifically, there is one such document cited in this biological opinion the Service acknowledges has been affected in its cited form by new scientific information. The Service has taken these new sources of information into account when using this document to help guide our analysis and decisions. This document is the South Florida Multi-Species Recovery Plan (MSRP) of 1999 (Service 1999).

South Florida Multi-Species Recovery Plan

The MSRP was designed to be a living document and it was designed to be flexible to accommodate the change identified through ongoing and planned research and would be compatible with adaptive management strategies. These principals are set forth in both the transmittal letter from the Secretary of the Interior and in the document itself. As predicted, this is what indeed occurred in the intervening years since the MSRP was published. The Service uses the MSRP in the context it still presents useful information when taken in conjunction with all the new scientific information developed subsequent to its publication.

Consultation History

On May 25, 2001, the Corps issued a public notice for permit application 199603501 (IP-SB). The proposed Terafina development would consist of residential areas (143 acres), lakes (52 acres), roads (32 acres), golf course (155 acres), internal wetland preserves (36 acres), and internal upland preserves (18 acres). The project site was described as consisting of 351 acres of jurisdictional wetlands and 85.31 acres of uplands, for a total of 436.86 acres (437 acres). The project included the filling and excavation of 306.6 acres of wetlands. As mitigation for wetland impacts, in addition to the 36 acres of onsite preserve, the applicant proposes to purchase and transfer to the District 154 acres of lands in the CREW. The Corps provided a determination of "may affect" for wood storks, red-cockaded woodpeckers, Florida panthers, and eastern indigo snakes. No compensation was proposed for the Florida panther.

On June 21, 2001, the Service responded to the public notice with a letter to the Corps requesting additional information for wood storks, red-cockaded woodpeckers, Florida panthers, and fish and wildlife resources (wetlands).

On July 17, 2001, the Service sent a letter to the Corps stating that the project will have substantial and unacceptable impacts to aquatic resources of national significance if permitted as specified in the public notice.

During the week of August 6, 2001, Service staff visited the site with Turrell and Associates, Incorporated.

On January 10, 2003, Turrell and Associated, Incorporated submitted a revised mitigation plan showing an increase in wetland preservation to 45.19 acres. A supporting WRAP analysis was included.

On April 3, 2003, Service staff met with Passarella and Associates, Incorporated, and Broad and Cassel, P.A. to discuss area hydrology and the proposed conveyance flow-way.

On April 9, 2003, Service staff met with the Corps, Passarella and Associates, Incorporated, and GL Homes to discuss flow-way issues, wetland mitigation, and endangered species concerns. Passarella and Associates, Incorporated stated that the applicant will provide a new biological assessment and revised plans for project impacts and mitigation.

On September 25, 2003, Service staff met with Passarella and Associates, Incorporated, GL Homes, Broad and Cassel, P.A., and John Fumero, P.A., to discuss a revised site plan, wetland mitigation, Florida panther habitat analysis, and wood stork habitat analysis. Project binders, containing revised plans with a biological assessment and WRAP analyses, dated August 2003, were submitted by Passarella and Associates, Incorporated.

On October 29, 2003, the Corps sent a letter to the Service transmitting the information that the Service had received on September 25, 2003, referenced above. The Corps revised their determinations for the red-cockaded woodpecker and eastern indigo snake to "may affect, but is not likely to adversely affect" and requested initiation of formal consultation for the wood stork and Florida panther.

On December 10, 2003, John Fumero, P.A., met with the Service to discuss project elements and status.

On December 11, 2003, Service staff initiated a conference call with Passarella and Associates, Incorporated, to discuss panther habitat acreages and characteristics for a habitat compensation analysis.

On January 6, 2004, GL Homes notified the Service by email that a 107-acre parcel in Hendry County, primarily pine flatwoods and freshwater marsh, had been identified for additional panther habitat compensation.

On January 9, 2004, Passarella and Associates, Incorporated sent the Service additional information regarding the Hendry County parcel to be purchased. Information included habitat characterization and a restoration plan.

On January 16, 2004, the Service provided the Corps with a letter concurring with the Corps' "may affect, but is not likely to adversely affect" determination for the eastern indigo snake and red-cockaded woodpecker. The Service also concurred with the Corps' "may affect" determination for the Florida panther and wood stork and entered into formal consultation.

On June 14, 2004, the Service issued the Biological Opinion, Service log number 4-1-04-F-5744, for the proposed Terafina project, Corps application number 199603501, for project effects on the Florida panther and wood stork.

On September 15, 2004, the Service received a request from the Corps to reinitiate consultation on the reference project, based on the remanding of the Florida Rock Biological Opinion dated January 30, 2002; Service log number 4-1-98-F-372, Corps application number SAJ-1994-2492 in National Wildlife Federation v. Norton, 332 F. Supp.2d 170 (D.D.C. 2004).

On October 19, 2004, the Service requested additional information and map figures from the Corps.

On October 23, 2004, the Service received additional information from Passarella and Associates, Incorporated.

On March 21, 2005, the Service issued a biological opinion for project effects to the Florida panther and wood stork.

On December 8, 2005, the Corps denied the Mirasol permits, which included the conveyance flowway within the 210 acre preserve. The permit denial required a revision of the Terafina permit to provide an alternate means to address water storage and conveyance.

On April 23, 2007, the Corps issued a revised Public Notice for the project modifications needed to address the alternate means of water storage and conveyance. The Public Notice also concluded that the Corps considers the proposed modifications to not warrant re-initiation of consultation pursuant to section 7 of the Act.

On May 8, 2007, the Service provided a letter to the Corps stating that we do not support the Corps determination for the Florida panther and wood stork and do concur with the Corps determination for the RCW and eastern indigo snake. The Service requested the Corps enter into formal consultation for the Florida panther and wood stork. The Service also notified the Corps that the Service has all information needed to conclude formal consultation on project effects to the Florida panther and wood stork.

On July 27, 2007, the Service received additional information from the applicant on the location of the 154 acres of compensation lands within the CREW watershed.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The Corps' original application and issued permit was for fill and excavation in 295.67 acres of wetlands and to alter 66.90 acres of uplands on the 646.55-acre site. The purpose of the project is to construct a residential community known as "Terafina" (Figure 2). The 647-acre project site is comprised of 557.14 acres of jurisdictional wetlands and 89.41 acres of uplands.

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Project impacts including both wetlands and uplands will be 362.57 acres. The applicant is proposing the restoration and preservation of 74 acres of within the development footprint; 210 acres within the project site, but adjacent to the development; 154 acres of lands in the Corkscrew Regional Ecosystem Watershed (CREW); and an additional 107 acres in Hendry County for a total restoration proposal of 546 acres.

In assessing wood stork effects, the Service considers the habitat loss to be only the wetland development footprint and is represented as 295.67 acres. As compensation for wood stork and wetland impacts, the applicant proposes to preserve and enhance 261.47 acres of wetlands and 22.51 acres of uplands onsite (210 acres of wetlands in the adjacent preserve and 51.47 acres of wetlands within the development), and purchase and restore 60.33 acres of wetlands in Hendry County (107 acres site of which 60.33 acres are wetlands) for a total wetland enhancement proposal of 321.80 acres. The onsite preserve includes a 210-acre area on the east side of the property that is part of a larger regional preserve. While not included in the calculation of wood stork mitigation, it is expected that the purchase and restoration of 154 acres within CREW will have an additional long-term benefit for the species. Data on the habitat types and hydroperiods of these wetlands are not available at this time and therefore, were not included. Therefore, acreage of wetlands to be restored and preserve for wood stork compensation totals 321.8 acres (210+51.47+60.33=321.8).

In assessing Florida panther effects, the Service considers both the development and the internal preserves to be not assessable after development. This habitat loss totals 437 acres. The project is within the boundaries of the Primary Zone (Kautz et al. 2006) (Figure 3) and provides habitat suitable for occasional use for foraging and dispersal. The applicant is proposing the enhancement and preservation of the 210 acres adjacent to the development footprint, the 154 acres of lands within CREW, and the 107 acres of habitat in Hendry County, for a total panther preservation proposal of 471 acres.

The proposed 107-acre compensation site in Hendry County and the 154-acre CREW compensation lands are located in the Primary Zone (Kautz et al. 2006) (Figure 4). The 107-acre site is currently a mixture of agricultural fields, forested uplands, forested wetlands, and freshwater marsh. It is situated along the western boundary of Okaloacoochee Slough State Forest and Wildlife Management Area. The 154-acre lands are located within CREW, a South Florida Water Management District Save Our Rivers program, located in southeastern Lee County and northern Collier County. CREW lands are primarily a mixture of forested uplands, forested wetlands and marshes. Restoration of wetlands and uplands on the 107-acre site and 154-acre CREW lands will consist of the removal of exotic vegetation. Restoration on the 107-acre site will also include planting of native vegetation.

The 210-acre onsite preservation area on the east side of the property is part of a larger regional slough that extends off-site. Within this onsite preservation area, along with exotic removal, four deeper marsh areas will be excavated to enhance wading bird foraging habitat.

The proposed compensation plan provides habitat preservation and restoration within and near the project area, and benefits the survival and recovery of the Florida panther as referenced in the draft Panther Recovery Plan (Service 2006) goal 1.1.1.2.3. This goal recommends that habitat preservation and restoration within the Primary Zone be provided in situations where land use intensification can not be avoided. The applicant has proposed equivalent habitat protection and restoration, to compensate for both the quantity and functional value of the lost habitat.

Project Acreage Summary

Project Site	646.55 Acres	Development Footprint	362.57 acres

On-site Preserve: 74 acres within but not part of development footprint, 210 acres within project site but outside of development footprint.

Off-site Preserve: 154 acres in CREW and 107 acres in Hendry County.

***Total Preservation Proposal**: 545 acres*

Florida panther Adverse Effects: 437 acres on-site, includes both the project development acres and the 74 acres of internal preserve.

Florida panther Compensation: 210 acres within project site, but adjacent to development footprint, 154 acres in CREW and 107 acres in Hendry County.

***Total Project Effects to the panther:** 437 acres*
***Total Preserve Proposal:** 471 acres*

Wood stork Adverse Effects: 295.67 acres development footprint.

Wood stork Compensation: 51.47 acres of wetlands within but not part of development footprint, 210 acres of wetlands within project site, but adjacent to development, and 60.33 of wetlands within the 107 acres in Hendry County site. The wetland enhancements proposed through the acquisition and restoration of the 154 acres in CREW were not assessed as components of our wood stork bio-mass evaluation because data on the habitat types and hydroperiods of these wetlands are not available at this time and therefore, were not included, although acquisition and restoration is expected to provide a beneficial effect to wood stork foraging and reductive success in the action area. Therefore, the overall assessment of the benefits of the mitigation is conservative.

***Total Project Effects to the Wood stork:** 296 acres*
***Total Preserve Proposal:** 475.80 acres*
***Total Preserve evaluated:** 321.80 (475.80-154=321.80)*

Action Area

Florida panther

The Service's Panther Focus Area for the Florida panther includes lands in Charlotte, Glades, Hendry, Lee, Collier, Palm Beach, Broward, Miami-Dade, and Monroe Counties, as well as the southern portion of Highlands County (Figure 5). Developed urban coastal areas in eastern Palm Beach, Broward, and Miami-Dade Counties, and in western Charlotte, Lee, and Collier Counties were excluded because they contain little or no panther habitat and it is unlikely that panthers would use such areas.

Movements of Florida panthers are much larger than the project site and, therefore, the Service's action area is larger than the proposed action area identified by the Corps' public notice. The

action area, which is a subset of the current panther range, includes those lands where the Service believes panthers may experience direct and indirect effects from the proposed development. Maehr et al. (1990a) monitored five solitary panthers continuously for 130-hour periods seasonally from 1986 to 1989, rarely observing measurable shifts in location during the day, but nocturnal shifts in location exceeding 20.0 kilometers (km) (12.4 miles) were not unusual. Maehr et al. (2002a) in a later report documented a "mean maximum dispersal distance" of 68.1 km (42.3 miles) for subadult males and 20.3 km (12.6 miles) for subadult females. In the same report Maehr et al. (2002a) documented a "mean dispersal distance" of 37.3 km (23.1 miles) for subadult males. Comiskey et al. (2002) documented a "mean dispersal distance" for subadult male panthers as an average distance of 40.1 km (24.9 miles) from their natal range, which is similar to the dispersal distance referenced by Maehr et al. (2002a).

Therefore, for both direct and indirect effects, the Service defined the action area (Figure 6) as all lands within a 25-mile radius of the Terafina project, which is slightly greater than the mean dispersal distance for subadult males. This action area does not include urban lands or lands west of I-75. This action area includes areas anticipated to sustain direct and indirect effects, such as roadways experiencing increased traffic, areas with increased human disturbance (project area and periphery of project), and areas in which habitat fragmentation and intraspecific aggression may be felt.

Wood stork

The Service has determined the action area for the wood stork is larger than the proposed action area identified in the Corps' public notice. We note the project site is located within 18 miles of three active wood stork nesting colonies. Two of these colonies are located within the National Audubon Society's Corkscrew Swamp Sanctuary (Corkscrew) about 7.8 miles and 8.9 miles northeast of the project site. The third wood stork nesting colony is located about 17.6 miles east of the project site, just north of the Fakahatchee Strand State Preserve. Coulter and Bryan (1993) found that 85 percent of wood stork foraging occurs within 12.5 miles of the nesting colony. Furthermore, the FWC considers the area within 18.6 miles of the nesting colony as the Core Foraging Area (CFA) for wood storks. For the purposes of this biological opinion, the action area is considered to include the project site and the CFAs of the three wood stork nesting colonies described above. The action area encompasses 1,621.1 square miles of Collier, Lee, and Hendry Counties (Figure 7).

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE

Florida panther

Status - Panther Biology/Ecology

The Florida panther, is the last subspecies of *Puma* (also known as mountain lion, cougar, painter, or catamount) still surviving in the eastern United States. Historically occurring throughout the southeastern United States (Young and Goldman 1946), today the panther is restricted to less than 5 percent of its historic range in one breeding population of less than 100 animals, located in south Florida.

When Europeans first came to this country, pumas roamed most all of North, Central, and South America. Early settlers attempted to eradicate pumas by every means possible. By 1899, it was felt that Florida panthers had been restricted to peninsular Florida (Bangs 1899). By the late 1920s to mid 1930s it was thought by many that the Florida panther had been completely eliminated (Tinsley 1970). In 1935, Dave Newell, a Florida sportsman, hired Vince and Ernest Lee, Arizona houndsmen, to hunt for panthers in Florida. They killed eight in the Big Cypress Swamp (Newell 1935). Every survey conducted since then has confirmed that a panther population occurs in southern Florida south of the Caloosahatchee River, and no survey since then has been able to confirm a panther population outside of southern Florida.

Attempts to eradicate panthers and a decline in panther prey (primarily white-tailed deer) resulted in a panther population threatened with extinction. Prior to 1949, panthers could be killed in Florida at any time of the year. In 1950, the Florida Game and Freshwater Fish Commission (now the Florida Fish and Wildlife Conservation Commission [FWC]) declared the panther a regulated game species due to concerns over declining numbers. The FWC removed panthers from the game animal list in 1958 and gave them complete legal protection. On March 11, 1967, the Service listed the panther as endangered (32 FR 4001) throughout its historic range, and these animals received Federal protection under the passage of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act). Also, the Florida Panther Act (State Statute 372.671), a 1978 Florida State law, made killing a panther a felony. The Florida panther is listed as endangered by the States of Florida, Georgia, Louisiana, and Mississippi.

Since the panther was designated as an endangered species prior to enactment of the Act, there was no formal listing package identifying threats to the species as required by section 4(a)(1) of the Act. However, the technical/agency draft of the Florida Panther Recovery Plan, third revision, addressed the five factor threats analysis (Service 2006). No critical habitat has been designated for the panther.

Taxonomy

The Florida panther was first described by Charles B. Cory in 1896 as *Felis concolor floridana* (Cory 1896). The type specimen was collected in Sebastian, Florida. Bangs (1899), however, believed that the Florida panther was restricted to peninsular Florida and could not intergrade with other *Felis* spp. Therefore, he assigned it full specific status and named it *Felis coryi* since *Felis floridana* had been used previously for a bobcat (*Lynx rufus*).

The taxonomic classification of the *Felis concolor* group was revised and described by Nelson and Goldman (1929) and Young and Goldman (1946). These authors differentiated 30 subspecies using geographic and morphometric (measurement of forms) criteria and reassigned the Florida panther to subspecific status as *Felis concolor coryi*. This designation also incorporated *F. arundivaga* which had been classified by Hollister (1911) from specimens collected in Louisiana into *F. c. coryi*. Nowell and Jackson (1996) reviewed the genus *Felis* and placed mountain lions, including the Florida panther, in the genus *Puma*.

Culver et al. (2000) examined genetic diversity within and among the described subspecies of *Puma concolor* using three groups of genetic markers and proposed a revision of the genus to

include only six subspecies, one of which encompassed all puma in North America including the Florida panther. However, Culver et al. (2000) determined that the Florida panther was one of several smaller populations that had unique features, the number of polymorphic microsatellite loci and amount of variation were lower, and it was highly inbred (eight fixed loci). The degree to which the scientific community has accepted the results of Culver et al. (2000) and the proposed change in taxonomy is not resolved at this time. The Florida panther remains listed as a subspecies and continues to receive protection pursuant to the Act.

Species Description

An adult Florida panther is unspotted and typically rusty reddish-brown on the back, tawny on the sides, and pale gray underneath. There has never been a melanistic (black) puma documented in North America (Tinsley 1970, 1987). Adult males can reach a length of seven feet (ft) (2.1 meters [m]) from their nose to the tip of their tail and may exceed 161 pounds (lbs) (73 kilograms [kg]) in weight; but, typically adult males average around 116 lbs (52.6 kg) and stand about 24-28 inches (in) (60-70 centimeters [cm]) at the shoulder (Roelke 1990). Female panthers are smaller with an average weight of 75 lbs (34 kg) and length of 6 ft (1.8 m) (Roelke 1990). The skull of the Florida panther is unique in that it has a broad, flat, frontal region, and broad, high-arched or upward-expanded nasal bones (Young and Goldman 1946).

Florida panther kittens are gray with dark brown or blackish spots and five bands around the tail. The spots gradually fade as the kittens grow older and are almost unnoticeable by the time they are six months old. At this age, their bright blue eyes slowly turn to the light-brown straw color of the adult (Belden 1988).

Three external characters—a right angle crook at the terminal end of the tail, a whorl of hair or cowlick in the middle of the back, and irregular, white flecking on the head, nape, and shoulders—not found in combination in other subspecies of *Puma* (Belden 1986), were commonly observed in Florida panthers through the mid-1990s. The kinked tail and cowlicks were considered manifestations of inbreeding (Seal 1994); whereas the white flecking was thought to be a result of scarring from tick bites (Maehr 1992, Wilkins et al. 1997). Four other abnormalities prevalent in the panther population prior to the mid-1990s included cryptorchidism (one or two undescended testicles), low sperm quality, atrial septal defects (the opening between two atria in the heart fails to close normally during fetal development), and immune deficiencies and were also suspected to be the result of low genetic variability (Roelke et al. 1993a).

A plan for genetic restoration and management of the Florida panther was developed in September 1994 (Seal 1994) and eight non-pregnant adult female Texas panthers (*Puma concolor stanleyana*) were released in five areas of south Florida from March to July 1995. Since this introgression, rates of genetic defects, including crooked tails and cowlicks, have dramatically decreased (Land et al. 2004). In addition, to date neither atrial septal defects nor cryptorchidism have been found in introgressed panthers (M. Cunningham, FWC, pers. comm. 2005). As of January 27, 2003, none of the eight female Texas panthers introduced in 1995 remain in the wild.

Population Trends and Distribution

The Florida panther once ranged throughout the southeastern United States from Arkansas and Louisiana eastward across Mississippi, Alabama, Georgia, Florida, and parts of South Carolina and Tennessee (Young and Goldman 1946). Historically, the panther intergraded to the north with *P. c. cougar*, to the west with *P. c. stanleyana*, and to the northwest with *P. c. hippolestes* (Young and Goldman 1946).

Although, generally considered unreliable, sightings of panthers regularly occur throughout the Southeast. However, no populations of panthers have been found outside of south Florida for at least 30 years despite intensive searches (Belden et al. 1991, McBride et al. 1993, Clark et al. 2002). Survey reports and more than 70,000 locations of radio-collared panthers recorded between 1981 and 2004 clearly define the panther's current range. Reproduction is known only in the Big Cypress Swamp/Everglades physiographic region in Collier, Lee, Hendry, Miami-Dade, and Monroe Counties south of the Caloosahatchee River (Belden et al. 1991). Although, the breeding segment of the panther population occurs only in south Florida, panthers have been documented north of the Caloosahatchee River over 125 times since February 1972. This has been confirmed through field sign (e.g., tracks, urine markers, scats), camera-trap photographs, seven highway mortalities, four radio-collared animals, two captured animals (one of which was radiocollared), and one skeleton. From 1972 through 2004, panthers have been confirmed in 11 counties (Flagler, Glades, Highlands, Hillsborough, Indian River, Okeechobee, Orange, Osceola, Polk, Sarasota, and Volusia) north of the river (Belden et al. 1991, Belden and McBride 2005). However, no evidence of a female or reproduction has been documented north of the Caloosahatchee River since 1973 (Nowak and McBride 1974, Belden et al. 1991, Land and Taylor 1998, Land et al. 1999, Shindle et al. 2000, McBride 2002, Belden and McBride 2005).

Puma are wide ranging, secretive, and occur at low densities. However, their tracks, urine markers, and scats are readily found by trained observers, and resident populations are easily located. Van Dyke (1986a) determined that all resident puma, 78 percent of transient puma, and 57 percent of kittens could be detected by track searches in Utah. In south Florida, the Florida panther's limited range and low densities may make the population count derived from track searches more accurate than in Utah. During two month-long investigations – one late in 1972 and early 1973 and another in 1974 – funded by the World Wildlife Fund to determine if panthers still existed in Florida, McBride searched for signs of panthers in portions of south Florida. In 1972, McBride authenticated a road-killed male panther in Glades County and a female captured and released from a bobcat trap in Collier County (R. McBride, Livestock Protection Company, pers. comm. 2005). In 1973, McBride captured one female in Glades County (Nowak and McBride 1974). Based on this preliminary evidence, Nowak and McBride (1974) estimated the "population from the Lake Okeechobee area southward to be about 20 or 30 individuals." In 1974, McBride found evidence of only two additional panthers in the Fakahatchee Strand and suggested that "there could be as few as ten individuals panthers in the area around Lake Okeechobee and southward in the state" (Nowak and McBride 1975). This initial survey, while brief in nature, proved that panthers still existed in Florida and delineated areas where a more exhaustive search was warranted. After this initial investigation, more comprehensive surveys on both public and private lands were completed (Reeves 1978; Belden and McBride 1983a, b; Belden et al. 1991). Thirty individual panthers were identified during a wide-ranging survey in 1985 in south Florida (McBride 1985).

Maehr et al. (1991) provides the only published estimate of population density based on a substantial body of field data (Beier et al. 2003). Maehr et al. (1991) estimated a density of 1 panther/27,520 acres [11,137 hectares (ha)] based on 17 concurrently radiocollared and four uncollared panthers. They extrapolated this density to the area occupied (1,245,435 acres [504,012 ha]) by radio-collared panthers during the period 1985-1990 to achieve a population estimate of 46 adult panthers for southwest Florida (excluding Everglades National Park [ENP], eastern Big Cypress National Preserve [BCNP], and Glades and Highlands Counties). Beier et al. (2003), however, argued that this estimate of density, although "reasonably rigorous," could not be extrapolated to other areas because it was not known whether densities were comparable in those areas.

More recently, McBride (2000, 2001, 2002, 2003) reported minimum population counts (*i.e.*, number known alive) based on panthers treed with hounds, physical evidence (*e.g.*, tracks where radio-collared panthers were not known to occur), documentation by trail-camera photos, and sightings of uncollared panthers by a biologist or pilot from a monitoring plane or via ground telemetry. He counted adults and subadult panthers but not kittens at the den). The population estimate in 2000 was 62 panthers (McBride 2000), with estimates of 78 in 2001 (McBride 2001), 80 in 2002 (FWC 2002), 87 in 2003 (FWC 2003), 78 in 2004 (R. McBride, Personal Communication, 2006), 82 in 2005 (R. McBride, Personal Communication, 2006), and 97 in 2006 (R. McBride, Personal Communication, 2006). The 3-year running average of the verified panther population shows an annual increase in the population over the reported years.

Life History

Reproduction: Male Florida panthers are polygynous, maintaining large, overlapping home ranges containing several adult females and their dependent offspring. The first sexual encounters for males normally occur at about 3 years based on 26 radio-collared panthers of both sexes (Maehr et al. 1991). Based on genetics work, some males may become breeders as early as 17 months (W. Johnson, National Cancer Institute, pers. comm. 2005). Breeding activity peaks from December to March (Shindle et al. 2003). Litters (n = 82) are produced throughout the year, with 56-60 percent of births occurring between March and June (Jansen et al. 2005, Lotz et al. 2005). The greatest number of births occurs in May and June (Jansen et al. 2005, Lotz et al. 2005). Female panthers have bred as young as 18 months (Maehr et al. 1989) and successful reproduction has occurred up to 11 years old. Mean age of denning females is 4.6 ± 2.1 (standard deviation [sd]) years (Lotz et al. 2005). Age at first reproduction for 19 known-aged female panthers averaged 2.2 ± 0.246 (sd) years and ranged from 1.8-3.2 years. Average litter size is 2.4 ± 0.91 (sd) kittens. Seventy percent of litters are comprised of either two or three kittens. Mean birth intervals (elapsed time between successive litters) are 19.8 ± 9.0 (sd) months for female panthers (n = 56) (range 4.1-36.5 months) (Lotz et al. 2005). Females that lose their litters generally produce another more quickly; five of seven females whose kittens were brought into captivity successfully produced another litter an average of 10.4 months after the removal of the initial litter (Land 1994).

Den sites are usually located in dense, understory vegetation, typically saw palmetto (*Serenoa repens*) (Maehr 1990, Shindle et al. 2003). Den sites are used for up to two months by female panthers and their litters from birth to weaning. Independence and dispersal of young typically occurs at 18 months, but may occur as early as one year (Maehr 1992).

Survivorship and Causes of Mortality: Mortality records for uncollared panthers have been kept since February 13, 1972, and for radio-collared panthers since February 10, 1981. One-hundred eighty-nine mortalities have been documented through October 30, 2006, with 86 (46 percent) of known deaths occurring in the past 5 years (FWC 2006a, FWC unpublished data). Overall, documented mortality averaged 3.6 per year through June 2001, and 16.0 per year from July 2001 through June 2006. Of the 189 total mortalities, 100 were radio-collared panthers that have died since 1981 (FWC 2006a, FWC unpublished data). From 1990-2004, mean annual survivorship of radio-collared adult panthers was greater for females (0.894 ± 0.099 sd) than males (0.779 ± 0.125 sd) (Lotz et al. 2005). Except for intraspecific aggression, the causes of mortality were found to be independent of gender (Lotz et al. 2005).

Intraspecific aggression was the leading cause of death for radio-collared panthers, accounting for 42 percent (Jansen et al. 2005, Lotz et al. 2005). Most intraspecific aggression occurs between male panthers; but, aggressive encounters between males and females, resulting in the death of the female, have occurred. Defense of kittens and\or a kill is suspected in half (5 of 10) of the known instances through 2003 (Shindle et al. 2003).

Unknown causes and collisions with vehicles accounted for 24 and 19 percent of radio-collared panther mortalities, respectively. From February 13, 1972, through June 30, 2006, Florida panther vehicular trauma (n=96), averaged 2.8 per year for radio-collared and uncollared panthers (FWC 2006a). Ten of the collisions were not fatal. Nineteen additional panthers were killed by vehicles from July 1, 2006, through August 21, 2007 (FWC, unpublished data), bringing the total to 115 panthers killed or injured by vehicles.

Female panthers are considered adult residents if they are older than 18 months, have established home ranges and bred (Maehr et al. 1991). Land et al. (2004) reported that 23 of 24 female panthers first captured as kittens survived to become residents and 18 (78.3 percent) produced litters; one female was too young to determine residency. Male panthers are considered adult residents if they are older than three years and have established a home range that overlaps with females. Thirty-one male panthers were captured as kittens and 12 (38.7 percent) of these cats survived to become residents (Jansen et al. 2005, Lotz et al. 2005). "Successful male recruitment appears to depend on the death or home-range shift of a resident adult male" (Maehr et al. 1991). Turnover in the breeding population is low with documented mortality in radio-collared panthers being greatest in subadults and non-resident males (Maehr et al. 1991, Shindle et al. 2003).

Den sites of female panthers have been visited since 1992 and the number of kittens that survived to 6 months for 38 of these litters has been documented. Florida and introgressed panther kitten survival to 6 months were estimated to be 52 and 72 percent, respectively, but were not significantly different (P = 0.2776) (Lotz et al. 2005). Survival of kittens greater than 6 months old was determined by following the fates of 55 radio-collared dependent-aged kittens, including 17 introgressed panthers from 1985 - 2004. Only one of these 55 kittens died before reaching independence, resulting in a 98.2 percent survival rate (Lotz et al. 2005). The FWC and NPS are continuing to compile and analyze existing reproductive and kitten data.

Dispersal: Panther dispersal begins after a juvenile becomes independent from its mother and continues until it establishes a home range. Dispersal distances are greater for males (n = 18) than females (n = 9) (42.5 mi [68.4 km] vs. 12.6 mi [20.3 km], respectively) and the maximum dispersal distance recorded for a young male was 139.2 mi (224.1 km) over a seven-month period followed by a secondary dispersal of 145 mi (233 km) (Maehr et al. 2002a). Males disperse an average distance of 25 mi (40 km); females typically remain in or disperse short distances from their natal ranges (Comiskey et al. 2002). Female dispersers are considered philopatric because they usually establish home ranges less than one average home range width from their natal range (Maehr et al. 2002a). Maehr et al. (2002a) reported that all female dispersers (n = 9) were successful at establishing a home range whereas only 63 percent of males (n = 18) were successful. Young panthers become independent at 14 months on average for both sexes, but male dispersals are longer in duration than for females (9.6 months and 7.0 months, respectively) (Maehr et al. 2002a). Dispersing males usually go through a period as transient (non-resident) subadults, moving through the fringes of the resident population and often occupying suboptimal habitat until an established range becomes vacant (Maehr 1997).

Most panther dispersal occurs south of the Caloosahatchee River with only four radio-collared panthers crossing the river and continuing north since 1981 (Land and Taylor 1998, Land et al. 1999, Shindle et al. 2000, Maehr et al. 2002a, Belden and McBride 2005). Western subspecies of *Puma* have been documented crossing wide, swift-flowing rivers up to a mile in width (Seidensticker et al. 1973, Anderson 1983). The Caloosahatchee River, a narrow (295-328 ft [90-100 m]), channelized river, probably is not a significant barrier to panther movements, but the combination of the river, State Route (SR) 80, and land uses along the river seems to have restricted panther dispersal northward (Maehr et al. 2002a). Documented physical evidence of at least 15 other uncollared male panthers have been confirmed north of the river since 1972, but no female panthers nor reproduction have been documented in this area since 1973 (Belden and McBride 2005).

Home Range Dynamics and Movements: Panthers require large areas to meet their needs. Numerous factors influence panther home range size including habitat quality, prey density, and landscape configuration (Belden 1988, Comiskey et al. 2002). Home range sizes of 26 radio-collared panthers monitored between 1985 and 1990 averaged 128,000 acres (51,800 ha) for resident adult males and 48,000 acres (19,425 ha) for resident adult females; transient males had a home range of 153,599 acres (62,160 ha) (Maehr et al. 1991). Comiskey et al. (2002) examined the home range size for 50 adult panthers (residents greater than 1.5 years old) monitored in south Florida from 1981-2000 and found resident males had a mean home range of 160,639 acres (65,009 ha) and females had a mean home range of 97,920 acres (39,627 ha). Beier et al. (2003) found home range size estimates for panthers reported by Maehr et al. (1991) and Comiskey et al. (2002) to be reliable. Annual minimum convex polygon home range sizes of 52 adult radio-collared panthers monitored between 1998 and 2002 ranged from 15,360 – 293,759 acres (6,216 – 118,880 ha), averaging 89,600 acres (36,260 ha) for 20 resident adult males and 44,160 acres (17,871 ha) for 32 resident adult females (Land et al. 1999, Shindle et al. 2000, Shindle et al. 2001, Land et al. 2002). The most current estimate of home-range sizes (minimum convex polygon method) for established, non-dispersing, adult, radio-collared panthers averaged 29,056 acres (11,759 ha) for females (n = 11) and 62,528 acres (25,304 ha)

for males (n = 11) (Lotz et al. 2005). The average home range was 35,089 acres (14,200 ha) for resident females (n = 6) and 137,143 acres (55,500 ha) (n = 5) for males located at BCNP (Jansen et al. 2005). Home ranges of resident adults tend to be stable unless influenced by the death of other residents; however, several males have shown significant home range shifts that may be related to aging (D. Jansen, National Park Service [NPS], pers. comm. 2005). Home-range overlap is extensive among resident females and limited among resident males (Maehr et al. 1991).

Activity levels for Florida panthers are greatest at night with peaks around sunrise and after sunset (Maehr et al. 1990a). The lowest activity levels occur during the middle of the day. Female panthers at natal dens follow a similar pattern with less difference between high and low activity periods.

Telemetry data indicate panthers typically do not return to the same resting site day after day, with the exception of females with dens or panthers remaining near kill sites for several days. The presence of physical evidence such as tracks, scats, and urine markers confirm that panthers move extensively within home ranges, visiting all parts of the range regularly in the course of hunting, breeding, and other activities (Maehr 1997, Comiskey et al. 2002). Males travel widely throughout their home ranges to maintain exclusive breeding rights to females. Females without kittens also move extensively within their ranges (Maehr 1997). Panthers are capable of moving large distances in short periods of time. Nightly panther movements of 12 mi (20 km) are not uncommon (Maehr et al. 1990a).

Intraspecific Interactions: Interactions between panthers occur indirectly through urine markers or directly through contact. Urine markers are made by piling ground litter using a backwards-pushing motion with the hind feet. This pile is then scent-marked with urine and occasionally feces. Both sexes make urine markers. Apparently males use them as a way to mark their territory and announce presence while females advertise their reproductive condition.

Adult females and their kittens interact more frequently than any other group of panthers. Interactions between adult male and female panthers last from one to seven days and usually result in pregnancy (Maehr et al. 1991). Aggressive interactions between males often result in serious injury or death. Independent subadult males have been known to associate with each other for several days and these interactions do not appear to be aggressive in nature. Aggression between males is the most common cause of male mortality and an important determinant of male spatial and recruitment patterns based on radio-collared panthers (Maehr et al. 1991, Shindle et al. 2003). Aggressive encounters between radio-collared males and females also have been documented (Shindle et al. 2003, Jansen et al. 2005).

Food Habits: Primary panther preys are white-tailed deer (*Odocoileus virginianus*) and feral hog (*Sus scrofa*) (Maehr et al. 1990b, Dalrymple and Bass 1996). Generally, feral hogs constitute the greatest biomass consumed by panthers north of the Alligator Alley section of I-75, while white-tailed deer are the greatest biomass consumed to the south (Maehr et al. 1990b). Secondary prey includes raccoons (*Procyon lotor*), nine-banded armadillos (*Dasypus novemcinctus*), marsh rabbits (*Sylvilagus palustris*) (Maehr et al. 1990b) and alligators (*Alligator mississippiensis*) (Dalrymple and Bass 1996). No seasonal variation in diet has been detected.

A resident adult male puma generally consumes one deer-sized prey every 8-11 days; this frequency would be 14-17 days for a resident female; and 3.3 days for a female with three 13-month-old kittens (Ackerman et al. 1986). Maehr et al. (1990b) documented domestic livestock infrequently in scats or kills, although cattle were readily available on their study area.

Infectious Diseases, Parasites, and Environmental Contaminants: *Viral Diseases*--Feline leukemia virus (FeLV) is common in domestic cats (*Felis catus*), but is quite rare in non-domestic felids. Routine testing for FeLV antigen (indicating active infection) in captured and necropsied panthers has been negative since testing began in 1978 to the fall of 2002. Between November 2002 and February 2003, however, two panthers tested FeLV antigen positive (Cunningham 2005). The following year, three more cases were diagnosed. All infected panthers had overlapping home ranges in the Okaloacoochee Slough ecosystem. Three panthers died due to suspected FeLV-related diseases (opportunistic bacterial infections and anemia) and the two others died from intraspecific aggression. Testing of serum samples collected from 1990-2005 for antibodies (indicating exposure) to FeLV indicated increasing exposure to FeLV beginning in the late 1990s and concentrated north of I-75. There was apparently minimal exposure to FeLV during this period south of I-75. Positive antibody titers in different areas at different times may indicate that multiple introductions of the virus into the panther population may have occurred. These smaller epizootics were apparently self-limiting and did not result in any known mortalities. Positive antibody titers, in the absence of an active infection (antigen positive), indicate that panthers can be exposed and overcome the infection (Cunningham 2005). Management of the disease includes vaccination as well as removal of infected panthers to captivity for quarantine and supportive care. As of June 1, 2005, about one-third of the population had received at least one vaccination against FeLV (FWC and NPS, unpublished data). No new positive cases have been diagnosed since July 2004.

Pseudorabies virus (PRV) (Aujeszky's disease) causes respiratory and reproductive disorders in adult hogs and mortality in neonates, but is a rapidly fatal neurologic disease in carnivores. At least one panther died from PRV infection presumably through consumption of an infected feral hog (Glass et al. 1994). At least one panther has also died of rabies (Taylor et al. 2002). This panther was radiocollared but not vaccinated against the disease.

Feline immunodeficiency virus (FIV) is a retrovirus of felids that is endemic in the panther population. About 28 percent of Florida panthers were positive for antibodies to the puma lentivirus strain of FIV (Olmstead et al. 1992); however, the prevalence may be increasing. Between November 2004 and April 2005, 13 of 17 (76 percent) were positive (M.Cunningham, FWC, unpublished data). The cause of this increase is unknown but warrants continued monitoring and investigation. There is also evidence of exposure to Feline panleukopenia virus (PLV) in adult panthers (Roelke et al. 1993b) although no PLV-related mortalities are known to have occurred.

Serological evidence of other viral diseases in the panther population includes feline calicivirus, feline herpes virus, and West Nile virus (WNV). However these diseases are not believed to cause significant morbidity or mortality in the population. All panthers found dead due to unknown causes are tested for alphaviruses, flaviviruses (including WNV), and canine distemper virus. These viruses have not been detected in panthers by viral culture or polymerase chain reaction (FWC, unpublished data).

Other Infectious Diseases - Bacteria have played a role in free-ranging panther morbidity and mortality as opportunistic pathogens, taking advantage of pre-existing trauma or FeLV infections (FWC, unpublished data). Dermatophytosis (ringworm infection) has been diagnosed in several panthers and resulted in severe generalized infection in at least one (Rotstein et al. 1999). Severe infections may reflect an underlying immunocompromise, possibly resulting from inbreeding depression or immunosuppressive viral infections.

Parasites - The hookworm, *Ancylostoma pluridentatum,* is found in a high prevalence in the panther population. Other parasites identified from live-captured or necropsied panthers include eight arthropod species, eight nematode species, three cestode species, two trematode species, and three protozoa species (Forrester et al. 1985, Forrester 1992, Wehinger et al. 1995, Rotstein et al. 1999, Land et al. 2002). Of these only an arthropod, *Notoedres felis*, caused significant morbidity in at least one panther (Maehr et al. 1995).

Environmental Contaminants - Overall, mercury in south Florida biota has decreased over the last several years (Frederick et al. 2002). However, high mercury concentrations are still found in some panthers. At least one panther is thought to have died of mercury toxicosis and mercury has been implicated in the death of two other panthers in ENP (Roelke 1991). One individual panther had concentrations of 150 parts per million (ppm) mercury in its hair (Land et al. 2004). Elevated levels of p, p'– DDE were also detected in fat from that panther. The role of mercury and/or p, p'– DDE in this panther's death is unknown and no cause of death was determined despite extensive diagnostic testing. Elevated mercury concentrations have also been found in panthers from Florida Panther National Wildlife Refuge (FPNWR). Two sibling neonatal kittens from this area had hair mercury concentrations of 35 and 40 ppm. Although other factors were believed to have been responsible, these kittens did not survive to leave their natal den. Consistently high hair mercury values in ENP and FPNWR and the finding of elevated values in some portions of BCNP warrant continued monitoring (Land et al. 2004). Other environmental contaminants found in panthers include polychlorinated biphenyls (Arochlor 1260) and organochlorines (p, p'–DDE) (Dunbar 1995, Land et al. 2004).

Habitat Characteristics/Ecosystem

Landscape Composition: Noss and Cooperrider (1994) considered the landscape implications of maintaining viable panther populations. Assuming a male home range size of 137,599 acres (55,685 ha) (Maehr 1990), an adult sex ratio of 50:50 (Anderson 1983), and some margin of safety, they determined that a reserve network as large as 15,625–23,438 mi^2 (40,469-60,703 km^2) would be needed to support an effective population size of 50 individuals (equating to an actual adult population of 100-200 panthers [Ballou et al. 1989]). However, to provide for long-term persistence based on an effective population size of 500 individuals (equating to 1,000 - 2,000 adult panthers [Ballou et al. 1989]), could require as much as 156,251-234,376 mi^2 (404,687-607,031 km^2). This latter acreage corresponds too roughly 60 - 70 percent of the Florida panther's historical range. Although it is uncertain whether this much land is needed for panther recovery, it does provide some qualitative insight into the importance of habitat conservation across large landscapes for achieving a viable panther population (Noss and Cooperrider 1994).

Between 1981 and 2003, more than 55,000 locations on more than 100 radio-collared panthers were collected. Belden et al. (1988), Maehr et al. (1991), Maehr (1997), Kerkoff et al. (2000), and Comiskey et al. (2002) provide information on habitat use based on various subsets of these data. Since almost all data from radio-collars have been collected during daytime hours (generally 0700-1100), and because panthers are most active at night (Maehr et al. 1990a), daytime radio locations are insufficient to describe the full range of panther habitat use (Beyer and Haufler 1994, Comiskey et al. 2002, Beier et al. 2003, Dickson et al. 2005, Beier et al. 2006).

A landscape-level strategy for the conservation of the panther population in south Florida was developed using a Florida panther potential habitat model based on the following criteria: (1) forest patches greater than 4.95 acres (2 ha); (2) non-urban cover types within 656 ft (200m) of forest patches; and (3) exclusion of lands within 984 ft (300m) of urban areas (Kautz et al. 2006). In developing the model, data from radio-collared panthers collected from 1981 through 2000 were used to evaluate the relative importance of various land cover types as panther habitat, thus identifying landscape components important for panther habitat conservation. Those components were then combined with a least cost path analysis to delineate three panther habitat conservation zones for south Florida: (1) Primary Zone – lands essential to the long-term viability and persistence of the panther in the wild; (2) Secondary Zone - lands which few panthers use contiguous with the Primary Zone, but given sufficient habitat restoration could accommodate expansion of the panther population south of the Caloosahatchee River; and (3) Dispersal Zone - the area which may facilitate future panther expansion north of the Caloosahatchee River (Kautz et al. 2006) (Figure 8). The Primary Zone is currently occupied and supports the breeding population of panthers. Although panthers move through the Secondary and Dispersal Zones, they are not permanently occupied. The Secondary Zone could support panthers with sufficient restoration.

These zones vary in size, ownership, and land cover composition. The Primary Zone is 2,270,711 acres (918,928 ha) in size, 73 percent of which is publicly owned (R. Kautz, Dennis, Breedlove, and Associates, pers. comm. 2005), and includes portions of the BCNP, ENP, Fakahatchee Strand Preserve State Park (FSPSP), FPNWR, Okaloacoochee Slough State Forest, and Picayune Strand State Forest. This zone's composition is 45 percent forest, 41 percent freshwater marsh, 7.6 percent agriculture lands, 2.6 percent prairie and shrub lands, and 0.52 percent urban lands (Kautz et al. 2006). The Secondary Zone is 812,157 acres (328,670 ha) in size, 38 percent of which is public land (R. Kautz, pers. comm. 2005). This zone's composition is 43 percent freshwater marsh, 36 percent agriculture, 11 percent forest, 6.1 percent prairie and shrub lands, and 2.3 percent low-density residential areas and open urban lands (Kautz et al. 2006). The Dispersal Zone is 28,160 acres (11,396 ha) in size, 12 percent of which is either publicly owned or in conservation easement. This zone's composition is 49 percent agriculture (primarily improved pasture and citrus groves), 29 percent forest (wetland and upland), 8.8 percent prairie and shrub land, 7.5 percent freshwater marsh, and 5.1 percent barren and urban lands (Kautz et al. 2006).

As part of their evaluation of occupied panther habitat, in addition to the average density estimate of one panther per 27,181 acres (11,000 ha) developed by Maehr et al. (1991), Kautz et

al. (2006) estimated the present average density during the timeframe of the study, based on telemetry and other occurrence data, to average 1 panther per 31,923 acres (12,919 ha). In the following discussions of the number of panthers that a particular zone may support, the lower number is based on the 31,923 acres (12,919 ha) value (Kautz et al. 2006) and the higher number is based on the 27,181 acres (11,000 ha) value (Maehr et al. 1991).

Based on these average densities, the Primary Zone could support 71 to 84 panthers; the Secondary Zone 8 to 10 panthers without habitat restoration and 25 to 30 panthers with habitat restoration (existing high quality panther habitat currently present in the Secondary Zone is estimated at 32 percent of the available Secondary Zone lands); and the Dispersal Zone, 0 panthers. Taken together, the three zones in their current condition apparently have the capacity to support about 79 to 94 Florida panthers.

Kautz et al.'s (2006) assessment of available habitat south of the Caloosahatchee River determined that non-urban lands in the Primary, Secondary, and Dispersal Zones were not sufficient to sustain a population of 240 individuals south of the Caloosahatchee River. However, Kautz et al. (2006) determined sufficient lands were available south of the Caloosahatchee River to support a population of 79 to 94 individuals (although not all lands are managed and protected).

Even though some suitable panther habitat remains in south-central Florida, it is widely scattered and fragmented (Belden and McBride 2005). Thatcher et al. (2006) used a statistical model in combination with a geographic information system to develop a multivariate landscape-scale habitat model based on the Mahalanobis distance statistic (D^2) to evaluate habitats in south central Florida for potential expansion of the Florida panther population. They identified 4 potential habitat patches: the Avon Park Bombing Range area, Fisheating Creek/Babcock-Webb Wildlife Management Area, eastern Fisheating Creek, and the Duette Park/Manatee County area. These habitat patches are smaller and more isolated compared with the current Florida panther range, and the landscape matrix where these habitat patches exist provides relatively poor habitat connectivity among the patches (Thatcher et al. 2006). Major highways and urban or agricultural development isolate these habitat patches, and they are rapidly being lost to the same development that threatens southern Florida (Belden and McBride 2005).

Diurnal Habitat Use: Diurnal panther locations appear to be within or closer to forested cover types, particularly cypress swamp, pinelands, hardwood swamp, and upland hardwood forests (Belden 1986, Belden et al. 1988, Maehr 1990, Maehr et al. 1991, Maehr 1992, Smith and Bass 1994, Kerkhoff et al. 2000, Comiskey et al. 2002). Dense understory vegetation comprised of saw palmetto provides some of the most important resting and denning cover for panthers (Maehr 1990). Shindle et al. (2003) show that 73 percent of panther dens were in palmetto thickets.

Radio-collar data and ground tracking indicate that panthers use the mosaic of habitats available to them as resting and denning sites, hunting grounds, and travel routes. These habitats include cypress swamps, hardwood hammocks, pine flatwoods, seasonally flooded prairies, freshwater marshes, and some agricultural lands. Although radio-collar monitoring indicates that forest is a preferred cover type, panthers also utilize non-forest cover types (Belden et al. 1988, Maehr et al.

1991, Comiskey et al. 2002). Compositional analyses by Kautz et al. (2006) confirmed previous findings that forest patches comprise an important component of panther habitat in south Florida, but that other natural and disturbed cover types are also present in the large landscapes that support panthers (Belden et al. 1988, Maehr et al. 1991, Comiskey et al. 2002). Kautz et al. (2006) found that the smallest class of forest patches (i.e., 9-26 acres [3.6-10.4 ha]) were the highest ranked forest patch sizes within panther home ranges; this indicates that forest patches of all sizes appear to be important components of the landscapes inhabited by panthers, not just the larger forest patches.

Nocturnal Habitat Use: Maehr et al. (1990a) provide the only descriptions of panther nocturnal activities and represent the available radiocollar data collected during night time hours. However, this paper does not provide analyses of nocturnal habitat use. Dickson et al. (2005) examined the movements of 10 female and seven male puma at 15-minute intervals during 44 nocturnal periods of hunting or traveling in southern California. They found that traveling puma monitored over nocturnal periods used a broader range of habitats than what they appeared to use based on diurnal locations alone. The use of Global Positioning System (GPS) radiocollars is now being investigated to determine if this technology will be suitable to answer questions regarding Florida panther nocturnal habitat use.

Prey Habitat Use: Panther habitat selection is related to prey availability (Janis and Clark 1999, Dees et al. 2001) and, consequently, prey habitat use. Adequate cover and the size, distribution, and abundance of available prey species are critical factors to the persistence of panthers in south Florida and often determine the extent of panther use of an area. Duever et al. (1986) calculated a deer population of 1,760 in BCNP, based on Harlow (1959) deer density estimates of 1/210 acres (85 ha) in pine forest, 1/299 acres (121 ha) in swamps, 1/1,280 acres (518 ha) in prairie, 1/250 acres (101 ha) in marshes, and 1/111 acres (45 ha) in hammocks. Schortemeyer et al (1991) estimated deer densities at 1/49-247 acres (20-100 ha) in three management units of BCNP based on track counts and aerial surveys. Labisky et al. (1995) reported 1/49 acres (20 ha) in southeastern BCNP. Using track counts alone, McCown (1994) estimated 1/183-225 acres (74-91 ha) on the FPNWR and 1/133-200 acres (54-81 ha) in the FSPSP.

Hardwood hammocks and other forest cover types are important habitat for white-tailed deer and other panther prey (Harlow and Jones 1965, Belden et al. 1988, Maehr 1990, Maehr et al. 1991, Maehr 1992, Comiskey et al. 1994, Dees et al. 2001). Periodic understory brushfires (Dees et al. 2001) as well as increased amounts of edge (Miller 1993) may enhance deer use of hardwood hammocks, pine, and other forest cover types. However, wetland and other vegetation types can support high deer densities. In the Everglades, for example, deer appear to be adapted to a mosaic of intergrading patches comprised of wet prairie, hardwood tree islands, and peripheral wetland habitat (Fleming et al. 1994, Labisky et al. 2003). High-nutrient deer forage, especially preferred by females, includes hydrophytic marsh plants, white waterlily (*Nymphaea odorata*), and swamp lily (*Crinum americana*) (Loveless 1959, Labisky et al. 2003). Wetland willow (*Salix spp.*) thickets provide nutritious browse for deer (Loveless 1959, Labisky et al. 2003).

Marshes, rangeland, and low-intensity agricultural areas support prey populations of deer and hogs. The importance of these habitat types to panthers cannot be dismissed based solely on use or lack of use when daytime telemetry are the only data available (Comiskey et al. 2002, Beier et al. 2003, Comiskey et al. 2004, Beier et al. 2006).

Travel and Dispersal Corridors: In the absence of direct field observations/measurements, Harrison (1992) suggested that landscape corridors for wide-ranging predators should be half the width of an average home range size. Following Harrison's (1992) suggestion, corridor widths for Florida panthers would range 6.1-10.9 mi (9.8-17.6 km) depending on whether the target animal was an adult female or a transient male. Beier (1995) suggested that corridor widths for transient male puma in California could be as small as 30 percent of the average home range size of an adult. For Florida panthers, this would translate to a corridor width of 5.5 mi (8.8 km). Without supporting empirical evidence, Noss (1992) suggests that regional corridors connecting larger hubs of habitat should be at least 1.0 mi (1.6 km) wide. Beier (1995) makes specific recommendations for very narrow corridor widths based on short corridor lengths in a California setting of wild lands completely surrounded by urban areas; he recommended that corridors with a length less than 0.5 mi (0.8 km) should be more than 328 ft (100 m) wide, and corridors extending 0.6-4 mi (1-7 km) should be more than 1,312 ft (400 m) wide. The Dispersal Zone encompasses 44 mi^2 (113 km^2) with a mean width of 3.4 mi (5.4 km). Although it is not adequate to support even one panther, the Dispersal Zone is strategically located and expected to function as a critical landscape linkage to south-central Florida (Kautz et al. 2006). Transient male panthers currently utilize this Zone as they disperse northward into south-central Florida.

Panther Recovery Objectives

The recovery objectives identified in the draft third revision of the Florida Panther Recovery Plan (Service 2006) are to (1) maintain, restore, and expand the Florida panther population and its habitat in south Florida and, if feasible, expand the known occurrence of Florida panthers north of the Caloosahatchee River to maximize the probability of the long-term persistence of this metapopulation; (2) identify, secure, maintain, and restore habitat in potential reintroduction areas within the panther's historic range, and to establish viable populations of the panther outside south and south-central Florida; and (3) facilitate panther conservation and recovery through public awareness and education.

Panther Management and Conservation

Habitat Conservation and Protection

Panthers, because of their wide-ranging movements and extensive spatial requirements, are particularly sensitive to habitat fragmentation (Harris 1984). Mac et al. (1998) defines habitat fragmentation as: "The breaking up of a habitat into unconnected patches interspersed with other habitat which may not be inhabitable by species occupying the habitat that was broken up. The breaking up is usually by human action, as, for example, the clearing of forest or grassland for agriculture, residential development, or overland electrical lines." The reference to "unconnected patches" is a central underpinning of the definition. For panther conservation, this definition underscores the need to maintain contiguous habitat and protected habitat corridors in key locations in south Florida and throughout the panther's historic range. Habitat fragmentation can result from road construction, urban development, and agricultural land conversions.

Habitat protection has been identified as being one of the most important elements to achieving panther recovery. While efforts have been made to secure habitat (Figure 9 and Table 1), continued action is needed to obtain additions to and inholdings for public lands, assure linkages are maintained, restore degraded and fragmented habitat, and obtain the support of private landowners for maintaining property in a manner that is compatible with panther use. Conservation lands used by panthers are held and managed by a variety of entities including FWS, NPS, Seminole Tribes of Florida, Miccosukee Tribe of Indians of Florida, FWC, Florida Department of Environmental Protection (FDEP), Florida Division of Forestry (FDOF), Water Management Districts (WMD), non-governmental organizations (NGO), counties, and private landowners.

Public Lands: Public lands in south Florida that benefit the panther are listed below and shown in Figure 9:

1. In 1947, ENP was established with 1,507,834 acres (610,201 ha) and in 1989 was expanded with the addition of 104,320 acres (42,217 ha).

2. In 1974, Congress approved the purchase and formation of BCNP, protecting 570,238 acres (230,768 ha), later 145,919 acres (59052 ha) were added.

3. In 1974, the State of Florida began acquiring land for the FSPSP, which encompasses over 80,000 acres (32,375 ha). Efforts are underway to acquire about 16,640 acres (6,734 ha).

4. In 1985, acquisition of Picayune Strand State Forest and Wildlife Management Area (WMA) began with the complex Golden Gate Estates subdivision buyouts and now comprises over 76,160 acres (30,821 ha). The Southern Golden Gate Estates buyout through State and Federal funds is complete. The South Belle Meade portion of Picayune Strand is about 90 percent purchased and although the State is no longer purchasing in South Belle Meade, Collier County's Transfer of Development Rights program is helping to secure the in-holdings.

5. In 1989, FPNWR was established and now protects 26,240 acres (10,619 ha).

6. In 1989, the Corkscrew Regional Ecosystem Watershed Land and Water Trust, a public/private partnership, was established and to date has coordinated the purchase of 42 26,880 acres (10,878 ha).

7. In 1996, the South Florida WMD, purchased the 32,000 acres (12,950 ha) Okaloacoochee Slough State Forest.

8. In 2002 Spirit of the Wild WMA, consisting of over 7,040 acres (2,849 ha), was taken into public ownership by the State of Florida and is managed by FDOF.

9. In 2003, Dinner Island Ranch WMA consisting of 21,760 acres (8,806 ha) in southern Hendry County was taken into public ownership by the State of Florida and is managed by FDOF.

Tribal Lands: Lands of the Seminole Tribes of Florida and Miccosukee Tribe of Indians of Florida encompass over 350,079 acres (141,673 ha) in south Florida. Of these, 115,840 acres

(46,879 ha) are used by panthers, and comprise 5 percent of the Primary Zone (R. Kautz, pers. comm. 2005). These lands are not specifically managed for the panther and are largely in cultivation.

Private Lands: A variety of Federal, State, and private incentives programs are available to assist private landowners and other individuals to protect and manage wildlife habitat. Voluntary agreements, estate planning, conservation easements, land exchanges, and mitigation banks are methods that hold untapped potential for conserving private lands. In 1954, the National Audubon Society established the nearly 10,880 acres (4,403 ha) Corkscrew Swamp Sanctuary. However, little additional private land has been protected south of the Caloosahatchee River for panther conservation. A number of properties identified by the State Acquisition and Restoration Council (ARC) for purchase by the Florida Forever Program are used by panthers (*e.g.*, Devil's Garden, Half Circle F Ranch, Pal Mal, and Panther Glades). North of the Caloosahatchee River, Fisheating Creek Conservation Easement, 41,600 acres (16,835 ha) in Glades County is a private holding used by dispersing male panthers. Also, 73,235 acres of the 90,845 acres Babcock Ranch were purchased in 2006 by the State of Florida and Lee County for conservation and agriculture. An additional 2,000 acres of this ranch were put into a conservation easement.

Habitat and Prey Management

Land management agencies in south Florida are implementing fire programs that mimic a natural fire regime through the suppression of human-caused wildfires and the application of prescribed natural fires. No studies have been conducted to determine the effects of invasive plant management on panthers. However invasive vegetation may reduce the panther's prey base by disrupting natural processes such as water flow and fire and by significantly reducing available forage for prey (Fleming et al. 1994). All public lands in south Florida have active invasive plant treatment programs. Management for panther prey consists of a variety of approaches such as habitat management and regulation of hunting and off-road vehicle (ORV) use.

Response to Management Activities

Few studies have examined the response of panthers to various land/habitat management activities. Dees et al. (2001) investigated panther habitat use in response to prescribed fire and found that panther use of pine habitats was greatest for the first year after the area had been burned and declined thereafter. Prescribed burning is believed to be important to panthers because prey species (e.g., deer and hogs) are attracted to burned habitats to take advantage of changes in vegetation structure and composition, including exploiting hard mast that is exposed and increased quality or quantity of forage (Dees et al. 2001). Responses of puma to logging activities (Van Dyke et al. 1986b) indicate that they generally avoid areas within their home range with intensification of disturbance.

There is the potential for disturbance to panthers from recreational uses on public lands. Maehr (1990) reported that indirect human disturbance of panthers may include activities associated with hunting and that panther use of Bear Island (part of BCNP) is significantly less during the hunting season. Schortemeyer et al. (1991) examined the effects of deer hunting on panthers at BCNP between 1983 and 1990. They concluded that, based on telemetry data, panthers may be altering their use patterns as a result of hunting.

Janis and Clark (2002) compared the behavior of panthers before, during, and after the recreational deer and hog hunting season (October through December) on areas open (BCNP) and closed (FPNWR, FSPSP) to hunting. Variables examined were: (1) activity rates, (2) movement rates, (3) predation success, (4) home range size, (5) home range shifts, (6) proximity to ORV trails, (7) use of areas with concentrated human activity, and (8) habitat selection. Responses to hunting for variables most directly related to panther energy intake or expenditure (i.e., activity rates, movement rates, predation success of females) were not detected (Janis and Clark 2002). However, panthers reduced their use of Bear Island, an area of concentrated human activity, and were found farther from ORV trails during the hunting season, indicative of a reaction to human disturbance (Janis and Clark 2002). Whereas the reaction to trails was probably minor and could be related to prey behavior, decreased use of Bear Island most likely reflects a direct reaction to human activity and resulted in increased use of adjacent private lands (Janis and Clark 2002).

Transportation Planning and Improvements

Construction of highways in wildlife habitat typically results in loss and fragmentation of habitat, traffic related mortality, and avoidance of associated human development. Roads can also result in habitat fragmentation, especially for females who are less likely to cross them (Maehr 1990).

There are presently 28 wildlife underpasses with associated fencing suitable for panther use along I-75 (Figure 10). The Florida Department of Transportation identified the location of and constructed six wildlife crossings on SR 29 (Figure 10). Crossings A and B, completed in 2007, were constructed in an area of 10 documented collisions from 1980 to 2004. Crossings C and D, north of I-75, were installed in 1995. There were two recorded collisions in the vicinity of crossing D from 1979 to 1990, but none at either C or D since crossing installation. Crossing E was installed in 1997. There has been one collision about 1 mile to the north in 2002. Crossing F was installed in 1999. There was one documented collision in the immediate vicinity in 1981, two collisions about 1.5 miles to the north since crossing installation, and one collision about 0.5 mile to the south in December 2005. No panther-vehicle collisions have been recorded in the immediate vicinity of wildlife crossings, with the exception of one collision in December 2005 on SR 29. There have been no collisions on east-west I-75 in the vicinity of crossings since installation in 1991. Prior to 1991, there were five recorded deaths from collisions.

More recent studies have been conducted to identify locations for needed wildlife crossings in Collier County to benefit the Florida panther and other wildlife. Swanson et al. (2005) used a least cost path (LCP) modeling approach to identify the most likely travel routes for panthers among six major use areas in southwest Florida. LCP modeling considers elements in the landscape that permit or impede panther movement when traveling. Swanson et al. (2005) identified 20 key highway segments where LCPs intersected improved roadways. Within Collier County LCPs intersected the following major highways: SR 29, CR 846 and CR 858 (Oil Well Road). Smith et al. (2006) studied the movements of the Florida panther, the Florida black bear, and other wildlife species along SR 29, CR 846 and CR 858 in Collier County. Data analyzed in the study were obtained from roadkill and track surveys, infra-red camera monitoring stations, existing data provided by the FWC (Florida panther radio telemetry and vehicle mortality

reports), and other studies. Smith et al. (2006) recommended that new wildlife crossings be considered at various sites along these roadways to reduce road-related mortality of panthers and other wildlife species, and increase connectivity among wildlife populations.

In an effort to help reduce the potential for roadway-related panther and wildlife mortality, Collier County has committed to construct two additional wildlife crossings and associated fencing. These crossings will be located at Oil Well Road (CR 858) in the Camp Keais Strand, and Immokalee Road (CR 846). The locations of both crossings have been identified as travel corridors for panthers and other wildlife.

Agriculture, Development, and Mining

The Service developed a draft Panther Habitat Assessment methodology and refugia design in 2003 to help guide the agency in evaluating permit applications for projects that could affect panther habitat (see discussion below). This draft methodology was a way to assess the level of impacts to panthers expected from a given project, and to evaluate the effect of any proposed compensation offered by the project applicant. Prior to development of the methodology, the Service from March 1984 through July 2003 concluded consultation on 42 projects involving the panther and habitat preservation (Table 2). The minimum expected result of these projects is impacts to 76,919 acres and the preservation of 15,479 acres of panther habitat. Of the 76,919 acres of impacts, 38,932 acres are due to agricultural conversion and 37,982 acres to development and mining. Portions (10,370 acres) of the largest agricultural conversion project, the 28,700 acres by U.S. Sugar Corporation, were re-acquired by the Federal Government as a component of the Talisman Land Acquisition (Section 390 of the Federal Agricultural Improvement and Reform Act of 1996 [Public Law 104-127] Farm Bill Cooperative Agreement, FB4) for use in the Comprehensive Everglades Restoration Project. The non-agriculture impacts are permanent land losses, whereas the agricultural conversions may continue to provide some habitat functional value to panthers, depending on the type of conversion.

From August 2003 to August 2007, the Service concluded consultations on 66 projects affecting 20,545 acres with preservation of 20,486 acres (Table 2). Following our refugia design assessment approach, the projects affected 9,512 acres in the Primary Zone, 6,953 acres in the Secondary Zone, and 4,081 acres in the Other Zone. Compensation provided included 18,152 acres in the Primary Zone, 652 acres in the Dispersal Zone, 272 acres in the Secondary Zone, and 1,410 acres in the Other Zone. The project affected lands were primarily agricultural fields consisting of row crops and citrus groves and natural lands with varying degrees of exotic vegetation. Functional habitat value of these lands to the Florida panther, following our Panther Habitat Assessment methodology provided a PHU loss from development of 82,573 PHUs, with a corresponding PHU preservation and enhancement complement of 160,399 PHUs. The preservation lands were generally native habitat lands or disturbed lands that included restoration components. Restoration components included exotic species removal, fire management, wetland hydrology improvement, improved forest management practices, and full habitat restoration from agriculture uses to native habitats.

Panther Habitat Evaluation and Compensation

Population Viability Analysis

Population Viability Analysis (PVA) has emerged as a key component of endangered species conservation. This process is designed to incorporate demographic information into models that predict if a population is likely to persist in the future. PVAs incorporate deterministic and stochastic events including demographic and environmental variation, and natural catastrophes. PVAs have also been criticized as being overly optimistic about future population levels (Brook et al. 1997) and should be viewed with caution; however, they are and have been shown to be surprisingly accurate for managing endangered taxa and evaluating different management practices (Brook 2000). They are also useful in conducting sensitivity analyses to determine where more precise information is needed (Hamilton and Moller 1995, Beissinger and Westphal 1998, Reed et al. 1998, Fieberg and Ellner 2000).

As originally defined by Shaffer (1981), "a minimum viable population for any given species in any given habitat is the smallest isolated population having a 99 percent chance of remaining extant for 1,000 years despite the foreseeable effects of demographic, environmental and genetic stochasticity, and natural catastrophes." However, the goal of 95 percent probability of persistence for 100 years is the standard recommended by population biologists and is used in management strategies and conservation planning, particularly for situations where it is difficult to accurately predict long-term effects (Shaffer 1978, 1981, 1987, Sarkar 2004).
Since 1981, 139 Florida panthers have been radio-collared and monitored on public and private lands throughout south Florida (Lotz et al. 2005). These data were used by researchers to estimate survival rates and fecundity and were incorporated into PVA models previously developed for the Florida panther (Seal et al. 1989, 1992, Cox et al. 1994, Kautz and Cox 2001, Maehr et al. 2002b). These models incorporated a range of different model parameters such as general sex ratios, kitten survival rates, age distributions, and various levels of habitat losses, density dependence, and intermittent catastrophes or epidemics. The outputs of these models predicted a variety of survival scenarios for the Florida panther and predicted population levels needed to ensure the survival of the species.

Root (2004) developed an updated set of PVA models for the Florida panther based on RAMAS GIS software (Akçakaya 2002). These models were used to perform a set of spatially explicit PVAs. Three general single-sex (i.e., females only) models were constructed using demographic variables from Maehr et al. (2002b) and other sources. A conservative model was based on Seal and Lacy (1989), a moderate model was based on Seal and Lacy (1992), and an optimistic model was based on the 1999 consensus model of Maehr et al. (2002b). In each model, first-year kitten survival was set at 62 percent based on recent information from routine panther population monitoring (Shindle et al. 2001). All models assumed a 1:1 sex ratio, a stable age distribution, 50 percent of females breeding in any year, and an initial population of 41 females (82 individuals including males), the approximate population size in 2001-2002 (McBride 2001, 2002).

Basic Versions: The basic versions of each model incorporated no catastrophes or epidemics, no change in habitat quality or amount, and a ceiling type of density dependence. The basic versions of the models incorporated a carrying capacity of 53 females (106 panthers - 50/50 sex ratio). Variants of the models were run with differing values for density dependence, various levels of habitat loss, and intermittent catastrophes or epidemics. Each simulation was run with 10,000 replications for a 100-year period. The minimum number of panthers needed to ensure a 95 percent probability of persistence for 100 years was estimated in a series of simulations in which initial abundance was increased until probability of extinction at 100 years was no greater than 5 percent. More detailed information concerning the PVA model parameters appears in Root (2004).

The results of these model runs predicted a probability of extinction for the conservative model of 78.5 percent in 100 years with a mean final total abundance of 3.5 females. Also, the probability of a large decline in abundance (50 percent) was 94.1 percent. The moderate model resulted in a 5 percent probability of extinction and mean final abundance of 42.3 females in 100 years. The probability of panther abundance declining by half the initial amount was 20 percent in 100 years under the moderate model. The optimistic model resulted in a 2 percent probability of extinction and mean final abundance of 51.2 females in 100 years. The probability of panther abundance declining by half the initial amount was only 9 percent in 100 years under the optimistic model. These models also provide a probability of persistence (100 percent minus probability of extinction) over a 100-year period of 95 percent for the moderate model and 98 percent for the optimistic model.

One Percent Habitat Loss: Model results were also provided by Root (2004) for probability of extinctions for 1 percent loss of habitat, within the first 25 years of the model run. The 1 percent loss of habitat equates to essentially all remaining non-urban privately owned lands in the Primary Zone and corresponds to the estimated rate of habitat loss (Root 2004) from 1986 to 1996 for the five southwest counties based on land use changes. For the moderate model, the model runs predict a probability of extinction increase of about one percent, from a probability of extinction of about 5 percent with no loss of habitat to 6 percent with 1.0 percent habitat loss per year, for the first 25 years. For the optimistic model, probability of extinction increased from about 2 percent with no loss of habitat to 3 percent with 1.0 percent habitat loss per year, for the first 25 years. These models also predicted the mean final abundance of females would decrease from 41 to 31 females, a 24.3 percent reduction for the moderate model and from 41 to 38 females, a 7.3 percent reduction for the optimistic model.

The model runs also predict a probability of persistence (100 percent minus the probability of extinction) over a 100-year period of about 94 percent for the moderate model and 97 percent for the optimistic model. The model runs, predict a mean final abundance of 62 individuals (31 females and 31 males) for the moderate model and 76 individuals (38 females and 38 males) for the optimistic model.

Population Guidelines: Kautz et al. (2006), following review of the output of Root's PVA models and those of other previous PVAs for the Florida panther, suggested a set of population guidelines for use in management and recovery of the Florida panther. These guidelines are:

(1) populations of less than 50 individuals are likely to become extinct in less than 100 years; (2) populations of 60 to 70 are barely viable and expected to decline by 25 percent over 100 years; (3) populations of 80 to 100 are likely stable but would still be subject to genetic problems (i.e., heterozygosity would slowly decline); and (4) populations greater than 240 have a high probability of persistence for 100 years and are demographically stable and large enough to retain 90 percent of original genetic diversity.

Population guidelines for populations of panthers between 50 and 60 individuals and between 70 and 80 individuals were not specifically provided in Kautz et al. (2006). However, the Service views the guidelines in Kautz et al. (2006) as a continuum. Therefore, we consider populations of 50 to 60 individuals to be less than barely viable or not viable with declines in population and heterozygosity. Similarly, we consider populations of 70 to 80 to be more than barely viable or somewhat viable with some declines in population and heterozygosity. Like other population guidelines presented in Kautz et al. (2006), these assume no habitat loss or catastrophes.

PVA Summaries and Population Guidelines: Root's (2004) moderate model runs, which have a carrying capacity 53 females (106 individuals), show final populations of 42.3 females (84 total) and 31.2 females (62 total) with extinction rates of 5 percent and 6 percent, respectively, for the basic and 1 percent habitat loss scenarios. The predicted final populations in Root (2004) are 84 and 62 panthers for no loss of habitat and 1 percent loss of habitat, respectively, over a 100-year period.

Kautz et al.'s (2006) population guidelines applied to the Root (2004) moderate models for a population of 62 to 84 panthers, with or without habitat loss, respectively, describe the "with habitat loss" population as barely viable and expected to decline by 25 percent over a 100-year period. The "without habitat loss" is likely stable but would still be subject to genetic problems.

The Service believes, as discussed in the section on "Population Trends and Distribution", that the 3-year average verified panther population estimate has shown an increase in the number of panthers reported yearly beginning in 2000; and that McBride's verified population of 82 panthers in 2005 and 97 panthers in 2006 is within Kautz et al.'s (2006) population guidelines that represents a population that is likely stable but would still be subject to genetic problems.

The Service also believes the model runs show that lands in the Primary Zone are important to the survival and recovery of the Florida panther and that sufficient lands need to be managed and protected in south Florida to provide for a population of 80 to 100 panthers, the range defined as likely stable over 100 years, but subject to genetic problems. As discussed in the following section, the Service has developed a south Florida panther conservation goal that, through regulatory reviews and coordinated conservation efforts with land owners and resource management partners, provides a mechanism to achieve this goal.

Model Violations: The actual likelihood of population declines and extinctions may be different than the guidelines and models suggest, depending upon the number of and severity of assumptions violated. The Service realizes that habitat loss is occurring at an estimated

0.8 percent loss of habitat per year (R. Kautz, FWC, personal communication, 2003). The Service has accounted for some habitat loss and changes in habitat quality within its regulatory program, and specifically through its habitat assessment methodology (discussed below). For example, we have increased the base ratio used within this methodology to account for unexpected increases in habitat loss. Similarly, we consider changes in habitat quality and encourage habitat restoration wherever possible.

With regard to the assumption of no catastrophes, the Service has considered the recent outbreak of feline leukemia in the panther population at Okaloacoochee Slough as a potential catastrophe. The FWC is carefully monitoring the situation and it appears to be under control at this time due to a successful vaccination program. However, if the outbreak spreads into the population, the Service will consider this as a catastrophe and factor this into our decisions.

We acknowledge uncertainties exist, assumptions can be violated, and catastrophes can occur. The Service and the FWC, along with our partners, will continue to monitor the panther population and the south Florida landscape and incorporate any new information and changes into our decision-making process.

South Florida Panther Population Goal

The Service's goal for Florida panther conservation in south Florida is to locate, preserve, and restore sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of a population of 80 to 100 individuals (adults and subadults) south of the Caloosahatchee River. The Service proposes to achieve this goal through land management partnerships with private landowners, through coordination with private landowners during review of development proposals, and through land management and acquisition programs with Federal, State, local, private, and Tribal partners. The acreages of lands necessary to achieve this goal, based on Kautz et al. (2006) average density of 31,923 acres (12,919 ha) per panther is 2,551,851 acres (1,032,720 ha) for 80 panthers or 3,189,813 acres (1,290,900 ha) for 100 panthers.

The principle regulatory mechanism that allows the Service to work directly with private land owners during review of development and land alteration projects is section 10 of the Act. The Service coordinates with Federal agencies pursuant to section 7 of the Act. In August 2000, the Service, to assist the Corps in assessing project effects to the Florida panther, developed the Florida panther final interim Standard Local Operating Procedures for Endangered Species (SLOPES) (Service 2000). The Florida panther SLOPES provide guidance to the Corps for assessing project effects to the Florida panther and recommends actions to minimize these effects. The Florida panther SLOPES also included a consultation area map that identified an action area where the Service believed land alteration projects may affect the Florida panther.

In the original SLOPES, the consultation area map (MAP) was generated by the Service by overlaying existing and historical panther telemetry data on a profile of Florida and providing a connecting boundary surrounding most of these points. Since the development of the MAP, we have received more accurate and up-to-date information on Florida panther habitat usage. Specifically we have received two documents that the Service believes reflects the most likely

panther habitat usage profiles although documentation clearly shows panther use of areas outside these locations. These documents are the publications by Kautz et al. (2006) and Thatcher et al. (2006). Based on the information in these documents, we have clarified the boundaries of the MAP to better reflect areas where Florida panthers predominate (Figure 5) and refer to these areas cumulatively as the Panther Focus Area.

The Panther Focus Area was determined from the results of recent panther habitat models south of the Caloosahatchee River (Kautz et al. 2006) and north of the Caloosahatchee River (Thatcher et al. 2006). Kautz et al. (2006) model of landscape components important to Florida panther habitat conservation was based on an analysis of panther habitat use and forest patch size. This model was used in combination with radio-telemetry records, home range overlaps, land use/land cover data, and satellite imagery to delineate primary and secondary areas that would be most important and comprise a landscape mosaic of cover types important to help support of the current panther breeding population south of the Caloosahatchee River.

Thatcher et al. (2006) developed a habitat model using Florida panther home ranges in south Florida to identified landscape conditions (land-cover types, habitat patch size and configuration, road density and other human development activities, and other similar metrics) north of the Caloosahatchee River that were similar to those associated with the current panther breeding population.

The Panther Focus Area MAP, south of the Caloosahatchee River is divided into Primary, Secondary, and Dispersal Zones; and north of the Caloosahatchee River into the Primary Dispersal/Expansion Area.

Primary Zone is currently occupied and supports the only known breeding population of Florida panthers in the world. These lands are important to the long-term viability and persistence of the panther in the wild.

Secondary Zone lands are contiguous with the Primary Zone and although these lands are used to a lesser extent by panthers, they are important to the long-term viability and persistence of the panther in the wild. Panthers use these lands in a much lower density than in the Primary Zone.

Dispersal Zone is a known corridor between the Panther Focus Area south of the Caloosahatchee River to the Panther Focus Area north of the Caloosahatchee River. This Zone is necessary to facilitate the dispersal of panthers and future panther population expansion to areas north of the Caloosahatchee River. Marked panthers have been known to use this zone.

Primary Dispersal/Expansion Area is the Fisheating Creek/Babcock-Webb Wildlife Management Area region. These are lands identified by Thatcher et al. (2006) as potential panther habitat with the shortest habitat connection to the Panther Focus Area in south Florida. Several collared and uncollared male panthers have been documented in this area since 1973, and the last female documented north of the Caloosahatchee River was found in this area.

Landscape Preservation Need and Compensation Recommendations

Land Preservation Needs: To further refine the land preservation needs of the Florida panther and to specifically develop a landscape-level program for the conservation of the Florida panther population in south Florida, the Service as previously discussed, in February 2000, appointed a Florida Panther Subteam. The Subteam in addition to the assignments discussed previously, was also charged with developing a landscape-level strategy for the conservation of the Florida panther population in south Florida. The results of this collaborative effort are partially presented in Kautz et al. (2006). One of the primary goals of this effort was to identify a strategically located set of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of the south population of the Florida panther. Kautz et al. (2006) focused their efforts on the area south of the Caloosahatchee River, where the reproducing panther population currently exists.

Kautz et al. (2006) created an updated Florida panther potential habitat model based on the following criteria: (1) forest patches greater than 4.95 acres (2 ha); (2) non-urban cover types within 656 ft (200 m) of forest patches; and (3) exclusion of lands within 984 ft (300 m) of urban areas. The potential habitat map was reviewed in relation to telemetry data, recent satellite imagery (where available), and panther home range polygons. Boundaries were drawn around lands defined as the Primary Zone (Figure 8), defined as the most important area needed to support a self-sustaining panther population. Kautz et al. (2006) referred to these lands as essential; however, as observed in the two previous plans (Logan et al. 1993; Cox et al. 1994), lands within the boundaries of the Primary Zone included some urban areas and other lands not considered to be truly panther habitat (*i.e.*, active rock and sand mines). The landscape context of areas surrounding the Primary Zone was modeled and results were used to draw boundaries of the Secondary Zone (Figure 8), defined as the area capable of supporting the panther population in the Primary Zone, but where habitat restoration may be needed (Kautz et al. 2006).

Kautz et al. (2006) also identified, through a least cost path model, the route most likely to be used by panthers dispersing out of south Florida, crossing the Caloosahatchee River, and dispersing into south-central Florida. Kautz et al. (2006) used ArcView GIS© version 3.3 and ArcView Spatial Analyst© version 2 (Environmental Systems Research, Incorporated, Redlands, California) to construct the least-cost path models and identify optimum panther dispersal corridor(s). The least-cost path models operated on a cost surface that ranked suitability of the landscape for use by dispersing panthers with lower scores indicating higher likelihood of use by dispersing panthers. The lands within the boundaries of the least cost model prediction were defined as the Dispersal Zone (Figure 8). The preservation of lands within this zone is important for the survival and recovery of the Florida panther, as these lands are the dispersal pathways for expansion of the south Florida panther population. The Primary Zone covers 2,270,590 acres (918,895 ha); the Secondary Zone covers 812,104 acres (328,654 ha); and the Dispersal Zone covers 27,883 acres (11,284 ha); providing a total of 3,110,578 acres (1,258,833 ha) (Kautz et al. 2006).

As part of their evaluation of occupied panther habitat, in addition to the average density estimate of one panther per 27,181 acres (11,000 ha) developed by Maehr et al. (1991), Kautz et

al. (2006) estimated the present average density during the timeframe of the study, based on telemetry and other occurrence data, to average 1 panther per 31,923 acres (12,919 ha). In the following discussions of the number of panthers that a particular zone may support, the lower number is based on the 31,923 acres (12,919 ha) value (Kautz et al. 2006) and the higher number is based on the 27,181 acres (11,000 ha) value (Maehr et al. 1991).

Based on these average densities, the Primary Zone could support 71 to 84 panthers; the Secondary Zone 8 to 10 panthers without habitat restoration and 25 to 30 panthers with habitat restoration (existing high quality panther habitat currently present in the Secondary Zone is estimated at 32 percent of the available Secondary Zone lands); and the Dispersal Zone, 0 panthers. Taken together, the three zones in their current condition apparently have the capacity to support about 79 to 94 Florida panthers.

Kautz et al.'s (2006) assessment of available habitat south of the Caloosahatchee River determined that non-urban lands in the Primary, Secondary, and Dispersal Zones were not sufficient to sustain a population of 240 individuals south of the Caloosahatchee River. However, Kautz et al. (2006) determined sufficient lands were available south of the Caloosahatchee River to support a population of 79 to 94 individuals (although not all lands are managed and protected).

Compensation Recommendations: To achieve our goal to locate, preserve, and restore sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of a population of Florida panthers south of the Caloosahatchee River, the Service chose the mid point (90 panthers) in Kautz et al.'s (2006) population guidelines that a population of 80 to 100 panthers is likely to be stable, although subject to genetic problems, through 100 years. In addition, a population of 90 individuals is eight individuals greater than a population of 82 individuals, which according to the best available PVA (Root 2004) is 95 percent likely to persist over 100 years (assuming a 50:50 male to female ratio). These eight individuals provide a buffer for some of the assumptions in Root's (2004) PVA. Our process to determine compensation recommendations for project affects that cannot be avoided in both our section 7 and section 10 consultations is based on the amount and quality of habitat that we believe is necessary to support a population of 90 panthers in south Florida.

The Service, based on Kautz et al.'s (2006) average panther population density of 31,923 acres per panther determined 2,873,070 acres of Primary Zone "equivalent" lands need to be protected and managed. This equivalency factor is needed, since Secondary Zone lands are of less value than Primary Zone lands to the panther, to assure that additional acreage (special consideration) is required in the Secondary Zone to compensate for its lower quality panther habitat. In other words, more than 31,923 acres per panther would be needed, hypothetically, if this acreage were all in the Secondary Zone (see discussion of Primary Zone equivalent lands in the following section). The combined acreage of lands within the Primary, Dispersal, and Secondary Zones is 3,110,577 acres (1,258,833 ha) (Kautz et al. 2006). Currently, 2,073,865 acres of Primary Zone equivalent lands are preserved (Table 4), so 799,205 additional acres need to be preserved to support a population of 90 panthers in south Florida (2,873,070 minus 2,073,865 equals 799,205).

The Service also consults on lands outside of the Primary, Secondary, and Dispersal zones that may effect panthers such as agricultural lands that are adjacent to the Panther Focus Area and proposals in urbanized areas that could generate traffic in or adjacent to the Panther Focus Area or have other identifiable impacts.

Primary Zone Equivalent Lands: Kautz et al. (2006), through their habitat evaluation of lands important to the Florida panther, identified three sets of lands, *i.e.,* Primary Zone, Secondary Zone, and Dispersal Zone, and documented the relative importance of these lands to the Florida panther. These lands generally referred to as Kautz et al.'s panther core lands (Figure 8), include the majority of the home ranges of the current population of the Florida panther. The Service, in our evaluation of habitat needs for the Florida panther expanded the boundaries of the Kautz et al. (2006) lands to include those lands south of the Caloosahatchee River where additional telemetry points historically were recorded. These additional lands (about 819,995 acres), referred to as the "Other" Zone, are added to the lands in Kautz et al.'s (2006) panther core lands (Figure 8) and represent the lands within the Service's 2000 consultation area boundary south of the Caloosahatchee River as shown in Figure 5. These lands (core lands and other zone lands) together are referred to by the Service as the Service's Panther Core Area (labeled on Figure 5 as "Original Panther Consultation Area South of the Caloosahatchee River"). The "Other" Zone lands, as well as the lands within the Secondary Zone, provide less landscape benefit to the Florida panther than the Primary and Dispersal Zones, but are important as a component of our goal to preserve sufficient lands to support a population of 90 panthers in South Florida.

To account for the lower landscape importance of these lands in our preservation goals and in our habitat assessment methodology, we assigned lands in the Other Zone a value of 0.33 and lands in the Secondary Zone a value of 0.69 to convert these lands to Primary Zone value, *i.e.,* Primary Zone equivalents (Table 3). Kautz et al. (2006) identifies the need for restoration in the Secondary Zone to achieve maximum benefits. To estimate the Primary Zone equivalent of Secondary Zone lands, we derived a relative habitat value (average PHU value) for each by comparing the habitat ranks estimated in Kautz et al. (2006 – Table 1) for each habitat type per zone. The average PHU value for the Primary Zone is 6.94 and for the Secondary Zone 4.79. Based on this analysis, the habitat value of the Secondary Zone is roughly 69 percent of the Primary Zone, and restoration is needed to achieve landscape function (4.79/6.94=0.69). Dispersal Zone lands are considered equivalent to Primary Zones lands with a 1/1 value. At-risk lands in the Other Zone total 819,995 acres. Actions on some of the Other Zone lands such as some actions in areas that have already been urbanized will not have an impact on panthers or their habitat, and these case-specific determinations will be made based on a review of the specific proposals. We estimate 80 percent of these actions will have an impact on achieving the panther population goal, and will monitor this carefully as we review proposed actions (819,995 times 0.8 equals 655,996 acres). Multiply this acreage (655,996 acres) by 0.33 to determine the acres of Primary Zone equivalent lands the Other Zone can provide (655,996 times 0.33 equals 216,479 acres of Primary Zone equivalent lands). Using this assessment, the 503,481 acres of Secondary Zone lands equate to 347,402 acres of Primary Zone equivalent lands. These equivalent values, 0.33 and 0.69, for Other and Secondary Zones, respectively, and 1/1 for Dispersal Zone, are important components in our assessment of compensation needs for a project in the panther consultation area and are components of our habitat assessment methodology as discussed below.

Habitat Assessment Methodology

To evaluate project effects to the Florida panther, the Service considers the contributions the project lands provide to the Florida panther, recognizing not all habitats provide the same functional value. Kautz et al. (2006) also recognized not all habitats provide the same habitat value to the Florida panther and developed cost surface values for various habitat types, based on use by and presence in home ranges of panthers. The FWC (2006b), using a similar concept, assigned likely use values of habitats to dispersing panthers. The FWC's habitats were assigned habitat suitability rank between 0 and 10, with higher values indicating higher likely use by dispersing panthers.

The Service chose to evaluate project effects to the Florida panther through a similar process. We incorporated many of the same habitat types referenced in Kautz et al. (2006) and FWC (2006b) with several adjustments to the assigned habitat use values reflecting consolidation of similar types of habitats and the inclusion of Everglades Restoration water treatment and retention areas. We used these values as the basis for habitat evaluations and the recommended compensation values to minimize project effects to the Florida panther (Table 6), as discussed below.

Base Ratio: To develop a base ratio that will provide for the protection of sufficient acreage of Primary Zone equivalent lands for a population of 90 panthers from the acreage of Primary Zone equivalent non-urban lands at risk, we developed the following approach.

The available Primary Zone equivalent lands are estimated at 3,276,563 acres (actual acreage is 4,376,444 acres [the "actual acreage" value includes acres of lands in each category in the Secondary and Other Zones as well as the lands in the Primary Zone]) (see Table 3). Currently 2,073,865 acres of Primary Zone equivalent lands (actual acreage is 2,578,152 acres) of non-urban lands are preserved. The remaining non-urban at-risk private lands are estimated at 1,202,698 acres of Primary Zone equivalent lands (actual acreage is 1,798,295 acres). To meet the protected and managed lands goal for a population of 90 panthers, an additional 799,205 acres of Primary Zone equivalent lands are needed. The base ratio is determined by dividing the primary equivalents of at-risk habitat to be secured (799,205 acres) by the result of the acres of at-risk habitat in the Primary Zone (610,935 acres) times the value of the Primary Zone (1); plus the at-risk acres in the Dispersal Zone (27,883 acres) times the value of the Dispersal Zone (1); plus the at-risk acres in the Secondary Zone (503,481 acres) times the value of the Secondary Zone (0.69); plus the at-risk acres in the Other Zone (655,996 acres) times the value of the Other Zone (0.33); minus the at-risk acres of habitat to be protected (799,205 acres). The results of this formula provide a base value of 1.98.

$$799{,}205 / ((610{,}935 \times 1.0) + (27{,}883 \times 1) + (503{,}481 \times 0.69) + (655{,}996 \times 0.33)) - 799{,}205 = 1.98$$

In evaluating habitat losses in the consultation area, we used an estimate of 0.8 percent loss of habitat per year (R. Kautz , FWC, personal communication, 2004) to predict the amount of habitat loss anticipated in south Florida during the next 5 years (*i.e.,* 6,000 ha/year; 14,820 acres/year). We conservatively assumed that we would be aware of half of these projects. We assumed that half of the projects would occur in the Primary Zone and half would occur in the Secondary Zone. We estimated that over a 5-year period that about 37,000 acres would be developed without Federal review. We adjusted the base value from 1.98 to 2.23.

We also realize that collectively habitat losses from individual single-family residential developments will compromise the Service's goal to secure sufficient lands for a population of 90 panthers. We believe that, on an individual basis, single-family residential developments by individual lot owners on lots no larger than 2.0 ha (5.0 acres) will not result in take of panthers on a lot-by-lot basis; however, collectively these losses may impact the panther. Panthers are a wide ranging species, and individually, a 2.0 ha (5.0 acre) habitat change will not have a measurable impact. Compensation for such small-scale losses on a lot-by-lot basis is unlikely to result in meaningful conservation benefits for the panther versus the more holistic landscape level conservation strategy used in our habitat assessment methodology. To account for these losses, we estimated that about another 12,950 acres over a 5-year period (2,590 acres per year) would be developed through this avenue. We adjusted the base value from 2.23 to 2.48.

We also realize there is a need for road crossings in strategic locations and we believe there are projects that may not have habitat loss factors but will have traffic generation factors. The Service considers increases in traffic as an indirect effect from a project and can contribute to panther mortality. Therefore, we have added another 0.02 to the base ratio to address traffic impacts, which could provide an incentive to implement crossings in key locations. Following the same approached shown above, we adjusted the base ratio from 2.48 to the 2.5. The Service intends to re-evaluate this base ratio periodically and adjust as needed to make sure all adverse effects are adequately ameliorated and offset as required under section 7 of the Act and to achieve the Service's conservation goal for the Florida panther.

Landscape Multiplier: As discussed previously in the above section on Primary Zone Equivalent Lands, the location of a project in the landscape of the core area of the Florida panther is important. As we have previously discussed, lands in the Primary and Dispersal Zones are of the most importance in a landscape context to the Florida panther, with lands in the Secondary Zone of less importance, and lands in the Other Zone of lower importance. These zones affect the level of compensation the Service believes is necessary to minimize a project's effects to Florida panther habitat. Table 5 provides the landscape compensation multipliers for various compensation scenarios. As an example, if a project is in the Other Zone and compensation is proposed in the Primary Zone, a Primary Zone equivalent multiplier of 0.33 is applied to the PHUs (see discussion below) developed for the project. If the project is in the Secondary Zone and compensation is in the Primary Zone, then a Primary Zone equivalent multiplier of 0.69 is applied to the PHUs developed for the project.

Panther Habitat Units – Habitat Functional Value: Prior to applying the base ratio and landscape multipliers discussed above, we evaluate the project site and assign functional values to the habitats present. This is done by assigning each habitat type on-site a habitat suitability value from the habitats shown in Table 6. The habitat suitability value for each habitat type is then multiplied by the acreage of that habitat type resulting in a number representing PHUs. These PHUs are summed for a site total, which is used as a measurement of the functional value the habitat provides to the Florida panthers. This process is also followed for the compensation-sites.

Exotic Species Assessment: Since many habitat types in south Florida are infested with exotic plant species, which affects the functional value a habitat type provides to foraging wildlife species (*i.e.,* primarily deer and hog), we believe the presence of these species and the value

these species provide to foraging wildlife needs to be considered in the habitat assessment methodology. As shown in Table 6, we have a habitat type and functional value shown for exotic species. This category includes not only the total acres of pure exotic species habitats present but also the percent-value acreages of the exotic species present in other habitat types.

For example, a site with 100 acres of pine flatwoods with 10 percent exotics would be treated in our habitat assessment methodology as 90 acres of pine flatwoods and 10 acres of exotics. Adding another 100 acres of cypress swamp with 10 percent exotics would change our site from 90 acres of pine flatwoods and 10 acres of exotics to 90 acres of pine flatwoods, 90 acres of cypress swamp, and 20 acres of exotics.

Habitat Assessment Methodology Application – Example: To illustrate the use of our habitat assessment methodology, we provide the following example. A 100-acre project site is proposed for a residential development. Plans call for the entire site to be cleared. The project site contains 90 acres of pine flatwoods and 10 acres of exotic vegetation, and is located in the "Secondary Zone." The applicant has offered habitat compensation in the "Primary Zone" to minimize the impacts of the project to the Florida panther. To calculate the PHUs provided by the site, we multiply the habitat acreage by the "habitat suitability value" for each habitat type and add those values to obtain a value of 840 PHUs ((90 acres of pine flatwoods x 9 [the habitat suitability value for pine flatwoods] = 810 PHUs) + (10 acres of exotic vegetation x 3 [the habitat suitability value for exotics] = 30 PHUs) = 840 PHUs). The value of 840 PHUs is then multiplied by the 2.5 (the base ratio) and 0.69 (the landscape multiplier) resulting in a value of 1,149 PHUs for the project site. In this example, the acquisition of lands in the Primary Zone containing at least 1,149 PHUs are recommended to compensate for the loss of habitat to the Florida panther resulting from this project.

Analysis of the species likely to be affected

The Florida panther is an endangered animal restricted to two to three million acres of land (6 to 9 percent of the total land area of Florida) in south Florida. The panther is a wide-ranging species that requires a biotically diverse landscape to survive. Dispersing subadult males wander widely through unforested and disturbed habitat. Human population in south Florida has dramatically increased, from one million in 1950 to six million in 1990, resulting in secondary disturbances such as increased human presence and noise, light, air, and water pollution. Increasing human population has resulted in increasing impacts on native habitat and flora and fauna. Resulting threats to panthers include road mortality, habitat loss, habitat fragmentation, and human disturbance.

Wood stork

The wood stork was federally listed under the Act as endangered on February 28, 1984. No critical habitat has been designated for the wood stork; therefore, none will be affected.

Species Description

The wood stork is a large, long-legged wading bird, with a head to tail length of 85 to 115 cm (33 to 45 inches [in]) and a wingspan of 150 to 165 cm (59 to 65 in) (Coulter et al. 1999). The plumage is white, except for iridescent black primary and secondary wing feathers and a short

black tail. Wood storks fly with theft neck and legs extended. On adults, the rough scaly skin of the head and neck is unfeathered and blackish in color, the legs are dark, and the feet are dull pink. The bill color is also blackish. During courtship and the early nesting season, adults have pale salmon coloring under the wings, fluffy undertail coverts that are longer than the tail, and their toes are bright pink. Immature wood storks, up to the age of about 3 years, have yellowish or straw-colored bills and varying amounts of dusky feathering on the head and neck (Coulter et al. 1999).

Life History

Wood stork nesting habitat consists of mangroves as low as 1 m (3 ft), cypress as tall as 30.5 m (100 ft), and various other live or dead shrubs or trees located in standing water (swamps) or on islands surrounded by relatively broad expanses of open water (Palmer 1962, Rodgers et al. 1987, Ogden 1991, Coulter et al. 1999). Wood storks nest colonially, often in conjunction with other wading bird species, and generally occupy the large-diameter trees at a colony site (Rodgers et al. 1996). The same colony site will be used for many years as long as the colony is undisturbed and sufficient feeding habitat remains in surrounding wetlands. However, not all storks nesting in a colony will return to the same site in subsequent years (Kushlan and Frohring 1986). Natural wetland nesting sites may be abandoned if surface water is removed from beneath the trees during the nesting season (Rodgers et al. 1996). In response to this type of changes to nest site hydrology, wood storks may abandon that site and establish a breeding colony in managed or impounded wetlands (Ogden 1991). Wood storks that abandon a colony early in the nesting season due to unsuitable hydrological conditions may re-nest in other nearby areas (Borkhataria et al. 2004; Crozier and Cook 2004). Between breeding seasons or while foraging wood storks may roost in trees over dry ground, on levees, or large patches of open ground. Wood storks may also roost within wetlands while foraging far from nest sites and outside of the breeding season (Gawlik 2002).

While the majority of stork nesting occurs within traditional stork rookeries, a handful of new stork nesting colonies are discovered each year (Meyer and Frederick 2004, Service unpublished data). These new colony locations may represent temporary shifts of historic colonies due to changes in local conditions, or they may represent formation of new colonies in areas where conditions have improved.

Wood storks forage in a wide variety of wetland types, where prey are available to storks and the water is shallow and open enough to hunt successfully (Ogden et al. 1978; Browder 1984; Coulter 1987). Calm water, about 2 to 16 in (5 to 40 cm) in depth, and free of dense aquatic vegetation is ideal (Coulter and Bryan 1993). Typical foraging sites include freshwater marshes, ponds, hardwood and cypress swamps, narrow tidal creeks or shallow tidal pools, and artificial wetlands such as stock ponds, shallow, seasonally flooded roadside or agricultural ditches, and managed impoundments (Coulter et al. 1999; Coulter and Bryan 1993).

Several factors affect the suitability of potential foraging habitat for wood storks. Suitable foraging habitats must provide both a sufficient density and biomass of forage fish and other prey, and have vegetation characteristics that allow storks to locate and capture prey. During nesting, these areas must also be sufficiently close to the colony to allow storks to efficiently

deliver prey to nestlings. Hydrologic and environmental characteristics have strong affects on fish density, and these factors may be some of the most significant in determining foraging habitat suitability, particularly in southern Florida.

Within the wetland systems of southern Florida, the annual hydrologic pattern is very consistent, with water levels rising over 3 feet during the wet season (June-November), and then receding gradually during the dry season (December-May). Storks nest during the dry season, and rely on the drying wetlands to concentrate prey items in the ever-narrowing wetlands (Kahl 1964). Because of the continual change in water levels during the stork nesting period, any one site may only be suitable for stork foraging for a narrow window of time when wetlands have sufficiently dried to begin concentrating prey and making water depths suitable for storks to access the wetlands. Once the wetland has dried to where water levels are near the ground surface, the area is no longer suitable for stork foraging, and will not be suitable until water levels rise and the area is again repopulated with fish. Consequently, there is a general progression in the suitability of wetlands for foraging based on their hydroperiods, with the short hydroperiod wetlands being used early in the season, the mid-range hydroperiod sites being used during the middle of the nesting season, and the longest hydroperiod areas being used later in the season (Kahl 1964; Gawlik 2002).

In addition, to the concentration of fish due to normal drying, several other factors affect fish abundance in potential foraging habitats. Longer hydroperiod areas generally support more fish and larger fish (Trexler et al. 2002; Jordan et al. 1998; Loftus and Ecklund 1994; Turner et al. 1999). In addition, nutrient enrichment (primarily phosphorus) within the oligotrophic Everglades wetlands generally results in increased density and biomass of fish in potential stork foraging sites (Rehage and Trexler *In Press*), and distances from dry-season refugia, such as canals, alligator holes, and similar long hydroperiod sites also affect fish density and biomass. Within the highly modified environments of southern Florida, fish availability varies with respect to hydrologic gradients, nutrient availability gradients, and it becomes very difficult to predict fish density. The foraging habitat for most wood stork colonies within southern Florida includes a wide variety of hydroperiod classes, nutrient conditions, and spatial variability.

Dense submerged and emergent vegetation may reduce foraging suitability by preventing storks from moving through the habitat and interfering with prey detection (Coulter and Bryan 1993). Some submerged and emergent vegetation does not detrimentally affect stork foraging, and may be important to maintaining fish populations. Average submerged and emergent vegetation cover at foraging sites was 26 and 29 percent, respectively, at foraging sites at a Georgia colony, and ranged from 0 to100 percent (Coulter and Bryan 1993). These cover values did not differ significantly from random wetland sites. Similarly, densely forested wetlands may preclude storks from accessing prey within the areas (Coulter and Bryan 1993). Storks tend to select foraging areas that have an open canopy, but occasionally use sites with 50 to 100 percent canopy closure (Coulter and Bryan 1993; O'Hare and Dalrymple 1997; Coulter et al. 1999).

Wood storks feed almost entirely on fish between 2 and 25 cm (1 to 10 in) in length (Kahl 1964; Ogden et al. 1976; Coulter 1987) but may occasionally consume crustaceans, amphibians, reptiles, mammals, birds, and arthropods. Lauritsen (personal communication 2007) observed

wood stork foraging on crayfish, although the value of this source of prey is unclear. Wood storks generally use a specialized feeding behavior called tactilocation, or grope feeding, but also forage visually under some conditions (Kushlan 1979). Storks typically wade through the water with the beak immersed and open about 7 to 8 cm (2.5 to 3.5 in). When the wood stork encounters prey within its bill, the mandibles snap shut, the head is raised, and the food swallowed (Kahl 1964). Occasionally, wood storks stir the water with their feet in an attempt to startle hiding prey (Rand 1956; Kahl 1964; Kushlan 1979). This foraging method allows them to forage effectively in turbid waters, at night, and under other conditions when other wading birds that employ visual foraging may not be able to forage successfully.

Wood storks generally forage in wetlands within 50 km (31 miles) of the colony site (Bryan and Coulter 1987), but forage most frequently within 20 km (12 miles) of the colony (Coulter and Bryan 1993). Maintaining this wide range of feeding site options ensures sufficient wetlands of all sizes and varying hydroperiods are available, during shifts in seasonal and annual rainfall and surface water patterns, to support wood storks. Adults feed furthest from the nesting site prior to laying eggs, forage in wetlands closer to the colony site during incubation and early stages of raising the young, and then further away again when the young are able to fly. Wood storks generally use wet prairie ponds early in the dry season then shift to slough ponds later in the dry season thus following water levels as they recede into the ground (Browder 1984).

Gawlik (2002) characterized wood storks as "searchers" that employ a foraging strategy of seeking out areas of high density prey and optimal (shallow) water depths, and abandoning foraging sites when prey density begins to decrease below a particular efficiency threshold, but while prey was still sufficiently available that other wading bird species were still foraging in large numbers (Gawlik 2002). Wood stork choice of foraging sites was significantly related to both prey density and water depth (Gawlik 2002). Because of this strategy, wood stork foraging opportunities are more constrained than many of the other wading bird species (Gawlik 2002).

Breeding wood storks are believed to form new pair bonds every season. First age of breeding has been documented in 3- to 4-year-old birds but the average first age of breeding is unknown. Eggs are laid as early as October in south Florida and as late as June in north Florida (Rodgers 1990; Service unpublished data). A single clutch of two to five (average three) eggs is laid per breeding season but a second clutch may be laid if a nest failure occurs early in the breeding season (Coulter et al. 1999). There is variation among years in the clutch sizes, and clutch size does not appear to be related to longitude, nest data, nesting density, or nesting numbers, and may be related to habitat conditions at the time of laying. Egg laying is staggered and incubation, which lasts about 30 days, begins after the first egg is laid. Therefore the eggs hatch at different times and the nestlings vary in size (Coulter et al. 1999). The younger birds are first to die during times of scarce food.

The young fledge in about 8 weeks but will stay at the nest for 3 to 4 more weeks to be fed. Adults feed the young by regurgitating whole fish into the bottom of the nest about three to ten times per day. Feedings are more frequent when the birds are young (Coulter et al. 1999). Feedings are less frequent when wood storks are forced to fly great distances to locate food (Bryan et al. 1995). The total nesting period from courtship and nest-building through

independence of young, lasts about 100 to 120 days (Coulter et al. 1999). Within a colony, nest initiation may be asynchronous, and consequently, a colony may contain active breeding wood storks for a period significantly longer than the 120 days required for a pair to raise young to independence. Adults and independent young may continue to forage around the colony site for a relatively short period following the completion of breeding.

Wood storks produce an average of 1.29 fledglings per nest and 0.42 fledglings per egg which is a probability of survivorship from egg laying to fledgling of 42 percent (Rodgers and Schwikert 1997). The probability of survivorship from egg laying to day 14 is 80 percent,to day 28 (hatching) 70 percent, to day 42 (nestling 2 weeks of age) 62 percent, to day 56 (nestling 4 weeks of age) 56 percent, to day 70 (nestling 6 weeks) 50 percent and to day 84 (fledgling) 42 percent. The greatest losses occur from egg laying to hatching with a 30 percent loss of the nest productivity. From hatching to nestlings of 2 weeks of age, nest productivity loss is an additional 8 percent. Corresponding losses for the remainder of the nesting cycles are on the average of a 6 percent per two week increase in age of the nestling (Rodgers and Schwikert 1997).

During the period when a nesting colony is active, storks are dependent on consistent foraging opportunities in wetlands within about 30 km for the nest site, with the greatest energy demands occurring during the middle of the nestling period, when nestlings are 23 to 45 days old (Kahl 1964). The average wood stork family requires 201 kg (443 pounds) of fish during the breeding season, with 50 percent of the nestling stork's food requirement occurring during the middle third of the nestling period (Kahl 1964). Receding water levels are necessary in south Florida to concentrate suitable densities of forage fish (Kahl 1964; Kushlan et al. 1975).

Many researchers (Flemming et al. 1994; Ceilley and Bortone 2000) believe the short hydroperiod wetlands provide a more important pre-nesting foraging food source and a greater effect on early nestling survival for wood storks than the foraging base (grams of fish per square-meter) that is suggested in short hydroperiod wetlands. For instance, Loftus and Eklund (1994) provide an estimate of 50 fish per square-meter for long hydroperiod wetlands and 10 fish per square-meter for short hydroperiod wetlands. As a result of the consistent pattern of drying that normally occurs during the stork nesting season, the short hydroperiod wetlands would also be the ones used for foraging early in the season when long hydroperiod wetlands remain too deep for storks to forage effectively, or sufficient prey concentration has not yet occurred as a result of drying.

Although, the short hydroperiod wetlands support fewer fish and lower fish biomass per unit area than long hydroperiod wetlands, these short hydroperiod wetlands were historically more extensive and provided foraging areas for storks during colony establishment, courtship and nest-building, egg-laying, incubation, and the early stages of nestling provisioning. This period corresponds to the greatest periods of nest failure (*i.e.*, 30 percent and 8 percent, respectively from egg laying to hatching and from hatching to nestling survival to two weeks) (Rodgers and Schwikert 1997).

Based on Kahl's (1964) estimate that 201 kg are needed for the success of a nest, and that 50 percent of the foraging base is needed in the middle third of the nesting cycle when chicks are about 23-45 days old (Kahl 1962), it is estimated that about 50 kg are needed to meet the foraging needs of the adults and nestling in the first third of the nesting cycle. Considering the

relatively low foraging values these short hydroperiod wetlands provide in relationship to corresponding long hydroperiod wetlands, a much larger acreages of these wetlands are needed to ensure survival and to sustain development of nestlings. The disproportionate reduction (85 percent) of this specific habitat loss known to have occurred from development and overdrainage has been proposed as a major cause of late colony formation and survivorship reduction in early nestling survival rates (Fleming et al. 1994b).

Storks that are not breeding do not require the same degree of fish concentration that is required to sustain successful nesting. Kahl (1964) estimated the food requirements for an individual free-flying stork to be about 502 g (live weight) per day. Storks that are not nesting are able to find sufficient prey to sustain themselves in many wetlands that would not be suitable to sustain adults and chicks during nesting.

Following the completion of the nesting season, both adult and fledgling wood storks generally begin to disperse away form the nesting colony. Fledglings have relatively high mortality rates within the first six months following fledging, most likely as a result of their lack of experience, including the selection of poor foraging locations (Hylton et al. 2006). Post-fledging survival also appears to be variable among years, probably reflecting the environmental variability that affects storks and their ability to forage (Hylton et al. 2006).

In southern Florida, both adult and juvenile storks consistently disperse northward following fledging in what has been described as a mass exodus (Kahl 1964). Storks in central Florida also appear to move northward following the completion of breeding, but generally do not move as far (Coulter et al. 1999). Many of the juvenile storks from southern Florida move far beyond Florida into Georgia, Alabama, Mississippi, and South Carolina (Coulter et al. 1999; Borkhataria et al. 2004; Borkhataria et al. 2006). Some flocks of juvenile storks have also been reported to move well beyond the breeding range of storks in the months following fledging (Kahl 1964). This post-breeding northward movement appears consistent across years.

Both adult and juvenile storks return southward in the late fall and early winter months. In a study employing satellite telemetry, Borkhataria et al. (2006) reported that nearly all storks that had been tagged in the southeastern U.S moved into Florida near the beginning of the dry season, including all subadult storks that fledged from Florida and Georgia colonies. Adult storks that breed in Georgia remained in Florida until March, and then moved back to northern breeding colonies (Borkhataria et al. 2006). Overall, about 75 percent of all locations of radio-tagged wood storks occurred within Florida (Borkhataria et al. 2006). Preliminary analyses of the rangewide occurrence of wood storks in December, recorded during the annual Christmas bird surveys, suggest that the vast majority of the southeastern United States wood stork population occurs in central and southern Florida. Relative abundance of storks in this region was 10 to 100 times higher than in northern Florida and Georgia (Service unpublished data). As a result of these general population-level movement patterns, during the earlier period of the stork breeding season in southern Florida, the wetlands upon which nesting storks depend are also being heavily used by a large portion of the southeastern United States wood stork population, including storks that breed in Georgia and the Carolinas, and subadult storks from throughout the stork's range. In addition, these same wetlands support a wide variety of other wading bird species (Gawlik 2002).

Population Dynamics

The United States breeding population of wood storks declined from an estimated 20,000 pairs in the 1930s to about 10,000 pairs by 1960 (49 FR 7332). The total number of nesting pairs in 1995 was 7,853 with 11 percent in South Carolina, 19 percent in Georgia, and 70 percent in Florida (Service 1997). However, recent nesting data shows that the wood stork population in the southeastern United States appears to be increasing (Table 7, Figure 11). Preliminary population totals indicate that the stork population has reached its highest level since it was listed as endangered in 1984. In all, about 11,200 wood stork pairs nested within their breeding range in the southeastern U.S (Service, unpublished data, 2006). The nesting and colony data (Table 7, Figure 11) show increases in both the number of nest and in the number of colonies with the greatest increases in both nest and colonies in Georgia, South Carolina, and North Carolina. The Florida colonies appear to fluctuate yearly and vary around a three-year running average of 49 colonies and 5,040 nests annually.

A review of the historic data shows that since the 1960s, the wood stork population has declined in southern Florida and increased in northern Florida, Georgia, and South Carolina (Ogden et al. 1987). The number of nesting pairs in the Everglades and Big Cypress ecosystems (southern Florida) declined from 8,500 pairs in 1961 to 969 pairs in 1995. During the same period, nesting pairs in Georgia increased from 4 to 1,501 and nesting pairs in South Carolina increased from 11 to 829 (Service 1996). The number of nesting pairs in northern and central Florida doubled between 1976 and 1986 (Ogden 1991). Although Ogden (1991) attributed this to an increase in the availability of altered wetland and artificial wetland nesting sites, the regional increase coincided with the northward shift of the wood stork breeding population center and the overall population decline in the southeastern United States.

Both the size and success of a wood stork colony varies from year to year based on availability of suitable wetland foraging areas, which can be affected by local rainfall patterns, regional weather patterns, and anthropogenic hydrologic management (Service 1996). The colony site may be vacant in years of drought due to inadequate foraging conditions in the surrounding area. Traditional colony nesting sites may be abandoned completely by storks when hydrological changes occur, removing surface water from beneath the colony trees. Conversely, nesting failures and colony abandonment may occur if unseasonable rainfall causes waters to rise when they are normally receding, thus dispersing rather than concentrating forage fish.

Between 1958 and 1985, the wood stork breeding population center shifted north from Lake Okeechobee to Polk County, a distance of about 132 km (82 miles). The 1976 breeding season was the last year when more pairs nested in south Florida than in central-north Florida. Productivity is generally higher in central-north Florida than south Florida. Whereas the number of colonies in south Florida has remained relatively stable, the number of colonies in central-north Florida region continues to increase (Ogden et al. 1987). The increase in central-north Florida is associated with an increase in colony numbers and not colony size. Colonies in the north are smaller than colonies in the south. Historically colonies in the south were associated with extensive wetlands and food was abundant. The implication is that food resources may be limiting colony sizes in central-north Florida (Ogden et al. 1987). Ogden et al. (1987) suggested the population shift is the result of deteriorating feeding conditions in south Florida and better nesting success rates in central-north Florida that compound population growth in that area.

The wood stork life history strategy has been characterized as a "bet-hedging" strategy (Hylton et al. 2006) in which high adult survival rates and the capability of relatively high reproductive output under favorable conditions allow the species to persist during poor conditions and capitalize on favorable environmental conditions. This life-history strategy may be adapted to variable environments (Hylton et al. 2006) such as the wetland systems of southern Florida.

Nest initiation date, colony size, nest abandonment, and fledging success of a wood stork colony varies from year to year based on availability of suitable wetland foraging areas, which can be affected by local rainfall patterns, regional weather patterns, and anthropogenic hydrologic management (Service 1997). A colony site may be vacant in years of drought or unfavorable conditions due to inadequate foraging conditions in the surrounding area (Kahl 1964). Traditional colony nesting sites may be abandoned completely by storks when hydrological changes occur such as removing surface water from beneath the colony trees (Service 1997; Coulter et al. 1999). Nesting failures and colony abandonment may also occur if unseasonable rainfall causes water levels to rise when they are normally receding, thus dispersing rather than concentrating forage fish (Kahl 1964; Service 1997; Coulter et al. 1999).

The annual climatological pattern that appeared to stimulate the heaviest nesting efforts by storks was a combination of the average or above-average rainfall during the summer rainy season prior to colony formation and an absence of unusually rainy or cold weather during the following winter-spring nesting season. This pattern produced widespread and prolonged flooding of summer marshes that maximized production of freshwater fishes, followed by steady drying that concentrated fish during the dry season when storks nest (Kahl 1964).

Status and Distribution

The wood stork is found from northern Argentina, eastern Peru and western Ecuador north to Central America, Mexico, Cuba, Hispaniola, and the southeastern United States (AOU 1983). Only the population segment that breeds in the southeastern United States is listed as endangered. In the United States, wood storks were historically known to nest in all coastal states from Texas to South Carolina (Wayne 1910; Bent 1926; Howell 1932; Oberholser 1938; Dusi and Dusi 1968; Cone and Hall 1970; Oberholser and Kincaid 1974). Dahl (1990) estimates these states lost about 38 million acres, or 45.6 percent, of their historic wetlands between the 1780s and the 1980s. However, it is important to note wetlands and wetland losses are not evenly distributed in the landscape. Hefner et al. (1994) estimated 55 percent of the 2.3 million acres of the wetlands lost in the southeastern United States between the mid-1970s and mid-1980s were located in the Gulf-Atlantic Coastal Flats. These wetlands were strongly preferred by wood storks as nesting habitat. Currently, wood stork nesting is known to occur in Florida, Georgia, South Carolina, and North Carolina. Breeding colonies of wood storks are currently documented in all southern Florida counties except for Okeechobee County. Additional expansion of the breeding range of wood storks in the southeastern United States may continue in coming years, both to the north and possibly to the west along the Gulf Coast (Billy Brooks, Service, personal communication 2006).

The decline in the United States population of the wood stork is thought to be related to one or more of the following factors: (1) reduction in the number of available nesting sites; (2) lack of protection at nesting sites; and/or (3) loss of an adequate food base during the nesting season (Ogden and Nesbitt 1979). Ogden and Nesbitt (1979) indicate a reduction in nesting sites is not the cause in the population decline, because the number of nesting sites used from year to year is relatively stable. They suggest loss of an adequate food base is a cause of wood stork declines. Changes in remaining wetland systems in Florida, including drainage and impoundment, may be a larger problem for wood storks than loss of foraging habitat (Ogden and Nesbitt 1979).

The primary cause of the wood stork population decline in the United States is loss of wetland habitats or loss of wetland function resulting in reduced prey availability. Almost any shallow wetland depression where fish become concentrated, either through local reproduction or receding water levels, may be used as feeding habitat by the wood stork during some portion of the year, but only a small portion of the available wetlands support foraging conditions (high prey density and favorable vegetation structure) that storks need to maintain growing nestlings. Browder et al. (1976; Browder 1978) documented the distribution and the total acreage of wetland types occurring south of Lake Okeechobee, Florida, for the period 1900 through 1973. We combined their data for habitat types known to be important foraging habitat for wood storks (cypress domes and strands, wet prairies, scrub cypress, freshwater marshes and sloughs, and saw grass marshes) and found these habitat types have been reduced by 35 percent since 1900.

The alteration of wetlands and the manipulation of wetland hydroperiods to suit human needs have also reduced the amount of habitat available to wood storks. The decrease in wood storks nesting on Cape Sable was related to the construction of the drainage canals during the 1920s (Kushlan and Frohring 1986). Water level manipulation can facilitate raccoon predation of wood stork nests when water is kept too low (alligators deter raccoon predation when water levels are high). Artificially high water levels may retard nest tree regeneration since many wetland tree species require periodic droughts to establish seedlings. Water level manipulation may decrease food productivity if the water levels and length of inundation do not match the breeding requirements of forage fish. Dry-downs of wetlands may selectively reduce the abundance of the larger forage fish species that wood storks tend to utilize, while still supporting smaller prey fish. Since the 1970s, wood storks have also been observed to shift their nest sites to artificial impoundments or islands created by dredging activities (Ogden 1991). The percentage of nests in artificial habitats in central and north Florida has increased from about 10 percent of all nesting pairs in 1959 to 1960 to 60 to 82 percent between 1976 and 1986 (Ogden 1991). Nest trees in these artificially impounded sites often include exotic species such as Brazilian pepper or Australian pine (*Casuarina* spp.). Ogden (1996) has suggested the use of these artificial wetlands indicates wood storks are not finding suitable conditions within natural nesting habitat or they are finding better conditions at the artificial wetlands. The long-term effect of these nesting areas on wood stork populations is unclear.

Human disturbance is a factor known to have a detrimental affect on wood stork nesting (Service 1997). Wood storks have been known to desert nests when disturbed by humans, thus exposing eggs and young birds to the elements and to predation by gulls and fish crows. The role of chemical contamination in the decline of the wood stork is unclear. Pesticide levels high enough

to cause eggshell thinning have been reported in wood storks but decreased productivity has not yet been linked to chemical contamination (Ohlendorf et al. 1978; Fleming et al. 1984). Burger et al. (1993) studied heavy metal and selenium levels in wood storks from Florida and Costa Rica. Adult birds generally exhibited higher levels of contaminants than young birds. The authors attribute this to bioaccumulation in the adults who may be picking up contaminants at the colony nesting site and while foraging at other locations during the non-breeding season. There were higher levels of mercury in young birds from Florida than young birds or adults from Costa Rica. Young birds from Florida also exhibited higher levels of cadmium and lead than young birds from Costa Rica. The authors recommended the lead levels in Florida be monitored. Burger et al. (1993) drew no conclusions about the potential health effects to wood storks.

The wood stork population in the southeastern United States appears to be increasing. Preliminary population totals indicate that the stork population has reached its highest level since it was listed as endangered in 1984. In all, about 11,200 wood stork pairs nested within their breeding range in the southeastern United States. Wood stork nesting was again recorded in North Carolina in 2006 after it was first documented there in 2005. This suggests that the northward expansion of wood stork nesting may be continuing. Several new colonies were located in 2006, including several in Florida. Of the preliminary total of 11,232 nesting pairs, 7,261 occurred within Florida. There were 1,919 nests recorded in Georgia, 1,963 in South Carolina, and 125 in North Carolina. Total nest numbers have also been over 9,000 in 2002 and 2003 (Service 2004). The number of colonies also continues to rise, and over 80 nesting colonies were reported in 2006 throughout the southeastern United States (Service, unpublished data), which is the highest to date in any one year.

The 2006 stork nesting season also appears to be very productive for storks throughout their range. While final productivity estimates are still not available, preliminary estimates are over 2.5 chicks per nest (Borkhataria et al. 2006). The apparent success this year is welcome news in light of the nearly complete failure of stork nesting in 2005 in southern Florida, and relatively poor nest success rates in this region that have occurred since 2002.

Recovery Goals

Measuring the biological aspect of the recovery of the wood stork is outlined in the Service's 1997 recovery plan. The plan's recovery criteria state that reclassification from endangered to threatened, could be considered when there are 6,000 nesting pairs and annual regional productivity is greater than 1.5 chicks per nest/year (calculated over a 3-year average). Delisting could be considered when there are 10,000 nesting pairs calculated over a 5-year period beginning at the time of reclassification and annual regional productivity is greater than 1.5 chicks per nest/year (calculated over a 5-year average). As a subset of the 10,000 nesting pairs, a minimum of 2,500 nesting pairs must occur in the Everglades and Big Cypress systems in south Florida. In 2001, the Service reinitiated another 5-year synoptic aerial survey effort for wood stork colonies throughout the southeast range of the species (Service 2003), and surveys have been conducted annually through 2006. Three-year averages calculated from nesting data from 2001 through 2006 indicate that the total nesting population has been consistently above the 6,000 threshold, and the averages have ranged from about 7,400 to over 8,700.

Wood Stork Nesting in the Southeastern United States

The 2006 estimate of total wood stork nesting pairs is the highest recorded since the stork was listed, and since the early 1960s (Table 7, Figure 11). The trend in the total nesting numbers shows a steady increasing trend, with some degree of variation around the trend that occurs as a result of local environmental conditions. The number of known colonies and a corresponding increase in nesting storks is shown for the colonies in Georgia, South Carolina, and North Carolina (Table 7, Figure 11). However, the number of colonies and nesting wood storks in Florida appears to fluctuate yearly and varies around a three-year running average of 49 colonies and 5,040 nest annually.

Wood Stork Nesting in the Everglades and Big Cypress Systems

There is confusion in the definition among the Service and species experts about what constitutes the boundaries of the Everglades and Big Cypress systems. The MSRP defines the Everglades and Big Cypress systems as those colonies south of Lake Okeechobee from Lee County on the west coast to Palm Beach County on the East Coast. Nesting pairs for colonies in this region totaled have been variable, but have shown a general pattern of decline within the past 4 to 5 years (Crozier and Gawlik 2003; Service 2003; Crozier and Cook 2004, Cook and Call 2005). However, in a review of the 10-year nesting data (Table 8, Figure 12), wood stork nesting success have shown a significant increase from the mid-1990 from an average of 400 to 500 pairs to a high of 4,549 pairs in 1999, with a three-year running average over the 10-year period ranging from 507 to 3,742 pairs with considerable variability over the 10-year period. These observed fluctuations in the nesting between years and nesting sites has been attributed primarily to variable hydrologic conditions during the nesting season (Crozier and Gawlik 2003; Crozier and Cook 2004). Frequent heavy rains during nesting can cause water levels to increase rapidly. The abrupt increases in water levels during nesting, termed reversals (Crozier and Gawlik 2003), may cause nest abandonment, re-nesting, late nest initiation, and poor fledging success. Abandonment and poor fledging success was reported to have affected most wading bird colonies in southern Florida during 2004 and 2005 (Crozier and Cook 2004, Cook and Call 2005).

Analysis of the species likely to be affected

The United States breeding population of wood storks declined from an estimated 20,000 pairs in the 1930s to about 10,000 pairs by 1960 (49 FR 7332). The total number of nesting pairs in 1995 was 7,853 with 11 percent in South Carolina, 19 percent in Georgia, and 70 percent in Florida (Service 1997). However, the wood stork population in the southeastern United States appears to be increasing. Preliminary population totals indicate that the stork population has reached its highest level since it was listed as endangered in 1984. In all, about 11,200 wood stork pairs nested within their breeding range in the southeastern United States. Wood stork nesting was again recorded in North Carolina in 2006 after it was first documented there in 2005. This suggests that the northward expansion of wood stork nesting may be continuing. Several new colonies were located in 2006, including several in Florida.

The primary cause of the wood stork population decline in the United States is loss of wetland habitats or loss of wetland function resulting in reduced prey availability. The alteration of wetlands and the manipulation of wetland hydroperiods to suit human needs have also reduced the amount of habitat available to wood storks and affected the prey base availability. The altered hydrology of these systems has also fostered the invasion of these systems by the exotic plant species, melaleuca. This plant species produces a dense understory and closed canopy, limiting suitability of these wetland systems to foraging by wood storks, although sufficient prey base may be present in the wetlands. Increasing human population has resulted in increasing impacts on native habitat and flora and fauna. Resulting threats to wood storks include habitat loss, habitat fragmentation, and human disturbance.

ENVIRONMENTAL BASELINE

Florida panther

The environmental baseline includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions, which occur simultaneously with the consultation in progress.

Status of the Species within the Action Area

As stated previously, for the purposes of this consultation, the action area includes the Corps' project area and surrounding lands frequently visited by panthers (Figure 6). The action area is a subset of the current geographic range of the panther and includes those lands that the Service believes may experience direct and indirect effects from the proposed development. Therefore, for both direct and indirect effects, the action area is defined as all lands within a 25-mile radius of the project. This action area does not include urban lands and lands west of I-75. The proposed action may have direct and indirect effects on the ability of panthers to breed, feed, and find shelter, and to disperse within the population.

The Service used current and historical radio-telemetry data, information on habitat quality, prey base, and evidence of uncollared panthers to evaluate panther use in the action area. Panther telemetry data are collected 3 days per-week from fixed-wing aircraft, usually in early to midmorning. However, researchers have shown panthers are most active between dusk and dawn (Maehr et al. 1990a, Beier 1995) and are typically at rest in dense ground cover during daytime monitoring flights (Land 1994). Therefore, telemetry locations may present an incomplete picture of panther activity patterns and habitat use (Comiskey et al. 2002). In addition, telemetry data alone may be misleading since less than half of the panther population is currently collared.

Although telemetry data may not provide a complete picture of panther activity patterns, telemetry locations are a good indicator, due to the extensive data set, of the approximate boundaries of home ranges, panther travel corridors, and the range of Florida panthers south of

the Caloosahatchee River. The FWC also uses observational data collected during telemetry flights to assess the yearly breeding activity of radio-collared panthers. Female panthers accompanied by kittens or male panthers within close proximity of an adult female were assumed to have engaged in breeding activity during that year. Documentation by McBride (Shindle et al. 2003) shows that between July 2002 and June 2003, 12-collared panthers, 4-uncollared females, and 3-uncollared males had home ranges in or home ranges that overlapped or were immediately adjacent to the same survey unit as the Terafina project. In addition, 8 other panthers that used this same survey unit previously died during this time period (Shindle et al. 2003). This unit, designated as Unit 5, includes the Florida Panther NWR, Corkscrew Swamp Sanctuary, and CREW.

Within the 25-mile radius action area, based on telemetry data as of January 2007, at least 27 living radio-collared panthers have overlapping home ranges. These panthers are FP 48 (female), FP 54 (male), FP 57 (female), FP 60 (male), FP 62 (male), FP 65 (male), FP 66 (female), FP 75 (female), FP 83 (female), FP 100 (female), FP 107 (female), FP 110 (female), FP 113 (male), FP 119 (male), FP 130 (male), FP 131 (male), FP 133 (male), FP 135 (male), FP 137 (male) and FP 139 (male), FP 140 (female), FP 141 (male), FP 143 (male), FP 144 (male), FP 146 (male), FP 147 (male), and FP 148 (female). In addition, McBride (2003) notes previous use of the action area by other panthers prior to their mortality. Six of these panthers are likely dispersing sub-adult males or sub-adult females without established territories. The nearest telemetry point to the site of a panther still alive as of this document, was FP 66 (female), recorded about 4 miles to the east. FP 92 (male) was documented less than 0.1 mile from the project site in July 2001; however, he died of unknown causes in September of that same year. Historically, there have been a total of six radio-collared male and female panthers (FP 28, FP 64, FP 66 FP 92, FP 99, FP 104, and TX 101) recorded within 5 miles of the project site on 80 occasions based on telemetry data from February 1981 through June 30, 2006 (Figure 13). This translates to an average of 4.7 occurrences per year or one occurrence every 78 days. Panther 28 was documented 6 times in 1989 and died in 1992 from intraspecific aggression. Panther 64 was documented 8 times in 1998 and died in 1999 from intraspecific aggression. Panther 66 was documented 4 times and is alive with a home range in Belle Meade and FPNWR. Panther 92 was documented 19 times in 2001 and died in 2001 from unknown causes. Panther 99 was documented 37 times from 2001 to 2002 and died in 2002 from a vehicle collision. Panther 104 was documented 1 time in 2002 and died in 2006 from an infection. Texas puma 101 was documented 5 times in 1995 and died of unknown causes in 2000. No other radio-collared panthers have been documented within 5 miles of the project site since November 2002. The status and activities of uncollared Florida panthers within the action area are unknown. However, the Service believes the project site may occasionally be used by other non-collared panthers because it contains habitat types used by panthers and their prey, and the project vicinity has been used historically by panthers as indicated by telemetry locations.

Past and ongoing Federal and State actions affecting panther habitat in the action area include the issuance of Corps permits and State of Florida Environmental Resource Permits authorizing the filling of wetlands for development projects and other purposes. Since 1982, the Corps and the State have had a joint wetland permit application process, where all permit applications submitted to the State are copied to the Corps and vice versa. Within the 25-mile action area, the Service, since January 14, 1992, has formally consulted on 58 projects and informally consulted

on 11 projects regarding the panther that were a result of Federal actions (database entries for formal consultations prior to 1992 are incomplete for projects in the action area) (Table 2). These projects have impacted or are expected to impact about 40,636 acres of panther habitat. These projects have also incorporated a total of 30,454 acres of preservation and restoration of panther habitat. The impacted lands generally are: (1) on the western fringe of occupied panther habitat; (2) vegetated with dense stands of exotic species, which may adversely affect the density of the panther prey base; and/or (3) support agricultural enterprises, *i.e.*, row crops, citrus, etc., which provide a lower quality habitat value to the Florida panther. The preserved lands, which are generally proximate to larger tracts of Federal, State, and other preserves, provide a higher quality habitat value for the Florida panther. The Service determined in the biological opinions issued for these 58 Federal actions requiring formal consultation, that individually and cumulatively these projects do not jeopardize the survival and recovery of the Florida panther.

In addition, the Service within the last 5 years has formally consulted on 3 projects within the same watershed as the Terafina project. The Service issued a biological opinion for the Bonita Beach Road project on October 6, 2003, a revised biological opinion for the Mirasol project on May 3, 2007, and is currently preparing a revised biological opinion for the Parklands project. The Service concluded in the biological opinions for the Bonita Beach Road and the Mirasol projects that as proposed these projects do not jeopardize the survival and recovery of the Panther.

Consultations within the Terafina Project Watershed

						Habitat Impacts	Habitat Preserved
BO	10/06/03	4-1-02-F-0027	200102043	Bonita Beach Road Development	L	1,117	785
BO	09/08/05	4-1-04-F-5260	200106580	Parklands Collier	C	489	591
BO	05/03/07	4-1-01-F-607	200001926	Mirasol	C	773	1,122
				Total		2,379	2,498

From July 2000 through September 2006, the Service also engaged in informal consultation for projects under 5 acres with the Corps for about 757 projects affecting about 764.1 acres in Collier County (primarily Northern Golden Gate Estates) and about 202.8 acres in Lee County (primarily Lehigh Acres) (database entries for informal consultations prior to 2000 are incomplete for projects in the consultation area). Almost all of these projects involved the construction of single-family residences in partially developed areas, each in most cases involving less than an acre of direct impact. Although panthers have been known to cross these areas to other parts of their range, prey base and denning utilization of these areas have been affected by the level of development and the additions of these residences is not expected to significantly further impact these habitat functions. For these actions, the Service concurred with the Corps' determination of "may affect, but is not likely to adversely affect" for these individual projects. These projects have been incorporated into the Service's environmental baseline for the Florida panther.

We have received information that within the action area, the Corps has, between March 2004, and September 2006, issued non-jurisdictional wetland determinations (isolated wetlands) for 27 projects totaling 252.2 acres. These determinations were issued per jurisdictional guidance provided recently in the Supreme Court decision, *Solid Waste Agency of Northern Cook County vs. U.S. Army Corps of Engineers,* 531 U.S. 159 (2001) and, therefore, they will not require a Federal Clean Water Act 404 wetland permit. These projects have been incorporated in the Service's environmental baseline for the Florida panther in this biological opinion and the Service has determined, based on the location of these projects (generally in the western fringe of the panther's geographic range), the quality of the habitat present on these project sites, and the overall status of the Florida panther, these projects individually and cumulatively do not jeopardize the survival and recovery of the Florida panther. However, since loss of panther foraging habitat may occur from construction of these projects and no Corps wetland permit is required, the Service is requesting the applicants pursue Habitat Conservation Plans in cooperation with the Service.

There have been 58 documented panther-vehicle collisions within the 25-mile action area (see Table 9 and Figure 10). The panther-vehicle collision closest to the project site (FP 99 [male]) occurred in 2002, on CR 846, about 7 miles east of the site. Another panther, UCFP 79 (female), was killed about 0.2 mile north of the FP 99 mortality on the same road in 2006. Four panther-vehicle collisions have occurred in the action area in 2006. One occurred 8 miles east of the project on CR 846; one occurred 17 miles south of the project on US 41; and, two occurred 11 miles and 25 miles north of the project on Corkscrew Road and I-75, respectively. Five panther-vehicle collisions have also occurred in the action area in 2007. Two panther-vehicle collisions occurred 11 miles north of the project on Corkscrew Road: one occurred on I-75 11 miles south; one 19 miles north on SR 82; and one 22 miles east on SR 29.

Activities within the action area have also benefited panthers. The issuance of Corps and State of Florida Environmental Resource Permits has preserved 30,454 acres of high quality panther habitat for permitted impacts to 40,636 acres of poor quality panther habitat (1992 to present). Installation of wildlife crossings under SR 29 and I-75 within the action area has also benefited the panther by protecting habitat connectivity and eliminating panther-vehicle collision mortalities. Additional benefits have resulted from the acquisition of high quality habitat through acquisition programs by the other Federal, State, and County resource agencies. Table 10 provides a summary of the State and County acquisitions within the last 5 years.

Moreover, the management of public lands, including prescribed fire and eradication of exotic vegetation in the Picayune Strand State Forest, Fakahatchee Strand State Preserve, Florida Panther NWR, ENP, and other conservation areas, is intended to improve habitat for panther prey species, which benefits panthers within these areas.

Factors Affecting Species Environment within the Action Area

Factors that affect the species environment (positively and negatively) within the action area include, but are not limited to, the presence and construction of highways and urban development, agriculture, resource extraction, public lands management (prescribed fire, public use, exotic eradication, etc.), hydrological restoration projects, public and private land protection efforts, effects of genetic inbreeding, and genetic restoration.

Development activities may result in avoidance or limited use of remaining suitable habitat by panthers as well as habitat loss, habitat fragmentation, habitat degradation, and also an increase in risk of vehicular collision (*e.g.,* injury or death).

Public and private land management practices can have a positive, neutral, or negative effect, depending on the management goals. Land protection efforts will help to stabilize the extant population. Hunting of the panther is no longer sanctioned, although there still may be instances of intentional or unintentional shooting of individuals for various reasons.

Wildlife Value and Habitat Quality: As discussed previously in the status of the species, the Service believes the existing habitat conditions present on a site and the foraging value that a site provides to the Florida panther and panther prey species are an important parameter in assessing the importance of the project site to the Florida panther and other wildlife species. In order to assess this importance, the Service requires wildlife surveys and plant species compositions as part of the applicant's biological assessment prepared for the project.

Wildlife Value - Wildlife surveys were conducted by Collier Environmental Consultants in July through August 1997 and Passarella and Associates, Incorporated, in June 2003. Panther prey such as white-tailed deer and several species of small mammals such as raccoons, opossums, rabbits, and grey squirrels were observed by Collier Environmental Consultants. The listed species surveys performed by Passarella and Associates, Incorporated, show only the presence of the American alligator (*Alligator mississippiensis*). Turrell and Associates, Incorporated, performed tracking surveys for white-tailed deer and feral hog in January 2001, May 2001, and January 2002. Wildlife tracks observed during surveys included white-tailed deer, dog, raccoon, squirrel, and rabbit. No feral hog tracks were observed. Four sets of white-tailed deer tracks were observed during the January 2001 survey, six sets during the May 2001 survey, and three sets during the January 2002 survey. Based on these surveys, the average deer population index was calculated at 1.21, which translates to an estimated deer population of one deer per 534 acres.

Habitat Quality - As discussed previously, white-tailed deer densities and other prey species are influenced by the quality of the foraging habitat present in an area. Exotic vegetation, primarily melaleuca, has infested the majority of the site (600.11 acres) averaging greater than 50 percent of existing vegetative cover. Monotypic stands of poor quality foraging plant species and the invasion of a site by exotic plants provide lower habitat foraging values and affect the utilization by and density of foraging species. Historical vegetation on the property included a mosaic of upland and wetland habitats that provided a seasonal pattern of plant growth. However, past agricultural practices and the invasion of the habitats by the exotics, melaleuca and Brazilian pepper, have resulted in the growth of dense stands of monotypic, unpalatable plant species that provide poor quality foraging needs for resident deer populations. The adjacent on-site compensation site, with its growth of invasive exotic plant species and altered hydrology, also displays similar foraging restrictions. However, the proposed enhancements will result in a more diverse mosaic of plant species, which will provide an increased foraging value to resident deer populations. The 154 acres of lands in CREW also have similar exotic coverage and will be restored as well. The 107 acres in Hendry support low densities of exotics, which will also be removed as part of the proposed action.

Habitat Assessment Methodology Application **-** The application of the habitat assessment methodology including the base ratio, landscape multiplier, PHU determinations, and compensation recommendations, are presented below for the Terafina project and compensation areas.

Table 11 illustrates the PHU calculations for the Terafina project with impacts to 437 acres of land in the Primary Zone and compensation provided by the preservation and enhancement of about 471 acres of panther habitat (210 acres on-site, about 154 acres off-site in CREW, and about 107 acres off-site in Hendry County) in the Primary Zone. Table 11 shows the 437-acre impact area to presently support 1,780 PHUs. This value is multiplied by 2.0 to provide the base ratio compensation need, which is 3,563 PHUs. The Service had previously agreed, prior to the reinitiation of formal consultation with the Corps, that a base ratio of 2.0 would be the multiplier for recommended compensation for project functional habitat evaluations.

Since the project is located in the Primary Zone and compensation is in the Primary Zone, the base ratio PHUs are unaffected by the landscape compensation multiplier of 1.0. The proposed compensation lands consisting of about 471 acres provides 3,563 PHUs. Therefore, the Service believes the impacts associated with the habitat lost by the proposed project will be minimized by the compensation actions proposed by the applicant.

Summary of Table 11
Panther Compensation

Project Development	437 acres	Compensation PHUs Needed	3,561 PHUs
Onsite Preserve	210 acres	Compensation PHUs Available	1,377 PHUs
CREW Lands	154 acres	Compensation PHUs Available	1,317 PHUs
Hendry County	107 acres	Compensation OHUs Available	870 PHUs
Total Compensation Needed	3,561 PHUs	Total Compensation Provided	3,563 PHUs

The lands proposed for development are on the western limits of the panther's range and panther habitat value has been diminished by exotic infestation. Lands proposed for preservation are in the Primary Zone, adjacent to other natural lands, and is consistent with the Service's panther goal to strategically locate, preserve, and restore sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of the Florida panther population south of the Caloosahatchee River.

Conservation Measures **-** The beneficial effects of the project include preservation of 471 acres of Primary Zone panther habitat. Though the project will result in a net loss in number of acres of habitat available to the panther, the habitat quality provided to the Florida panther through restoration and preservation will be of higher functional value to that of the areas to be impacted, and the habitat will be protected in perpetuity. The off-site panther habitat compensation parcel and surrounding area are presently providing a diverse mosaic of native plant species, which provide foraging value to

resident deer populations. The site will be managed to prevent infestation by exotic vegetation in perpetuity. CREW is in an area where panther usage has been high historically, though fewer collared panthers have been documented using this area recently. The Hendry County lands are also in the panther Primary Zone, shows significant panther usage, and contains habitats valuable for breeding, foraging, and dispersal by the Florida panther.

EFFECTS OF THE ACTION

Florida panther

This section analyzes the direct and indirect effects of the proposed action and interrelated and independent actions on the Florida panther and Florida panther habitat.

Factors to be Considered

Residential, commercial, and industrial development projects may have a number of direct and indirect effects on the Florida panther and panther habitat. Direct impacts, which are primarily habitat based, may include: (1) the permanent loss and fragmentation of panther habitat; (2) the permanent loss and fragmentation of habitat that supports panther prey; (3) roadway improvements: (4) the loss of available habitat for foraging, breeding, and dispersing panthers; (5) a reduction in the geographic distribution of habitat for the species; (6) harassment by construction activities; and (7) habitat compensation. Indirect effects may include: (1) an increased risk of roadway mortality to panthers traversing the area due to the increase in vehicular traffic; (2) increased disturbance to panthers and panther prey in the project vicinity due to human activities (human/panther interactions); (3) the reduction in value of panther habitat adjacent to the project due to habitat fragmentation; and (4) a potential increase of intraspecific aggression between panthers due to reduction of the geographic distribution of habitat of the panther. These indirect effects are habitat based, with the exception of vehicular mortality, which could result in lethal "take." Intraspecific aggression, though habitat based, could also result in lethal "take."

This project site contains panther habitat and is located within the western portion of the geographic range of the Florida panther. The timing of construction for this project, relative to sensitive periods of the panther's lifecycle, is unknown. Panthers may be found on and adjacent to the proposed construction footprint year-round. The project will be constructed in a single, disruptive event, and result in permanent loss and alteration of a portion of the existing ground cover on the project site. The time required to complete construction of the project is not known, but it is likely that land clearing associated with the development could be undertaken in phases over several years. The disturbance associated with the project will be permanent and result in a loss of habitat currently available to the panther; however, fragmentation of habitat will not occur due to the proposed project's position in the landscape of existing development.

Analyses for Effects of the Action

The 647-acre Terafina project site currently provides habitat of various quality for the Florida panther. The project site is located in the Primary Zone (Kautz et al. 2006), and is inside of the Panther focus area as defined by the Service. The project site is located on the western fringe of occupied habitat, is adjacent to urban development, and is not located within known dispersal

corridors (FWC 2006b) between larger publicly owned managed lands. The project will result in the conversion of 437 acres of panther habitat onsite into a residential development.

Compensation for the loss of 437 acres of panther habitat will be through the protection and restoration of 154 acres within CREW and 107 acres in Hendry County of high quality panther habitat and through the protection and restoration of 210 acres of habitat on-site. The 154-acre CREW lands, the 107-acre Hendry County site and the 210-acre onsite preserve area are in Primary Zone habitat (Kautz et al. 2006). High quality panther habitat borders the 107-acre Hendry County site to the north, east, and south and borders the majority of the CREW lands. Restoration of wetlands and uplands on the 107–acre Hendry County site, 154-acre CREW lands, and the 210-acre on-site preservation area will consist of the removal of exotic vegetation. Restoration of the 107-acre Hendry County site and the 210-acre onsite preservation area will also include planting of native vegetation. The 107-acre Hendry County site and the 210-acre on-site preservation area will be protected by a conservation easement granted to the State of Florida and maintained in perpetuity. CREW is under existing control and ownership by the State of Florida.

Direct Effects

Direct effects are those effects that are caused by the proposed action, at the time of construction, are primarily habitat based, are reasonably certain to occur and include: (1) the permanent loss and fragmentation of panther habitat; (2) the permanent loss and fragmentation of habitat that supports panther prey; (3) roadway improvements: (4) the loss of available habitat for foraging, breeding, and dispersing panthers; (5) a reduction in the geographic distribution of habitat for the species; (6) harassment by construction activities; and (7) habitat compensation. The direct effects this project will have on the Florida panther within the action area are discussed below.

Permanent Loss and Fragmentation of Panther Habitat: The project will result in the loss of 437 acres of panther habitat located within the Primary Zone. The land will be converted to support a residential community. Though the habitat value of the project site to the panther is marginal, the habitat loss may adversely affect the panther by decreasing the spatial extent of lands available to the panther.

Panthers, because of their wide-ranging movements and extensive spatial requirements, are also particularly sensitive to habitat fragmentation (Harris 1984). Mac et al. (1998) defines habitat fragmentation as: "The breaking up of a habitat into unconnected patches interspersed with other habitat, which may not be inhabitable by species occupying the habitat that was broken up. The breaking up is usually by human action, as, for example, the clearing of forest or grassland for agriculture, residential development, or overland electrical lines." The reference to "unconnected patches" is a central underpinning of the definition. For panther conservation, this definition underscores the need to maintain contiguous habitat and protected habitat corridors in key locations in south Florida. Habitat fragmentation can result from road construction, urban development, and agricultural land conversions within migratory patterns of panther prey species and affect the ability of panthers to move freely throughout their home ranges. Construction of highways in wildlife habitat typically results in loss and fragmentation of habitat, traffic related mortality, and avoidance of associated human development. Roads can also result in habitat fragmentation, especially for females who are less likely to cross them (Maehr 1990).

As described above, the project site is adjacent to existing and permitted urban development and roadways and is at the extreme west edge of the Service's Panther Focus Area. The property is not located within known dispersal or connection corridors (FWC 2006b) to larger publicly owned managed lands. As a result of our analysis, we believe that fragmentation of panther habitat is not expected to result from project implementation.

Permanent Loss and Fragmentation of Habitat that Supports Panther Prey: Prey surveys documented use of the site by white-tailed deer, primary panther prey species. Exotic vegetation, primarily melaleuca, has infested the majority of the site (600.11 acres) averaging greater than 50 percent of existing vegetative cover and is of poor foraging value to these and other prey species. The project will result in the loss of about 437 acres of habitat available for use by panther prey species. It is bounded by CR 846 and existing development to the south, agricultural activity to the north, and existing and proposed development to the west. The northeast property boundary is undeveloped while the southeast boundary is adjacent to numerous small farms and out-parcels. Immediately to the east of these out-parcels is a former rock and gravel mine known as Mule Pen Quarry that has been converted into a residential development known as Heritage Bay. Although the native habitats have been degraded by high densities of exotic plants and hydrological alteration, suggesting that the foraging value of panther prey habitat is generally poor, the loss of habitat may adversely affect the panther by decreasing the spatial extent of lands available for use by panther prey. As described above however, the project site is in an area adjacent to existing and permitted urban development and roadways and is at the extreme west edge of the consultation area. The property is not located within known dispersal or connection corridors (FWC 2006b) to larger publicly owned managed lands. Therefore, as a result of our analysis, fragmentation of panther prey habitat is not expected.

Road Way Improvements: No expansion of surrounding roads will occur as part of the Terafina project. Some improvements may be necessary to enhance the existing lanes and drainage swales to meet public health and safety standards for ingress and egress of vehicles to the project development.

Loss of Available Habitat for Foraging, Breeding, and Dispersing Panthers: The site is bounded by existing or proposed residential development to the west and south, agricultural activity to the north, and provides limited use potential for the panther due to the exotic infestation and the distance from the more commonly used core lands of the panther. According to the FWC, an un-collared animal is known to frequent Bird Rookery Swamp approximately three miles northeast of the project, and a collared animal has been tracked north of Twin Eagles Golf Course approximately five miles to the east of the Project. Two living panthers, FP 146 (male) and FP 148 (female) have been documented about 8 to 9 miles south of the project on numerous occasions in 2006. Prior to that, the last animal documented within 10 miles of the project was in 2003, which was TX 106. TX 106 was last documented on January 6, 2003, and removed from the wild on January 8, 2003. Since the existing habitat quality of the site is generally poor, as it is primarily exotic-infested with limited foraging value for prey species, we believe panther usage of the site is limited; however, habitat loss may adversely affect the panther by decreasing the spatial extent of lands available to the panther for foraging, breeding, and dispersing.

Reduction in the Geographic Distribution of Habitat for the Species: The project will result in the loss of about 437 acres of non-developed land along the western edge of the Panther Focus Area. This loss represents only 0.02 percent of the 1,962,294 acres of available non-urban private lands in south Florida in the Service's panther core area of the Florida panther (Table 3). The Service believes the habitat values lost by the development will be minimized by the preservation and restoration actions proposed by the applicant. The lands proposed for development are primarily exotic-infested native communities on the western fringe of the occupied range of the Florida panther and are adjacent to existing roads, urban areas, agriculture, and mining to the south, west, north, and east, respectively. The lands proposed for preservation are consistent with the Service's panther conservation strategy to locate, preserve, and restore sets of lands containing sufficient area, access, and appropriate cover types to ensure the long-term survival of the Florida panther south of the Caloosahatchee River.

Harassment by Construction Activities: The timing of construction for this project, relative to sensitive periods of the panther's lifecycle, is unknown. However, land clearing associated with the development will be completed in phases over several years. There are no known den sites within the project boundaries and the quality and quantity of the habitat foraging base for prey species is low. Therefore, we believe panther usage of the property is limited and we do not believe project construction will result in direct panther mortality, but may result in temporary disturbance to resident or dispersing panthers.

Compensation: The applicant's proposed preservation acreage is estimated at 462 acres. The lands proposed for development are hydrologically disturbed, are invaded by exotic vegetation, are on the fringe of the currently occupied range of the Florida panther, and are adjacent to urban areas and CR 846. The lands proposed for preservation are connected to other larger tracts of preserved lands and are consistent with the Service's panther goal to locate and preserve sets of lands containing sufficient area and appropriate cover types to ensure the long-term survival of the Florida panther south of the Caloosahatchee River.

Interrelated and Interdependent Actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No interrelated or interdependent actions are expected to result from the project.

Indirect Effects

Indirect effects are those effects that result from the proposed action and are reasonably certain to occur. The indirect effects this project will have on the Florida panther within the action area are discussed below and in the assessment of functional habitat values previously discussed. They include: (1) an increased risk of roadway mortality to panthers traversing the area due to the increase in vehicular traffic; (2) increased disturbance to panthers and panther prey in the project vicinity due to human activities (human/panther interactions); (3) the reduction in value of panther habitat adjacent to the project due to habitat fragmentation; and (4) a potential increase of intraspecific aggression between panthers due to reduction of the geographic distribution of habitat of the panther.

Increased Risk of Roadway Mortality: In evaluating a project's potential to increase roadway mortality to the Florida panther, we consider the location of the project in relation to surrounding native habitats, preserved lands, and wildlife corridors that are frequently used by the Florida panther. We also consider the current configuration and traffic patterns of surrounding roadways and the projected increase and traffic patterns expected to result from the proposed action. We evaluate the habitats present on-site, their importance in providing foraging needs for the Florida panther and panther prey species, and if the site development would further restrict access to surrounding lands important to the Florida panther and panther prey species.

The project will result in minor increased vehicular traffic in the project vicinity during construction and operation. Vehicular mortality and injury data (see Table 9 and Figure 10) provided by the FWC indicate collisions with motor vehicles have been increasing since 2001 in the 25-mile radius project action area. In 2003 and 2004, there were seven documented panther-vehicle collisions per year within the project action area (Table 9). These 2 years represent the most panthers killed by vehicles in single years in the action area. Four panthers per year were killed in 2005 and 2006 and 5 were killed in 2007. Of the 58 documented collisions, 51 (88 percent) have occurred more than 10 miles away from the project site and 57 (98 percent) occurred more than 5 miles from the project site. There have been no panther-vehicle collisions closer than 5 miles from the project site.

The project will result in increased vehicular traffic in the project vicinity during construction and operation. However, vehicular mortality data (see Table 9 and Figure 10) provided by the FWC indicate that collisions with motor vehicles are not an important source of panther mortality in the project vicinity. According to traffic studies provided by GL Homes, it is estimated that Terafina will generate 1,000 new external daily trips. Terafina's access to the external roadway net work is Logan Boulevard. Logan Boulevard will provide north-south travel between Terafina and Immokalee Road. Terafina's traffic distribution is about 85 percent to the west on Immokalee Road and 15 percent to the east on Immokalee Road. Of the 15 percent trips east bound on Immokalee Road, it is anticipated that eventually 15 percent will travel south on County Road 951. Although there will be some traffic increase east of the project site, the traffic flow pattern to and from the proposed residential community will be generally to the west into urban areas and not into the more rural lands of Collier County. Considering this information and the distances from the project site to documented collisions, it is unlikely that the traffic generated by this project will significantly increase the risk of roadway related harm and harassment to panthers.

The risk to the panther from collisions with vehicles as a result of the Terafina project is difficult to quantify, the Service believes that the increase in traffic generated by the project may potentially contribute to an increase in harm and harassment of panthers in the action area. Panthers are known to use the lands within the project vicinity and four panthers were killed within the project action area in 2006. The closest mortality was on CR 846 on-quarter mile north of the Collier County Fairgrounds on November 28, 2002, about 5 miles northeast of the proposed project site. Another panther, UCFP 79, was killed in that same vicinity on January 26, 2006. The most recent collision occurred on March 30, 2007. That panther, UCFP 93, was killed about 11 miles north of the project site on I-75 about 0.5 miles north of Corkscrew Road.

Panther and Prey Disturbance (Panther/Human Interactions): Potential increases in disturbance to the Florida panther and panther prey were evaluated. As discussed previously in our assessment of fragmentation, we considered habitat quality related factors and occurrence data for the Florida panther and panther prey species. This information is also the basis of our evaluation of disturbance to the Florida panther and to panther prey species. As discussed previously, the existing habitat on the project site consists of exotic-dominated wetland and upland communities that provide low quality habitat to the Florida panther. The site is primarily disturbed pine flatwoods, mixed hardwood-pine, and cypress swamp with greater than 50 percent melaleuca coverage over 85 percent of those habitat types, and thus exhibiting limited foraging value to panther prey species. Though panthers and panther prey may occasionally use the habitats within the project area, we believe panther usage of the property is infrequent and we do not believe project construction will result in a significant increase in panther/human interactions and prey disturbance.

Habitat Fragmentation: Considering our discussion of fragmentation under Direct Effects, the project site is located on the western fringe of occupied habitat, is adjacent to existing and proposed urban development, and is not located within known dispersal corridors to larger publicly owned managed lands important to the panther; therefore, fragmentation of panther habitat is not expected to result from project implementation. The project site is located on the western fringe of the Panther Focus Area. It is surrounded by existing or proposed development and agricultural activities. Therefore, fragmentation of panther prey species habitat is not expected.

Intraspecific Aggression: Potential increases in intraspecific aggression and disturbance to the Florida panther were evaluated. As discussed previously in our assessment of fragmentation and habitat for panther and panther prey, we considered habitat quality related factors and occurrence data for the Florida panther and panther prey species as factors affecting intraspecific aggression.

Since 1987 there has been only one documented panther mortality attributed to intraspecific aggression within 10 miles of the project site. FP 64 (male) died about 9 miles northeast of the project site in March 1999. This animal was killed by an uncollared male in Audubon's Corkscrew Sanctuary. The project area, on the other hand, is surrounded by existing and approved development and is in an area that has been previously fragmented by roads and land conversion. As previously discussed, the habitats on the property provide for low quality foraging for prey, which directly affects the frequency and duration of use of the property by panthers. However, the reduction in the geographic range of habitat for dispersal and/or escape cover may contribute to a potential increased risk of harm and harassment of panthers in the action area due to intraspecific aggression.

Species Response to the Proposed Action

The proposed action will result in increased human activity and noise in the project area during construction of the project. However, since panthers are not commonly known to use lands within and adjacent to the project site, activities associated with construction of the Terafina project are not anticipated to significantly increase risk of disturbance to panthers, though some temporary disturbance may occur.

The project will result in the loss of a relatively small amount (437 acres) of potential panther habitat. According to the most current home range estimates of the Florida panther (Lotz et al. 2005), this loss represents 1.5 percent of a female panther's average home range (29,059 acres) and 0.7 percent of a male panther's average home range (62,542 acres). The project area provides mostly poor quality panther habitat and panthers are not known to commonly use the project area; however, the loss of habitat may contribute to increases in intraspecific aggression through decreasing the spatial extent of lands available to the panther for foraging, breeding, and dispersing. We anticipate any resident panthers with home ranges overlapping or in the vicinity of the project area will adjust the size and location of their ranges to account for this loss and that adjustment is anticipated to occur in concert with project construction.

Panthers are sensitive to habitat fragmentation. However, the project site is located on the western fringe of occupied habitat, is adjacent to urban development, and is not located within known dispersal corridors (FWC 2006b) between larger publicly owned managed lands. Therefore, fragmentation of panther habitat is not expected to result from project implementation.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions reasonably certain to occur in the action area considered in this biological opinion. Although future federal actions located within the action area affecting panthers are technically not linked to this project and will be considered in separate section 7 consultations, the Service notes that several projects formerly linked by the regional flow-way, which are also within same watershed, have been the subject of section 7 consultations resulting in biological opinions and have been included in the environmental baseline. These projects include Bonita Beach Road, Parklands, and Mirasol. The Service issued a biological opinion for the Bonita Beach Road project on October 6, 2003, a revised biological opinion for the Mirasol project on May 3, 2007, and is currently preparing a revised biological opinion for the Parklands project. The Service concluded in the biological opinions for the Bonita Beach Road and the Mirasol projects that as proposed these projects do not jeopardize the survival and recovery of listed species. To identify future private actions that would affect panthers and that may reasonably be certain to occur in the action area, the Service first identified the types of land alteration actions that could occur in the action area, then developed a mechanism to distinguish between those that will require future federal review and those that are not likely to be a future federal action, and thus meet the cumulative effects definition. To estimate future non-federal actions, the Service chose to identify and tabulate recent past non-federal actions and project this level of development as representative of future non-federal actions.

Within the action area, past and ongoing state and county actions affecting panther habitat include: (1) State of Florida DRI Orders (2001 to 2004); (2) Comprehensive Plan Amendments (2003 to 2004); (3) Lee and Collier County Zoning Amendments (2003 to 2004); (3) Collier County's PUDs (2001 to 2004); (4) Lee County's PUDs (2003 to April 2004); and (5) South Florida Water Management District's Environmental Resource Permits (2003 to 2004) (Figure 14). To evaluate these effects, the Service incorporated the Florida Land Use, Cover and

Forms Classification System (FLUCCS) mapping to determine properties that may be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps. To determine which of these projects would likely be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps, we identified the percentage of the project site that was classified as wetland habitat, based on the FLUCCS mapping units. The mapping units relied on by the Service included the 600 series (wetland classifications) and the 411 and 419 pine flatwood classifications (hydric pine systems). For listing purposes, properties with less than 5 percent wetlands were considered by the Service to be generally exempt from regulatory review as these quantities of wetlands could be avoided by project design.

Within the action area, based on FLUCCS mapping, about 1,094.45 acres could be expected to be subject to development without Federal permit involvement through the Clean Water Act section 404 (Table 12). This level of development represents 3.77 percent of a female panther's average home range (29,059 acres) and 1.75 percent of a male panther's average home range (62,542 acres).

State and county land alteration permits in southwest Florida not part of those actions listed above, generally included single-family residential developments within Northern Golden Gate Estates and Lehigh Acres. Vacant lands within the area of Northern Golden Gate Estates (north of I-75), also within the action area, totaled about 34,028 acres as of September 2004 (Figure 15). To evaluate these effects, the Service overlaid the plat boundaries on 2004 aerials, queried the parcel data from Collier County's Property Appraisers Office, noted lots with developments, compared those to 2003 aerials, and noted the changes. Vacant lands within the area of Northern Golden Gate Estates (north of I-75) totaled about 35,768 acres as of August 2003. The breakdown of acres for August 2003 is: (1) wetlands, about 17,572 acres; (2) uplands, about 17,990 acres; and (3) water, about 210 acres. These changes were overlain on the National Wetlands Inventory (NWI) maps for presence of wetlands. This evaluation was used to estimate the acreage of properties that may be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps. A comparison of the 2003 and 2004 data for Northern Golden Gate Estates indicates about 1,740 acres of land were converted from vacant to developed with the breakdown as: (1) wetlands, about 696 acres; and (2) uplands, about 1,740 acres.

The evaluation process provided an estimate of 417 lots totaling 1,740 acres for Northern Golden Gate Estates. Therefore, using NWI mapping for the Northern Golden Gate Estates, a total of about 1,740 acres could be expected to be subject to development in a year in these areas without Federal permit involvement. Based on historical records for wetland permits issued by the Corps for these areas, most of these projects will involve the construction of single-family residences in partially developed areas and will involve less than an acre of impact. This level of development represents 3.59 percent of a female panther's average home range (29,059 acres) and 1.67 percent of a male panther's average home range (62,542 acres).

Vacant lands within the area of Lehigh Acres, also within the action area, totaled about 34,852 acres as of April 2003 (Figure 16). The breakdown of acres is: (1) wetlands, about 1,057 acres; (2) uplands, about 33,592 acres; and (3) water, about 202 acres. A review of aerial photography and Lee County building permit data for Lehigh Acres from the 1-year period prior to April 2003,

indicates about 441 acres of land was converted from vacant to occupied, during the 1-year period. The breakdown of converted acres is estimated as: (1) wetlands, 66 acres; (2) uplands, 375 acres; and (3) water, 0 acres. Therefore, using NWI mapping, about 375 acres could be expected to be subject to development in a year in this area without Federal permit involvement.

In conclusion, the Service's cumulative effects analysis has identified about 3,209.45 acres within the action area that could be developed without Federal wetland permit involvement. This level of development, which the Service believes is representative of future non-Federal actions, is reasonably certain to occur and, therefore, meets the definition of cumulative effect. This level of projected future development represents 11 percent of a female panther's average home range (29,059 acres) and 5.13 percent of a male panther's average home range (62,542 acres), though the impacts will be scattered and generally located on the fringes of occupied panther habitat, supported primarily with disturbed vegetative communities, in row crops, or in partially developed areas. These lands represent 0.16 percent of the non-urban private lands at risk in the Service's panther core area (1,962,294 acres) (Table 3). Based on the above analysis, we believe the loss of the habitat associated with these lands, though insignificant in the short term, may adversely impact the panther as development continues to occur in the future in the action area. The Service has accounted for some habitat loss and changes in habitat quality through its habitat assessment methodology and is encouraging state and county environmental staff to pursue section 10 (HCP) process to account for and compensate for adverse effects to the Florida panther.

SUMMARY OF EFFECTS

Panther Usage: The timing of construction for this project, relative to sensitive periods of the panther's lifecycle, is unknown. However, it is likely all land clearing associated with the development will be completed in phases over several years. There are no known den sites within the project boundaries and the quality and quantity of the foraging prey base is low.

Though panthers likely use the habitats within the project's action area, we believe panther usage of the project site is infrequent and we do not believe project construction will result in direct panther mortality, but may result in temporary disturbance to resident or dispersing panthers.

Traffic: There will be traffic increases with project development. As discussed above and in previous sections, the lands on the project site provide limited value to the Florida panther and panther prey species, the site is adjacent to existing and proposed urban development, and the proposed action will further restrict suitability of the site for use by either resident or dispersing panthers. Panthers, however, are known to use the lands within the action area and collisions with motor vehicles have been increasing since 2001 in the project action area. Although the risk to the panther from collisions with vehicles as a result of the Terafina project is difficult to quantify, the Service believes that the increase in traffic generated by the project may potentially contribute to an increase in harm and harassment of panthers in the 25-mile radius action area.

Habitat Loss: The Service, based on the habitat evaluations discussed previously, believes the project will result in the direct and indirect loss of about 437 acres of mostly low quality panther habitat within the Primary Zone (see discussion under Wildlife Assessment). Habitat types are

primarily exotic-infested wetlands and other natural communities. The prevalence of exotics within the project area provides limited foraging value to panther prey species. We believe panther usage of the site is limited; however, the permanent loss is anticipated to adversely affect the panthers in the action area by decreasing the spatial extent of lands available for foraging, breeding, and dispersing. This loss of about 437 acres of panther habitat represents 0.02 percent of the 1,962,294 acres of available non-urban private lands in the Service's panther core area. This small loss (0.02 percent) of non-urban private lands on the western edge of the panther's range will not adversely affect the Service's land conservation and preservation goals.

Compensation: The project will provide for the preservation of about 546 acres of Primary Zone habitat. The functional value of the habitats to the panther will be maintained long-term through hydrological restoration and the removal of exotic vegetation. The preservation of these lands in the Service's panther core area represents 0.07 percent of the 799,205 acres of private lands still needed for the population of 90 individuals. The preservation of about 471 acres of panther habitat in the Primary Zone will minimize the impact of the loss of 437 acres lower quality habitat to the panther and will further the Service's panther conservation goal.

The proposed compensation plan, which provides habitat preservation and restoration inside and outside the project action area, benefits the survival and recovery of the Florida panther as referenced in the draft Panther Recovery Plan (Service 2006) goal 1.1.1.2.3. This goal recommends that habitat preservation and restoration within the Primary Zone be provided in situations where land use intensification can not be avoided. The applicant has proposed equivalent habitat protection and restoration, to compensate for both the quantity and functional value of the lost habitat.

Fragmentation: The project site is also located on the western edge of occupied habitat, is adjacent to other existing and proposed development, and is not located within known dispersal corridors to larger publicly owned managed lands important to the panther. Therefore, fragmentation of panther habitat is not expected to result from project implementation.

Intraspecific Aggression: Potential increases in intraspecific aggression and disturbance to the Florida panther were evaluated. The Service believes, as previously discussed, the habitat on the property provides low quality foraging for prey species, which directly affects the frequency and duration of use of the property by panthers. However, the reduction in the geographic range of habitat for dispersal and/or escape cover may contribute to a potential increased risk of harm and harassment of panthers in the action area due to intraspecific aggression.

Cumulative Analysis: In the cumulative analysis, the Service identified the potential loss of about 3,209.45 acres within the action area that could be developed without Federal wetland permit involvement and we believe this level of development represents future non-Federal actions expected to occur in the action area. This level of development represents a small percentage (0.16 percent of the 1,962,294 acres) of available non-urban private lands in the core area. In general, these lands are primarily within previously impacted areas or are in the western more urbanized portion of the Florida panther's consultation area. Although this small percentage of lands may be lost from the core area of private lands available for panther conservation, the Service believes the loss of these lands will not adversely affect the Service's land conservation and preservation goals.

Conservation Land Acquisitions: The State and County land acquisition programs acquired about 11,726 acres of lands within the action area from 2000 to 2005 (Table 10), which represents 1.47 percent of the 799,205 acres of private lands still needed for the population of 90 individuals. These lands are generally located within the core lands of the Florida panther and are intended to be actively managed for the benefit of many wildlife species including the Florida panther. The preservation of these lands in the panther core lands will have a beneficial effect on the panther and further the Service's goal in panther conservation.

CONCLUSION

In conclusion, the Service believes there will be no direct take in the form of mortality or injury of the Florida panther resulting from this project. However, the increase in traffic and potential increase in intraspecific aggression in the action area as a result of the project may potentially contribute to an increase in harm and harassment to the Florida panther. This indirect take is difficult to quantify due to the wide-ranging habit of the species and the challenge of linking the death or injury of a single panther to increases in panther interactions (intraspecific aggression) or traffic generated as a result of the Terafina project. The adverse affects of project-generated traffic and intraspecific aggression potential, however, is not anticipated to appreciably diminish or preclude the survival and recover of the panther.

The loss of habitat from implementing the project, taking into consideration the status of the species, remaining habitat, and other factors considered in this biological opinion, such as the overall recovery objectives and other cumulative effects from actions in the action area, will be minimized by the conservation of other, more functionally valuable habitat, which for this project is the preservation of about 471 acres of Primary Zone habitat (210 onsite, 154 acres in CREW, and 107 acres in Hendry County. Taking all of the above into consideration, the Service believes the proposed construction and operation of the Terafina project is not likely to jeopardize the continued existence of the Florida panther. Critical habitat has not been designated for this species; therefore, none will be affected.

ENVIRONMENTAL BASELINE

Wood stork

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions, which occur simultaneously with the consultation in progress.

Past and ongoing Federal and State actions affecting wood stork habitat in the action area include the issuance of Corps permits and State of Florida Environmental Resource Permits authorizing the filling of wetlands for development projects and other purposes. Since 1982, the Corps and the State have had a joint wetland permit application process, where all permit applications submitted to the State are copied to the Corps and vice versa. Within the wood stork action area,

the Service, since January 14, 1992, in association with formal consultations on other species within the action area has formally consulted on 5 projects and informally consulted on 50 projects regarding the wood stork with habitat affects associated with 5,354 acres of wetland losses with an associated restoration and preservation of 19,713 acres of wetlands. Formal consultations have exempted incidental take of productivity of 71 nests per year. This productivity loss was associated with the direct effects (loss) of 1,117 acres of wetlands and indirect effects (hydrological change) of 1,150 acres of wetlands. These same projects also provided for preservation and restoration of 2,681 acres of wetlands. Existing habitat functional value to wood storks, as discussed in the biological opinions for these projects, was adversely affected by varying levels of exotic species infestations. A similar habitat adversity was also present in the conservation lands, although remediated following project implementation. The Service determined in the biological opinions issued for these 5 projects that individually and cumulatively these projects do not jeopardize the survival and recovery of the wood stork.

Formal Consultations on Projects within the Action Area

						Direct	Indirect	Conserved	Nest Take
BO	10/06/03	4-1-02-F-0027	200102043	Bonita Beach Road Development	L	99	1,500	531	50
BO	12/29/03	4-1-02-F-1743	200202926	The Forum - Saratoga Investments	L	137	-	600	14
BO	02/23/04	4-1-02-F-015	200105926	Cypress Run	C	28	-	25	1
BO	09/08/05	4-1-04-F-5260	200106580	Parklands Collier	C	208	-	524	5
BO	03/03/07	4-1-01-F-607	200001926	Mirasol	C	645	-	1,001	1
				Total		1,117	1,500	2,681	71

From July 2000 through September 2006, the Service also engaged in informal consultation for projects under 5 acres with the Corps for about 757 projects affecting about 764.1 acres in Collier County (primarily Northern Golden Gate Estates) and about 202.8 acres in Lee County (primarily Lehigh Acres) (database entries for informal consultations prior to 2000 are incomplete for projects in the consultation area), with varying amounts of wetland impacts ranging from less that 0.1 acre to 5 acres. Almost all of these projects involved the construction of single-family residences in partially developed areas. As discussed above, existing habitat functional value to wood storks was adversely affected by varying levels of exotic species infestations. Generally for project wetland impacts greater than 0.1 acre, habitat compensation is required by the Corps that functionally replaces the wetland habitat value lost from the project impact. For these actions, the Service concurred with the Corps' determinations of "may affect, but is not likely to adversely affect" for these individual projects. These projects have been incorporated into the Service's environmental baseline for the wood stork. See also, Table 23: Terafina Consultation Area Project List – Wood Storks.

We have received information that within the action area the Corps has, between March 2004, and September 2006, issued non-jurisdictional wetland determinations (isolated wetlands) for 27 projects totaling 252.2 acres. These determinations were issued per jurisdictional guidance provided recently in the Supreme Court decision, *Solid Waste Agency of Northern Cook County vs. U.S. Army Corps of Engineers,* 531 U.S. 159 (2001) and, therefore, they will not require a Federal Clean Water Act 404 wetland permit. These projects have been incorporated in the Service's environmental baseline for the wood stork in this biological opinion and the Service has determined, based on the location of these projects generally adjacent to urban development, the quality of the habitat present on these project sites, and the overall status of the wood stork, these projects individually and cumulatively do not jeopardize the survival and recovery of the wood stork.

Activities within the action area have also benefited wood storks. The issuance of Corps and State of Florida Environmental Resource Permits has preserved 19,713 acres of high quality wood stork habitat for permitted impacts to 5,354 acres of poorer quality wood stork habitat (1992 to present). Additional benefits have resulted from the acquisition of high quality habitat through acquisition programs by the other Federal, State, and County resource agencies. Table 10 provides a summary of the State and County acquisitions within the last 5 years, many of which include substantial acres of wetlands.

Moreover, the management of public lands, including prescribed fire and eradication of exotic vegetation in the Picayune Strand State Forest, Fakahatchee Strand State Preserve, Florida Panther NWR, ENP, and other conservation areas, is intended to improve wetland and upland habitats that also benefit wood storks.

The project area is 646.55 acres and consists of 557.14 acres of wetlands and 89.41 acres of uplands. The proposed development footprint is 437 acres, which includes a developed area of 363 acres and internal preserves of 75 acres. The 363 acre developed area includes 295.67 acres of wetlands and 67.33 acres of uplands. The internal preserves include 51.47 acres of wetlands and 23.53 acres of uplands. The applicant is also proposing an additional wetland preserve of 210 acres adjacent to the development footprint. Total on-site wetland preserve is 261.47 acres. The applicant is also providing an additional 60.33 acres of wetland preserve within the 107 acres Hendry County site. In summary, total wood stork habitat loss is 295.67 acres and total wood stork habitat enhancement and preservation is 321.80 acres. While not included in the calculation of wood stork mitigation, it is expected that the purchase and restoration of 154 acres within CREW will have an additional long-term benefit for the species.

Existing Project Area Habitat Conditions

The analysis of existing habitats expected to be impacted by the proposed project is based on vegetation mapping conducted by Passarella and Associates in their FLUCCS mapping. The prevalent community type, although historically classified as pine and pine/cypress flatwoods is primarily a community dominated by the exotic forest species, melaleuca. In most vegetated communities recently surveyed by the Service during field visits into these types of habitats, the communities were classified as primarily a closed canopy forest, with an understory, when one

was present, of remnant herbaceous graminoid species. Melaleuca expansion into native habitat and density increases in previously invaded habitat have increased substantially from 1972 through 2006 as seen in aerial photographs over this time frame. It is expected melaleuca invasion and density increases over the project area would increase without the eradication efforts proposed by the project.

Status of the Species within the Action Area

As stated previously, the Service has determined, for the purposes of this biological opinion, the action area is considered to include the project site and the CFAs of the three wood stork nesting colonies described previously (Figure 7). The action area for both direct and indirect effects encompasses 1,621.1 square miles of Collier, Lee, and Hendry Counties, Florida. The proposed action may have direct and indirect effects on the ability of wood storks to breed, feed, and find shelter within the action area.

Nesting in the Action Area

A census of the wood storks currently using the action area has not been conducted. However, three active nesting colonies are known to occur within the action area. Two of these colonies are located within Corkscrew, approximately 5.5 miles and 6.6 miles northeast of the project site. The third wood stork nesting colony is located approximately 16.5 miles east of the project site, just north of the Fakahatchee Strand State Preserve. Wood stork nest surveys have been conducted annually at these nesting colonies through aerial surveys (Meyer and Frederick 2004) and ground-based monitoring of stork numbers and reproductive success (J. Lauritsen, Corkscrew, personal communication, 2004). Data for the two colonies located in Corkscrew indicate 900 nests in 1999, 1,722 nests in 2000, no nest in 2001, 1,240 nests in 2002, 1,100 nests in 2003, and 520 nests in 2004. In 2005, birds attempted to nest but most nests were ultimately abandoned. In 2006, 800 pairs nested and 1,550 birds fledged with an average of 1.9 fledglings per nest (Lauritsen 2006). Additional data collected by the National Audubon Society indicate 2,538 wood storks fledged during 2000 and 3,160 fledged during 2002. In 2003 and 2004, 780 and 450 young were fledged, respectively (Audubon 2004). On average over the last 44 years, 1,654 nests are initiated yearly, producing an average of 2,161 fledged young, or 1.3 young fledged per nest. However, the 44-year average is somewhat misleading. Prior to 1968, as many as 5,000 wood stork nests were initiated annually. Nesting activity peaked in 1961 when 6,000 nests were initially producing a record 17,000 young fledged, or 2.8 fledged young per nest.

The production of wood stork colonies varies considerably between years and locations, apparently in response to differences in food availability; colonies limited by food resources may fledge an average of 0.5 to 1.0 young per active nest; colonies not limited by food resources may fledge between 2.0 and 3.0 young per active nest (Ogden 1996). The 44-year average indicates, at least for the two colonies at Corkscrew, these colonies are generally limited by food resources. During the year 2002, these colonies were not limited by food resources. No data on nest productivity is available for the colony north of Fakahatchee Strand State Preserve; however, based on the overlapping CFAs, it is likely these birds face many of the same foraging conditions as the storks nesting within Corkscrew.

Historical data on colony locations identifies the Everglades basin colonies and the Corkscrew colonies as the primary nesting locations for wood storks in south Florida (Ogden and Nesbitt 1979). In the late 1950s and early 1960s, the Corkscrew colonies accounted for 51 percent of the Florida population, and supported approximately 6,000 nesting pairs (Jason Lauritsen, Corkscrew, personal communication, 2002). Survey data collected between 1991 and 1995 indicate the Corkscrew colonies represent approximately 12 percent of the Florida population of nesting storks and this is consistently one of the largest nesting colonies in Florida. The original listing recognized the relationship between the declining wood stork population, the loss of suitable foraging habitat, and colony nesting failures, particularly in the breeding colonies in south Florida where human actions had reduced wetland areas by about 35 percent (Ogden and Nesbitt 1979). Although the Corkscrew colonies currently account for 12 percent of the Florida nesting population, these colonies continue to occasionally produce large numbers of young in south Florida (Service 1999). The acquisition and preservation of these colonies' habitat, and recovery of more natural hydropatterns within the foraging grounds surrounding these colonies, are recognized as critical to the recovery of wood storks in south Florida (Service 1997; 1999).

Historic and Current Patterns of Wood Storks in the Project Footprint

Although no site-specific wood stork presence or foraging prey base studies were conducted within the project footprint, such studies were conducted on an adjacent project site (Turrell 2003). As referenced in the Services biological opinion for the Mirasol project dated May 3, 2007, (Service 2007) ongoing wildlife surveys have been conducted and documented by Turrell. During the survey periods wood storks have been observed perching on cypress and slash pine trees along the Cocohatchee Canal. Wood storks have also been documented foraging along the canal where water flows over an armored shoreline approximately 0.5 mile to the east of the Terafina property. Foraging has also been documented within an open pasture area immediately to the east of the property. No foraging has been documented on the property; however, wood storks were documented by Audubon of Florida foraging in wetlands at the adjacent Mirasol property on several occasions from late September through December 2006 (Jason Lauritsen, email communication, January 5, 2007).

Factors Affecting Species Environment within the Action Area

The wood stork is known to forage within suitable wetland habitats located throughout the 1,621 square mile action area. Suitable wood stork foraging habitat consists of shallow wetlands with water depths of 2 to 15 inches. Data obtained from the NWI indicate approximately 473,462 acres of wetlands containing potentially suitable habitat for wood stork foraging occur within the action area (Figure 7). However, the inventory was last updated in 1984 and increasing development in Lee, Collier, and Hendry Counties has impacted some of these potential foraging areas. In order to provide a more accurate accounting of the wetlands within the core foraging areas of the three wood stork colonies, the Service used both the NWI and the FLUCCS maps. The specific step-by-step analysis used is referenced below.

The District maps are based on Florida Land Use Codes and Forms Classification System (FLUCCS) codes, which is a different land use classification than that used in the NWIs.

Corresponding NWI and wetland FLUCCS codes that provide overlapping wetland categories are the 500 and 600 series FLUCCS codes. However, there are several FLUCCS codes in the 200 and 400 categories that could be either upland or wetland. For instance, the majority of the subject property on the District maps is depicted as 4119 (pine flatwood [an upland FLUCCS code designation]). U.S. Army Corps of Engineers (Corps) approved jurisdictional information on these types of habitats in the action area shows the majority of these properties as being hydric pine flatwoods and are considered wetlands although not classified as such by the FLUCCS codes. The District maps also do not allow for wetland determinations on agricultural activities, such as pastures (200 series). For this reason, our analysis used both sets of maps. Specifically, we used the 1984 NWI map as the base map and overlaid the District maps. We eliminated the NWI wetlands areas that the District maps depicted as developed. Those areas indicated on the District map as passive agricultural (such as pasture and fallow lands) that were also shown to be wetlands on the 1984 NWI maps were left in and counted as wetlands for purposes of this analysis. We also included those lands with a FLUCCS code of 4119 (hydric pine flatwoods) as wetlands in our analysis.

As discussed previously, wood stork habitat quality can be adversely affected by the level of exotic species infestation within these systems. Mechanism of control of exotic plant species invasion primarily consist of mechanical removal of these plants and in some instances hydrological changes in wetland hydroperiods that benefit the recruitment of desirable native species. Recent trial studies have also been undertaken that rely on biological controls to regulate the recruitment and survival of these exotic plant species in the environment. The most promising proposal is the use of the cur-culionid weevil, *Oxyops vitiosa,* as a natural enemy of the exotic melaleuca plant, ***M. quinquenervia***. This weevil and its larvae form have been shown to feed aggressively on leaf foliage. Studies have shown that this aggressive feeding produces a corresponding response from the plant with an increase in growth tissue production and a substantial decrease in seed reproduction (Pratt et al. 2005). The authors state in their evaluation "Although herbivory by *O. vitiosa* can clearly reduce fruit and seed production of its host, it remains unclear how these impacts alter *M. quinquenervia's* abundance and invasion potential. The lack of a long-lived soil seed bank (≈ 2 years), however makes *M. quinquenervia* particular vulnerable to herbivore-mediated reduction in fitness and delays in reproductive maturation. As canopy held seed banks continue to diminish over time, reproductive suppression is predicted to have direct, long-term effects on recruitment, invasion potential, and abundance." Additional studies are being proposed that evaluate this demographic transition and quantify the effects of herbivory in the context of the entire plant life cycle and its ability to expand or diminish over time.

Foraging Habitat

Researchers have shown wood storks forage most efficiently and effectively in habitats where prey densities are high, and the water shallow and canopy open enough to hunt successfully (Ogden et al. 1978; Browder 1984; Coulter 1987). Prey availability to wood storks is dependent on a composite variable consisting of density (number or biomass/m^2) and the vulnerability of the prey items to capture (Gawlik 2002). For wood storks, prey vulnerability appears to be largely controlled by physical access to the foraging site, water depth, the density of submerged vegetation, and the species-specific characteristics of the prey. For example, fish populations

may be very dense, but not available (vulnerable) because the water depth is too great (>30 cm) for storks or the tree canopy at the site is too dense for storks to land. Calm water, about 5 to 40 cm (2 to 16 in) in depth, and free of dense aquatic vegetation is ideal (Coulter and Bryan 1993).

Coulter and Bryan's (1993) study suggested wood storks preferred ponds and marshes, and visited areas with little or no canopy more frequently. Even in foraging sites in swamps, the canopy tended to be sparse. They suggested open canopies may have contributed to detection of the sites and more importantly may have allowed the storks to negotiate landing more easily than at closed-canopy sites. In their study the median amount of canopy cover where wood stork foraging was observed was 32 percent. Other researchers (Frederick, personnel communication, 2006 and Rodgers, personnel communication, 2006) also confirm wood storks will forage in woodlands, though the woodlands have to be fairly open and vegetation not very dense. Furthermore, the canopies must be open enough for wood storks to quickly take flight to avoid predators. In south Florida, they agree wood storks will forage in melaleuca-dominated wetlands when the trees are noncontinuous, in broken stands (blowdowns), in small islands, or sparsely distributed. They will not forage in melaleuca where the stem density is high and the canopy closed (Frederick, personnel communication, 2006).

Melaleuca-infested Wetlands

As discussed previously, wetland suitability for wood stork foraging is partially dependent on vegetation density. Melaleuca is a dense-stand growth plant species, effectively producing a closed canopy and dense understory growth pattern that generally limits a site's accessibility to foraging by wading birds. However, O'Hare and Dalrymple (1997) suggest moderate infestations of melaleuca may have little effect on some species' productivity (*i.e.*, amphibians and reptiles) as long as critical abiotic factors such as hydrology remain. They also note as the levels of infestation increase, usage by wetland dependent species decreases. Their studies also show the number of fish species present in a wetland system remain stable at certain levels of melaleuca. However, the availability of the prey base for wood storks and other foraging wading birds is reduced by the restriction of access caused from dense and thick exotic vegetation. Wood storks and other wading birds can forage in these systems in open area pockets (*e.g.*, wind blow-downs), provide multiple conditions are optimal (*e.g.*, water depth, prey density). In O'Hare and Dalrmyple's study (1997), they identify five cover types and provide information on the number of wading bird species and the number of individuals observed within each of these vegetation classes.

Their vegetation classes are:

DMM:	75 to 100 percent mature dense melaleuca coverage
DMS:	75 to 100 percent sapling dense melaleuca coverage
P75:	50 to 75 percent melaleuca coverage
P50:	0 to 50 percent melaleuca coverage
MAR (Marsh):	0 to 10 percent coverage

The number of wading bird (wetland-dependent) species and individuals observed per cover type is shown below in columns 1, 2, and 3. To develop an estimate of the importance a particular wetland type may have (based on density and aerial coverage by exotic species) to wetland

dependent species, we developed a foraging suitability value using observational data from O'Hare and Dalrymple (1997). The Foraging Suitability Value as shown in column 5 (Table 13) is calculated by multiplying the number of species by the number of individuals and dividing this value by the maximum number of species and individuals combined (12*132=1584). The results are shown below for each of the cover types in O'Hare and Dalrymple (1997) study. As an example for the P50 cover type the foraging suitability is calculated by multiplying 11 species times' 92 individuals for a total of 1,012. Divide this value by 1,584, which is the maximum number of species time the maximum number of individuals (12*132 = 1,584) and the resultant is 0.6389 or 64 percent (11*92=1012/1584*100=63.89).

Cover Type	# of Species(S)	# of Individuals (I)	S*I	Foraging Suitability
DMM	1	2	2	0
DMS	4	10	40	3
P75	10	59	590	37
P50	11	92	1012	64
MAR	12	132	1584	100

This approach was developed to provide us with a method of assessing wetland acreages and their relationship to prey densities and prey availability. We consider wading bird use to be a general index of food availability. Based on this assessment we developed the following index:

Exotic Percentage	Foraging Suitability (Percent)
Between 0 and 25 percent exotics	100
Between 25 and 50 percent exotics	64
Between 50 and 75 percent exotics	37
Between 75 and 90 percent exotics	3
Between 90 and 100 percent exotics	0

In our assessment however, we consider DMM to represent all exotic species densities between 90 and 100 percent and DMS to represent all exotic species densities between 75 and 90 percent. In our evaluation of a habitat's suitability, the field distinction between an exotic coverage of 90 percent and 100 percent in many situations is not definable, therefore unless otherwise noted in the field reports and in our analysis; we consider a suitability value of 3 percent to represent both system profiles.

Exotic Species in the Project Footprint

The prevalent community type, although historically classified as pine and pine/cypress flatwoods is primarily a community dominated by the exotic forest species, melaleuca. In most vegetated communities, the community was classified as primarily a closed canopy forest, with an understory, when one was present, of remnant herbaceous graminoid species.

As discussed previously, melaleuca expansion into native habitat and density increases within previously invaded habitat have increased substantially from 1972 through 2006 as seen in aerial photographs over this time frame. It is expected that melaleuca invasion and density increases over the project area would increase without the eradication efforts proposed by the project.

Table 14 provides a summary of all upland and wetland acreages within the project development footprint. However, since most upland land uses and wetlands with dense melaleuca coverage provide minimal foraging value to wood storks, Table 15 provides the suitable wetland habitat types within the project development footprint evaluated by the Service. A summary of the information from Tables 14 and 15 shows that about 295.67 acres of wetland cover types out of the project development footprint of 347.14 acres will be adversely affected. As discussed previously, since cover type habitat distinctions between 90 percent and 100 percent exotics were not provided, all wetland cover types, even those with greater than 90 percent exotics are considered suitable for wood stork foraging although with a variance in functional value depending on the density of melaleuca.

Exotic Species in the Terafina Action Area

As discussed previously, the Terafina action area is in the overlapping core foraging areas of the three adjacent wood stork colonies. These colonies are:

- #619310 (CORK1) in Corkscrew Swamp Sanctuary, with approximately 285,286 acres of wetland cover types;
- #619018 (CORK2) also in Corkscrew Swamp Sanctuary, with approximately 292,149 acres of wetland cover types; and
- #619161 (CATH) (North Catherine Island) approximately 16.5 miles east-southeast of the project site, with approximately 394,040 acres of wetland cover types.

With overlap, all three colonies encompass approximately 481,666 acres of wetland cover types.

Based on aerial surveys and site inspections by Service personnel of wetland systems throughout the action area, we estimated that about 10 percent of the total CFA could have dense melaleuca coverage and would not be suitable for wood stork foraging. However, since no methods are available to determine the locations of these systems, the Service is considering all wetland cover types, even those with greater than 90 percent exotics suitable for wood stork foraging although with a variance in functional value depending on the density of melaleuca.

Fish Prey Density per Hydroperiod

Prey densities can be affected by the density and types of vegetation present in a wetland and by the hydroperiod of the wetland. In the O'Hare and Dalrymple (1997) study, the authors suggest that moderate infestations of melaleuca may have little effect on some species' productivity as long as critical abiotic factors such as hydrology remain, although dense melaleuca (greater than 75 percent canopy densities) do show a gradual reduction in prey bases. However, fish densities do vary with duration of hydroperiod and can have a significant effect on wood stork foraging and nest productivity. For instance, research on Everglades fish populations using a variety of quantitative sampling techniques (pull traps, throw traps, block nets) have shown that the density of small forage fish increases with hydroperiod: marshes inundated for <120 days average ± 4 fish/m^2; whereas those flooded for >340 days of the year average ± 25 fish/m^2 (Loftus and Eklund 1994; Trexler et al. 2002).

The Service (1999) described a short hydroperiod wetland as wetlands with between 0 and 180-day inundation, and long hydroperiod wetlands as greater than 180-day inundation. However, Trexler et al. (2002) defined short hydroperiod wetlands as systems with less than 300 days per year inundation. In our discussion of hydroperiods in this biological opinion, we are considering short hydroperiod wetlands to be those that have an inundation of 180 days or fewer.

The most current information on hydroperiods in the action area was developed by the District for evaluation of various restoration projects throughout the Everglades Protection Area. In their modeling efforts, they identified seven hydroperiods:

- Class 1 (0-60 days inundation)
- Class 2 (60-120 days inundation)
- Class 3 (120-180 days inundation)
- Class 4 (180-240 days inundation)
- Class 5 (240-300 days inundation)
- Class 6 (300-330 days inundation)
- Class 7 (330-365 days inundation)

Trexler et al. (2002) in studies in the Everglades provided densities, as the square-root of the number of fish per square-meter for only six hydroperiods, although covering the same range of hydroperiods developed by the District. Trexler et al.'s (2002) hydroperiods and square-root fish densities are:

	Density		**Density**
• Class 1 (0-120 days inundation)	= 2.0	• Class 4 (240-300 days inundation)	= 4.5
• Class 2 (120-180 days inundation)	= 3.0	• Class 5 (300-330 days inundation)	= 4.8
• Class 3 (180-240 days inundation)	= 4.0	• Class 6 (330-365 days inundation)	= 5.0

Trexler et al. (2002) fish densities are provide as the square-root of the number of fish per square-meter. For our assessment, we squared these numbers to provide fish per square-meter, a simpler calculation when other prey density factors are included in our evaluation of adverse effects to listed species from the proposed action and also extrapolated the densities over seven hydroperiods, which is the District's number. For example Trexler's et al. (2002) square-root density of a class 2 wetland with 3 fish would equate to a District model class 3 wetland with 9 fish.

Based on the above discussion, the following mean annual fish densities were extrapolated to the seven District Model hydroperiods:

- Class 1 (0-60 days) = 2 fish/m^2
- Class 2 (60-120 days) = 4 fish/m^2
- Class 3 (120-180 days) = 9 fish/m^2
- Class 4 (180-240 days) =16 fish/m^2
- Class 5 (240-300 days) = 20 fish/m^2
- Class 6 (300-330 days) = 23 fish/m^2
- Class 7 (330-365 days) = 25 fish/m^2

Fish Biomass per Hydroperiod

However, a more important parameter than fish per square-meter in defining fish densities is the biomass these fish provide. In the ENP and WCA-3 studies by Turner et al. (1999) and Trexler et al. (2002), the standing stock (biomass) of large and small fishes combined in unenriched

Class 5 and 6 hydroperiod wetlands averaged between 5.5-6.5 g wet mass/m^2. However, in short hydroperiod wet prairies in Corkscrew Swamp biomass values were estimated between 2 to 2.5 g wet mass/m^2 (wet mass represents between 2 and 2.5 times dry mass [Kushlan et al. 1986]). A value of 0.5 g dry mass/m^2 was reported by Turner et al. (1999) for Carlson and Duever (1979) wet prairies in Corkscrew Swamp. Relating this information to the hydroperiod classes developed by the District, we estimated the mean annual biomass densities per hydroperiod. For our assessment, we considered Class 7 hydroperiod wetlands based on Turner et al. (1999) and Trexler et al. (2002) studies to have a mean annual biomass of 6.5 g wet mass/m^2. The remaining biomass weights were determined as a direct proportion of the number of fish per total weight of fish for a Class 7 hydroperiod (6.5 grams divided by 25 fish equals 0.26 grams per fish).

For example, a class 3 wetland has 9 fish and with an average weight of 0.26 grams per fish, the biomass of a class 3 wetland would be 2.3 grams (9*0.26=2.3). Based on the above discussion, the biomass per hydroperiod class is:

- Class 1 (0-60 days) = 0.5 grams/m^2
- Class 2 (60-120 days) = 1.0 grams/m^2
- Class 3 (120-180 days) = 2.3 grams/m^2
- Class 4 (180-240 days) = 4.2 grams/m^2
- Class 5 (240-300 days) = 5.2 grams/m^2
- Class 6 (300-330 days) = 6.0 grams/m^2
- Class 7 (330-365 days) = 6.5 grams/m^2

Wood Stork Suitable Prey Size per Hydroperiod

Wood storks are highly selective in their feeding habits and in studies on fish consumed by wood storks, primarily sunfish and four other species of fish comprised over 85 percent of the number and 84 percent of the biomass of over 3,000 prey items collected from adult and nestling wood storks (Ogden et al. 1976). Ogden et al. (1976, 1978) noted that the key species consumed by wood storks included:

Sunfishes (*Centrarchidae*; 14 percent of individuals, 44 percent of biomass);
Yellow Bullhead (*Italurus natalis*; 2 percent of individuals, 12 percent of biomass);
Marsh killfish (*Fundulus confluentus*; 18 percent of individuals, 11 percent of biomass);
Flagfish (*Jordenella floridae*, 32 percent of individuals, 7 percent of biomass);
Sailfin Molly (*Poecilia latipinna*, 20 percent of individuals, 11 percent of biomass).

These species were also observed to be consumed in much greater proportions than they occur at feeding sites, and abundant smaller species (*e.g.*, mosquitofish, least killfish, bluefin killfish) are under-represented, which the researchers believed was probably because their small size does not elicit a bill-snapping reflex in these tactile feeders (Coulter et al. 1999). Their studies also showed that in addition to selecting larger species of fish, wood storks consumed individuals that are significantly larger (>3.5 cm) than the mean size available (2.5 cm), and many were greater than one-year old (Ogden et al. 1976; Coulter et al. 1999). Ogden et al.'s (1976 – Figure 4) also shows that wood storks also generally consumed fish that were between 1.5 and 9.0 cm in length.

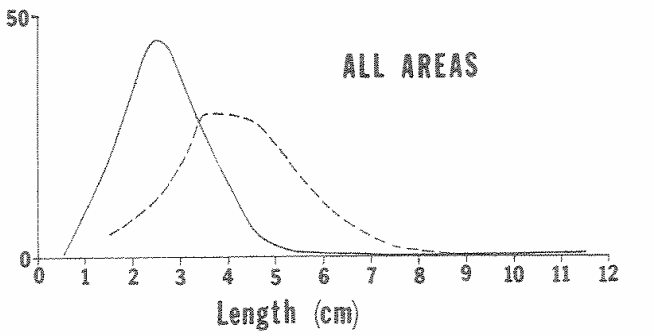

FIGURE 4. Length frequency distribution of fish available to and consumed by Wood Storks in different habitats.

In Ogden et al.'s (1979) Figure 4, the dotted line is the distribution of fish consumed and the solid line is the available fish. Straight interpretation of the area under the dotted line curve represents the size classes of fish likely consumed by wood storks and is the basis of our determination of the amount of biomass that is within the size range of fish most likely consumed by wood storks, which in this example is a range size of 1.5 and 9.0 cm in length.

Fish Biomass Available for Wood Stork Consumption

To estimate that fraction of the available fish biomass that potentially might be consumed by wood storks, the following analysis was conducted. Trexler et al.'s (2002) 2-year throw-trap of absolute and relative fish abundance distributed across 20 study sites in the ENP and the WCAs was assumed to be representative of the Everglades fish assemblage available to wood storks (n = 37,718 specimens of 33 species). The mean biomass of each species within this fish fauna that fell within the wood stork prey size limits of 1.5-9.0 cm was estimated from the length and wet mass relationships for Everglades's animals developed by Kushlan et al. (1986). The proportion of each species that was outside of this prey length and biomass range was estimated using the species mean and variance provided in Kushlan et al. in Table 1 (1986). These biomass estimates assumed the length and mass distributions of each species was normally distributed and the fish biomass could be estimated by eliminating that portion of each species outside of this size range. These biomass estimates of available fish prey were then standardized to a sum of 6.5 g/m^2 for Class 7 hydroperiod wetlands.

For example, in Appendix 1, in Kushlan et al. (1986) the warmouth (*Lepomis gulosus*) had an average biomass of 36.76 g/m^2 and accounted for 4.8 percent of the freshwater Everglades ichthyofauna; after standardization, warmouth biomass would be about 0.5 g/m^2 of the total fish biomass in a 6.5 g/m^2 sample from long hydroperiod wetlands. However, the size frequency distribution (assumed normal) for warmouth indicate that 48 percent are too large for wood storks and 0.6 are too small (outside the 1.5 cm to 9 cm size likely consumed), so the warmouth biomass within the wood stork's preferred size range is only 0.25 g/m^2. Using this approach summed over all species, in long hydroperiod wetlands only about 3.54 g/m^2 of the 6.5 g/m^2 sample consists of fish within the size range preferred by wood storks or about 55 percent (3.54/6.5*100=54.5).

Alternatively, the preferred sunfishes and four other species that accounted for 84 percent of the biomass eaten by wood storks (Ogden et al. 1976) would total 2.34 g/m^2 under this approach; adding another 16 percent would suggest that 2.79 g/m^2 of fish are likely to be consumed by wood storks of the 6.5 g/m^2 that are available or about 42.9 percent (2.79/6.5*100=42.9).

The mean of these two estimates is 3.17 g/m^2 for long hydroperiod wetlands (3.54+2.79=6.33/2=3.17). This proportion of available fish prey of a suitable size (3.17 g/m^2/ 6.5 g/m^2 = 0.49 or 49 percent) was then multiplied by the total fish biomass in each hydroperiod class to provide an estimate of the total biomass of a hydroperiod that is the appropriate size and species composition most likely consumed by wood storks.

As an example a class 3 District model hydroperiod wetland with a biomass of 2.3 grams/m^2 adjusted by 49 percent for appropriate size and species composition, provides an available biomass of 1.13 grams/m^2. Following this approach, the biomass per hydroperiod potentially vulnerable to predation by wood storks based on size and species composition is:

- Class 1 (0-60 days) = 0.25 grams/m^2
- Class 2 (60-120 days) = 0.49 grams/m^2
- Class 3 (120-180 days) = 1.13 grams/m^2
- Class 4 (180-240 days) = 2.1 grams/m^2
- Class 5 (240-300 days) = 2.5 grams/m^2
- Class 6 (300-330 days) = 2.9 grams/m^2
- Class 7 (330-365 days) = 3.2 grams/m^2

Wood Stork-Wading Bird Prey Consumption Competition

Another factor in assessing wood stork foraging potential is the likelihood that wood storks will be the wading bird species that actually consumes the concentrated prey. Fleming et al. (1994b) provides an estimate of 10 percent of the total biomass in their studies of wood stork foraging as the amount that is actually consumed by the storks. However, the Fleming et al. (1994b) estimate also includes a second factor, the suitability of the foraging site for wood storks, a factor that we have calculated separately. In their assessment, these two factors, competition and habitat suitability, accounted for a 90 percent reduction in the biomass actually consumed by the storks. We are considering that these two factors are equally important and are treated as equal components in the 90 percent reduction; therefore, we consider each factor to represent 45 percent of the reduction. Since we have a separate reduction factor for habitat suitability in our approach, this 45 percent habitat reduction factor in Flemings estimate is doubling this prey base reduction factor. In consideration of this approach, Fleming et al.'s (1994) estimate that 10 percent of the biomass would actually be consumed by wood storks would be adjusted to an estimate of 55 percent (10 percent plus the 45 percent already accounted for) of the available biomass would actually be consumed by the storks and is the factor we believe represents the amount of the wood stork suitable prey base that is actually consumed by the wood stork.

Nest Productivity

Many researchers including Flemming et al. (1994) and Ceilley and Bortone (2000) believe the short hydroperiod wetlands provide a more important pre-nesting foraging food source and a

greater early nestling survivor value for wood storks than the foraging base (grams of fish per square-meter) suggests. Although the short hydroperiod wetlands provide less fish, these prey bases historically were more extensive and provided foraging needs of the pre-nesting storks and the early-age nestlings, which corresponds to the greatest periods of mortality in wood stork nest productivity.

The total nesting period, from courtship and nest-building through independence of young, lasts approximately 100 to 120 days (Coulter et al. 1999). Wood storks produce an average of 1.29 fledglings per nest and have a probability of survivorship from egg laying to fledgling of 42 percent (Rodgers and Schwikert 1997). The greatest losses occur from egg laying to hatching with a 30 percent loss of the nest productivity. The second highest level of loss occurs from hatching to nestlings of 2 weeks of age with an additional 8 percent. Corresponding losses for the remainder of the nesting cycles are on the average of 6 percent per two week increase in age of the nestling (Rodgers and Schwikert 1997).

Kahl (1964) estimated that 201 kg of forage was needed for a successful nest, with 50 percent of the nestling stork's food requirement occurring during the middle third of the nestling period. The remaining foraging needs (based on Kahl's (1964) productivity graph) are generally linear with an estimate of 25 percent (50 kg) needed to meet the foraging needs of the adults and nestling in the first third of the nesting cycle and 25 percent (50 kg) needed for fledging to dispersing juveniles.

Hydrology

Action Area: The Service's action area for the project is the CFAs for the three wood stork colonies (Figure 7) and includes the footprint of the proposed development and preserve areas.

Alteration of hydrology and historical flow-ways results in restrictive flows and drainage, as demonstrated for the Cocohatchee basin. These restrictions can negatively influence wetlands and other surface water systems important to wood storks through changes in seasonal flooding and drawdown cycles and extended periods of unusually high water or low water. These restrictions can also result in changes in the vegetative community from a mixed open forest canopy with a herbaceous component to a closed canopy, dense forest without a herbaceous component.

The National Wetlands Inventory (NWI), the District Land Use Maps, and personal knowledge have been used to estimate wetland coverage and hydroperiod classes within the CFA of the three colony sites (Figure 17). As previously discussed, we consider short hydroperiods to be wetlands inundated for 180 days or fewer which includes Classes 1, 2, and 3. Following this approach, the wetland hydroperiods for three CFAs were estimated and are shown in Figure 18 and Table 16. The acreages in Table 16 are estimated from the NWI and SFWMD maps.

We estimate about 227,845 acres of short-hydroperiod wetlands are within the core foraging areas of the three rookeries, with an additional 253,821 acres of long-hydroperiod wetlands.

Project Wetland: In order to determine classes of wetland hydroperiods, available surface water level data for the Terafina property was examined. Surface water level monitoring using four continuous recording monitoring wells was initiated on the property in June 2006 and is on-going. Based on this water level data, length of inundation for the majority of the on-site wetlands was slightly greater than 120 days. As such, these on-site wetlands were classified as Class 3 wetlands (Table 17 and 18). Two deeper wetlands areas (one located along the south property boundary and the other in the southwest portion of the property) have ground elevations as low as 9.5 and 9.8 feet. These wetland areas totaling 6.02± acres have a length of inundation of approximately 210 days. As such, these wetland areas were classified as Class 4 wetlands (Table 18).

No water level data or ground elevations were available for the 107± Acre Hendry County Mitigation Parcel. As such, wetland hydroperiod classes were based on wetland habitat type. The marsh habitats were assigned as a Class 4 wetland since these habitat types typically have longer hydroperiods. The remaining transitional wetland habitats (hydric pine, hydric wax myrtle, and wet prairie) were assigned as Class 3 wetlands (Table 19).

Since there are no proposed changes to water levels for the proposed preserved wetlands on the Terafina property and the wetlands on the 107± acre Hendry County Mitigation Parcel as a result of the proposed project, the wetland hydroperiod class in the post-development condition will not change for the wetlands identified as Class 3 and Class 4. However, as part of the wetland mitigation plan for the Terafina property, it is proposed to create four "wading bird foraging areas" that require excavating and recontouring the wetland ground elevations. As such portions of these four areas, located entirely within the existing melaleuca dominated wetlands will have a longer hydroperiod. It is estimated that the hydroperiods for these areas will be within the range of 180 to 240 days (Class 4 wetlands).

Summary of the Factors Affecting Vulnerability of Wetland Habitats to Wood Stork Foraging in the Action Area

Through the above discussions, we have identified that there are essentially four variables in assessing wood stork foraging habitat. The first is the density of melaleuca within habitats suitable for wood stork foraging, the second is the hydroperiod of the wetland affected, the third is the fish density (biomass) available to the wood stork from the biomass of the wetlands affected, and the fourth is the likelihood that the wood stork is the wetland species that actually consumes the concentrated prey. All four of these parameters when combined provide us with an estimate of the effect of wetland foraging losses and gains in grams of fish in our assessment of the effects of the action on wood storks.

As an example, a 50-acre wetland with 60 percent melaleuca coverage, with a Class 5 hydroperiod, with 55 percent of the wood stork suitable biomass actually consumed by wood storks would provide about 102,950 grams (103 kg) of fish potentially vulnerable to predation by wood storks.

Fifty acres converts to 202,350 m^2; 60 percent melaleuca coverage equates to a 37 percent foraging potential; a Class 5 wetland has 2.5 grams of suitable fish per m^2; and 55 percent of the

biomass is actually consumed by wood storks and not other species of wading birds. Thus, the following calculation can be made:

(202,350*.37*2.5*.55=102,950)

An underlying assumption of this assessment method is that fishes within these wetlands either are available to storks or become available at some point during the dry season. The declining water levels over time result in the prey in different wetlands becoming available to storks at some point during the spring dry-down.

EFFECTS OF THE ACTION

Wood stork

This section analyses the direct and indirect effects of the project on the wood stork and wood stork habitat. As defined by the Corps, the proposed action includes the construction of an upscale residential and golf course community to be known as "Terafina." The 646.55-acre project site consist of 363 acres of residential areas; lakes; road rights of ways; clubhouse, maintenance, and sales buildings; open space; and on-site wetland preserves (261.47). The project also includes two off-site preserves, 107 acres in Hendry County and 154 acres in CREW. The 107 acres in Hendry County include 60.33 acres of wetlands.

The project proposes to impact 295.67 acres of wetlands, all of which are suitable for wood stork foraging. The project proposes compensatory mitigation for these adverse effects through enhancement and preservation of 261.47 acres on-site and 60.33 acres off-site within the Hendry County mitigation site. The additional 154 acres of CREW lands are not included in our wood stork analysis. Data on the habitat types and hydroperiods of these wetlands are not available at this time and therefore, were not included. While not included in the calculation of wood stork mitigation, it is expected that the purchase and restoration of 154 acres within CREW will have an additional long-term benefit for the species.

Therefore for assessment purposes, our wood stork biomass analysis address loss of the 295.67 acres of Class 3 hydroperiod wetlands on-site and the preservation of 321.80 of both Class 3 and Class 4 hydroperiod wetlands (261.47 acres on site and 60.33 acres in the Hendry County site).

Factors to be Considered

Development pressures due to ongoing population growth in Collier and Lee Counties continue to threaten wetlands in the action area. Data from the U.S. Census Bureau indicate during the period of 1968 to 2000 the populations of Collier, Hendry, and Lee Counties have increased by 94, 78, and 88 percent, respectively. The population of this three-countywide area was estimated at 731,675 during the 2000 census, and is expected to continue to grow, with a concomitant increase in the filling of wetlands due to development.

Residential, commercial, and industrial development projects may have a number of direct and indirect effects on the wood stork and wood stork habitat. Direct impacts, which are primarily habitat based, may include: (1) the permanent loss of available habitat for foraging, feeding, breeding, and dispersing wood storks; (2) changes in hydroperiods of wetlands that supports wood stork foraging, feeding, breeding, and dispersing wood storks; (3) the fragmentation of wood stork habitat; (4) harassment by construction activities; (5) a reduction in the geographic distribution of habitat for the species; and (6) habitat compensation. Indirect effects may include: (1) increases in disturbance frequency, intensity or severity to wood storks in the project vicinity due to human activities; (2) changes in the wood stork prey base; and (3) changes in the value of wood stork habitat adjacent to the project due to project related hydrological alterations. These indirect effects are habitat based.

This project site contains wood stork foraging habitat and is located within the CFA of three wood stork colonies. The timing of construction for this project, relative to sensitive periods of the wood stork's lifecycle, is unknown. Wood storks may be found on and adjacent to the proposed construction footprint year-round. The project will be constructed in a single, disruptive event, and result in permanent loss and alteration of a portion of the existing ground cover on the project site. The time required to complete construction of the project is not known, but it is likely land clearing associated with the development could be undertaken in phases over several years. The disturbance associated with the project will be permanent and result in a loss of habitat currently available to the wood stork; however, fragmentation of habitat will not occur due to the proposed project's position in the landscape of existing development. We evaluated impacts to storks using the method described in the Environmental Baseline Section above, which combines the effects of canopy cover and prey availability on the relative suitability of these wetlands for stork foraging. Impacts to storks were determined based on the calculated reduction in prey availability (biomass).

Analyses for Effects of the Action

Wood storks, as previously discussed, forage most efficiently and effectively in habitats where prey densities are high, and the water shallow and open enough to hunt successfully (Ogden et al. 1978; Browder 1984; Coulter 1987). Calm water, about 2 to 16 in (5 to 40 cm) in depth, and free of dense aquatic vegetation is ideal (Coulter and Bryan 1993). Typical foraging sites include freshwater marshes, ponds, hardwood and cypress swamps, narrow tidal creeks or shallow tidal pools, and artificial wetlands such as stock ponds, shallow, seasonally flooded roadside or agricultural ditches, and managed impoundments.

Habitat: As discussed in the previous section on Factors Affecting the Species and Environments within the Action Area, suitable wood stork foraging habitat within the footprint of the project site is affected by the density of exotic plant species and percent of canopy closure within affected wetlands. As discussed previously, we believe that dense melaleuca (>90 percent), because of its restrictive canopy, has effectively precluded wood storks from foraging in these communities. The remaining communities, although with varying densities of exotic species, still provide some foraging value to the wood stork, though the value is dependant on the density of the exotic species. Based on wading bird richness values (the number of species and the number of individuals) provided in the O'Hare and Dalrymple (1997) study.

Based on this assessment we developed the following index:

Exotic Percentage	Foraging Suitability (Percent)
Between 0 and 25 percent exotics	100
Between 25 and 50 percent exotics	64
Between 50 and 75 percent exotics	37
Between 75 and 90 percent exotics	3
Between 90 and 100 percent exotics	0

Since there was no project distinctions in exotic species densities between 75 and 90 percent and 90 to 100 percent, all onsite wetlands are considered suitable for wood stork foraging although with significant variance in functional value. Therefore, wetlands with exotic species densities between 75 and 100 percent were assigned a 3 percent foraging suitability value (Table 15).

Wood Stork Assessment: Wood storks forage most efficiently and effectively in habitats where prey densities are high and the water shallow and open enough to hunt successfully (Ogden et al. 1978; Browder 1984; Coulter 1987). In the previous section, we provided an assessment of the openness of the wetlands and their importance to wood stork foraging. The second component of importance to wood stork foraging efficiency is related to prey fish densities, which are referenced as the number of fish per m^2 (a quantity measurement), or the grams of fish per m^2 (a biomass measurement). The most important factor affecting these parameters is the existing hydroperiod of the wetlands affected. The shorter the hydroperiod, the less the amount of time available for growth and maturation of fish prey species within the hydrated wetlands, which generally results in less numbers and lower biomass of fish in these systems. Researchers in fish density studies in ENP, WCA-3, and Corkscrew Swamp provided standing stock (biomass) of large and small fishes for various wetland hydroperiods (Turner et al. 1999, Trexler et al. 2002, Carlson and Duever 1979).

However, as previously discussed, wood storks are very selective in the size of fish they consume, generally between 1.5 and 9.0 cm in length and usually greater than one year old (Ogden et al. 1976, Coulter et al. 1999). Factoring this size restriction and species preference into the standing stock (biomass) of large and small fishes referenced above, we determined the biomass of each hydroperiod that would be consumed by storks based on preferred size. By incorporating the last remaining factor in the prey density foraging value to wood stork, the amount of the prey base actually consumed by wood stork per hydroperiod (55 percent of the available wood stork suitable biomass, which is based on Fleming et al.'s [1994b] studies [see detailed discussion in the Factors Affecting the Species and the Environment in the Action Area]), we can estimate the amount of biomass actually consumed in grams/ m^2 per hydroperiod.

As an example, a 50-acre wetland with 60 percent melaleuca coverage, with a Class 5 hydroperiod would provide about 102,950 grams (103 kg) of fish potentially vulnerable to predation by wood storks. Fifty acres converts to 202,350 m^2; 60 percent melaleuca coverage equates to a 37 percent foraging potential; a Class 5 wetland has 2.5 grams of suitable fish per m^2; and 55 percent of the biomass is actually consumed by wood storks and not other species of wading birds.

Thus, the following calculation can be made:

(202,350*.37*2.5*.55=102,950)

Project Footprint Foraging Prey Base Assessment: Following this approach, a foraging prey base evaluation of the proposed project footprints based on the above information provides a biomass foraging loss to wood storks of 129.29 kg of fish biomass (Table 19). The prey base loss is based on 295.67 acres of suitable wood stork foraging habitat with a range of functional value. The exotic species density habitat suitability values range from 3 percent to 100 percent, depending on the density of exotic vegetation. The hydroperiods vary from Class 3 (120 to 240 days) to Class 4 (240 to 300 days) with 99 percent of the project footprint represented by Class 3. We consider the wood stork suitable fish density (grams per m^2 per hydroperiod class) to be as described in the earlier section relating to fish densities in each wetland class. As previously noted, the wood stork consumption percentage is 55 percent (*i.e.*, 55 percent of the biomass will actually be consumed by wood storks).

Direct Effects

Direct effects are those effects caused by the proposed action at the time of construction, are primarily habitat based, are reasonably certain to occur, and include: (1) the permanent loss of available habitat for foraging, feeding, breeding, and dispersing wood storks; (2) changes in hydroperiods of wetlands that supports wood stork foraging, feeding, breeding, and dispersing wood storks; (3) the fragmentation of wood stork habitat; (4) harassment by construction activities; (5) a reduction in the geographic distribution of habitat for the species; and (6) habitat compensation. The direct effects this project will have on the wood stork within the action area are discussed below.

Permanent Loss of Habitat: The project will result in the loss of approximately 295.67 acres of wetlands on the site. The land will be converted to support a residential/golf course community. Existing habitat quality for wood storks is generally poor, as it is primarily disturbed flatwoods supporting an average of 50 percent exotics. In our assessment of wood stork foraging suitability, we estimated that all 295.67 acres are considered suitable for foraging by wood storks, with a range of functional value. This loss represents approximately 0.05 percent of the available foraging area within each of the three colonies whose CFAs overlap the project (Table 16). No wood storks are known to have nested within the project area and all of the wading bird censuses conducted to date have demonstrated that the area is periodically used by resident and or migratory, over-wintering wood storks. Therefore, based on the analyses provided above on the level of melaleuca infestation within the project wetlands and the analysis of project area foraging base in the Environmental Baseline, we believe there will be a loss of 295.67 acres of wood stork foraging habitat of varying foraging value to the wood stork.

Changes in the Mosaic of Hydroperiods: Stork nesting success generally relies on a mosaic of hydroperiods within the core foraging area of the colony. Storks nest during the dry season, and rely on the drying wetlands to concentrate prey items in the ever-narrowing wetlands (Kahl 1964). Because of the continual change in water levels during the stork nesting period, any one site may only be suitable for stork foraging for a narrow window of time when wetlands have

sufficiently dried to begin concentrating prey, making water depths suitable for storks to access the prey. Once the wetland has dried to where the water levels are near the ground surface, the area is no longer suitable for stork foraging, and will not be suitable until water levels rise and the area is again repopulated with fish. Consequently, there is a general progression in the suitability of wetlands for foraging based on their hydroperiods, with the short hydroperiod wetland used early in the season, the mid-range hydroperiod sites being used during the middle of the nesting season, and the longest hydroperiod areas being used later in the season (Kahl 1964; Gawlik 2002).

In our evaluation of hydroperiods within the wood stork action area (overlap of all three rookeries), we determined that of the available wetlands within the action area (481,666 acres), there were about 227,845 acres of short-hydroperiod wetlands. Short-hydroperiod wetlands in the project footprint total about 295.67 acres. The loss of the 295.67 acres of short-hydroperiod wetlands suitable for wood stork foraging represents about 0.13 percent of the short-hydroperiod wetlands in the action area (295.67/227,845=0.13). There are no long-hydroperiod wetlands in the project development footprint.

In our assessment of the Terafina development footprint (Table 17), we noted that the predominant wetland hydroperiod was a Class 3 (99 percent) with an average of 120 to 180 days inundation. To complete this analysis, we assumed the existing available foraging habitat acreages would be available with or without the project. We calculated the proposed development will result in the loss of 129.29 kg of fish biomass (Table 21).

In our assessment of the preservation lands (Tables 21a, 21b and 22), we determined that prior to restoration the preserve lands provide for an existing foraging base of 437.07 kg of fish biomass and following restoration these lands provide 935.99 kg of fish biomass, an increase of 498.92 kg of fish biomass (935.99-437.07=498.92).

Since the importance of short-hydroperiod wetlands in relationship to early nesting productivity of a wood stork colony is extremely critical, as discussed previously, we also calculated the productivity of both short- and long-hydroperiod wetlands separately. The existing preserve lands currently provide 184.43 kg of short-hydroperiod fish biomass with a corresponding long-hydroperiod productivity of 252.64 kg of fish biomass. Following restoration, the preserve lands will provide 661.81kg of fish biomass of short-hydroperiod wetlands and 274.18 kg of long-hydroperiod fish biomass.

Following the above analysis, the restoration actions proposed for the preserve lands will provide an increase of 477.38 kg of fish biomass in short-hydroperiod wetlands (661.81-184.43=477.38) and 21.54 kg of fish biomass in long-hydroperiod wetlands (274.18-252.64=21.54). Considering that the expected fish productivity loss from the proposed development is 129.29 kg of fish biomass represented by all short-hydroperiod wetlands, the proposed restoration actions will provide a 2.69 fold increase in availability of fish biomass for short-hydroperiod wetlands, all within Class 3 hydroperiod wetlands (477.38-129.29=348.09/129.29=2.69).

As shown in Table 20, wood stork biomass foraging losses from the proposed development are compensated for in the enhancements of the preserve lands. Our evaluation shows an overall increase of 348 kg of fish biomass and is the bases of our evaluation for estimating incidental take (477.38-129.29=348). In this instance, no incidental take is expected to occur as a projected increase in short hydroperod biomass is expected and based on the biomass need of 50 kg of short hydroperiod fish biomass per nest, the project is expected to provide a beneficial effect of an increase in nest productivity of 6.96 nest per year (348/50=6.96).

To summarize the discussion above, the project development will result in the loss of 295.67 acres of wetlands, all suitable for wood stork foraging, although of varying foraging value to the wood stork. The proposed preservation lands evaluated in our wood stork foraging assessment consist of 322 acres, with an additional 154 acres of restored lands not considered in our assessment as explained previously. The hydroperiod class analysis, by individual hydroperiod classes, shows that over all, the project development will result in a loss of 129.29 kg of fish biomass from wetland losses in the project development. The proposed restorations will provide an overall increase of 498.92 kg of biomass over existing baseline of the wetlands in the preserve. The net biomass increase is 369.63 kg with a short-hydroperiod fish biomass increase of 348.09 kg (661.81-184.43-129.29=348.09) and a long-hydroperiod increase of 21.54 kg (274.18-252.64=21.54).

On an individual hydroperiod analysis, the project development will result in the loss of 129.29 kg of fish biomass associated with a class 3 hydroperiod and an increase of 477.38 kg in the preserve, showing a net increase overall of 348.09 kg of short hydroperiod wetlands. Long hydroperiod wetlands; although, not present in the project site also show a net increase associated with preserve restoration of 21.54 kg. No incidental take is expected to occur as a projected increase in short hydroperod biomass is expected. Based on the biomass need of 50 kg of short hydroperiod fish biomass per nest, the proposed action is projected to provide a beneficial effect of an increase in nest productivity of 6.96 nests(348/50=6.96).

Fragmentation of Habitat: Mac et al. (1998) define habitat fragmentation as, "The breaking up of a habitat into unconnected patches interspersed with other habitat which may not be inhabitable by species occupying the habitat that was broken up. The breaking up is usually by human action, as, for example, the clearing of forest or grassland for agriculture, residential development, or overland electrical lines." In the case of the proposed project, habitat will be affected by the development of the property. However, in a larger framework, the Terafina project area is located adjacent to urban development and is in an area of intense development pressure; therefore, fragmentation of wood stork habitat is not expected to result from project implementation. The project site proposes a large preserve area that connects existing and proposed preserve areas to the east with existing and proposed preserved lands to the east. For these reasons, fragmentation of wood stork foraging habitat is not expected.

Construction: The timing of construction for this project relative to sensitive periods of the wood stork's lifecycle is unknown. However, it is likely all land clearing associated with the development will occur in phases. There are no known roosting or colony sites within the project boundaries and the quality and quantity of the foraging prey base (based on previous

discussion of existing habitat quality and foraging values) is low. Therefore, we believe wood stork usage of the property is limited and we do not believe project construction will result in direct wood stork harassment or mortality.

Reduction in Geographic Distribution of Habitat: The wood stork population in the southeastern United States appears to be continuing to grow. Preliminary population totals indicate that the stork population has reached its highest level since it was listed as endangered 1984. In all, approximately 10,900 wood stork pairs nested within their breeding range in the southeastern United States. Wood stork nesting was again recorded in North Carolina in 2006 after it was first documented there in 2005. This suggests the northward expansion of wood stork nesting may be continuing. Several new colonies were located in 2006, including several in Florida. The number of colonies also continues to rise, and over 80 nesting colonies were reported in 2006 throughout the southeastern United States (Service unpublished data), which is the highest to date in any one year. The proposed Terafina project will not significantly reduce the geographic distribution of habitat and the distribution of the species.

Compensation: Wood stork habitat lost by the development will be offset by the preservation and enhancement of about 475.80 acres of lands on- and off-site, of which only 322 acres of wetlands were considered in our biomass evaluation for wood storks. The applicant has also purchased and will enhance, restore, and maintain 154 acres of lands in CREW (Figure 4b). Although not included in the Service's calculation of mitigation, it is anticipated that the restoration of the CREW lands will have additional benefits to the wood stork. The lands proposed for development are primarily hydrologically disturbed, exotic infested, and are adjacent to CR 846 and existing urban areas. The lands proposed for preservation although portions are still adjacent to development, are connected to other larger tracts of preserved lands and are consistent with the Service's wood stork goal to acquire, enhance, preserve, and recover natural hydropatterns within foraging habitat of the wood stork.

Interrelated and Interdependent Actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No interrelated or interdependent actions are expected to result from the project.

Indirect Effects

Indirect effects are defined as those effects that are caused by the proposed action, and are later in time but are still reasonably certain to occur (50 CFR 402.02). The indirect effects this project may have on the wood stork within the action area are discussed below. They include: (1) increases in disturbance frequency, intensity or severity to wood storks in the project vicinity due to human activities; (2) changes in the wood stork prey base; and (3) changes in value of wood stork habitat adjacent to the project due to project related hydrological alterations.

Increased Disturbance: The timing of construction for this project, relative to sensitive periods of the wood stork's lifecycle, is unknown. Wood storks may be found on and adjacent to the proposed construction footprint year-round. The project will be constructed in a single, disruptive event, and result in permanent loss and alteration of a portion of the existing ground cover on the project site. The time required to complete construction of the project is not known, but it is likely land clearing associated with the development could be undertaken in phases over several years. The on-site wetland preserves, which provide a foraging prey base for wood storks in a suburban setting, may increase the likelihood of harassment and disturbance to the species. However, this is a common occurrence throughout the species range and is not expected to adversely affect the wood stork. In order to minimize potential human/stork interactions, the project is proposing to educate all residents (through literature and signage) as to the potential presence of wood storks around the community.

Changes in Wood Stork Prey Base:

Prey Base Loss **-** The proposed action will result in the loss of 295.67 acres of wetlands, all of which are considered suitable for foraging by wood storks. In our assessment of adverse effects to the resident prey base available to foraging wood storks, we calculated an at-risk prey base of 129.29 kg of fish biomass (Table 20), all of which are short hydroperiod wetlands, represented by Class 3 hydroperiod. We do not believe additional indirect affects to the prey base will occur.

Prey Base Increase **-** Increases in the availability of potential foraging habitat and prey resulting from the proposed restoration and enhancement measures are expected to exceed the estimated loss of 129.29 kg of fish prey base lost to project. The restoration and enhancement activities result in an increase in wood stork suitable foraging biomass of 369 kg (Table19). The exotic species density habitat suitability values range from 0 percent to 100 percent, depending on the habitat polygon. The hydroperiods range from Class 3 (120 to 180 days) to Class 4 (300 to 330 days) with 99 percent of the mitigation area represented by Class 3 (120 to 180 days). The wood stork suitable fish density (grams per m^2 per hydroperiod class) is as described in the earlier section relating to fish densities in each wetland class. As previously noted, the wood stork consumption percentage is 55 percent (*i.e.*, 55 percent of the biomass will actually be consumed by wood storks).

We estimate the applicant's restoration work will provide a net increase of 348 kg of fish biomass in short-hydroperiod wetlands and 21.54 kg of fish biomass in long-hydroperiod wetlands. Considering the expected fish productivity loss from the proposed development is129.29 kg of fish biomass, all of which represent short-hydroperiod wetlands, the proposed restoration actions will provide a 2.69 fold increase in availability of fish biomass for short-hydroperiod wetlands.

However, as we discussed previously, we evaluate wood stork biomass productivity per hydroperiod class and based on our analysis, our evaluation shows an overall increase of 348 kg of fish biomass and is the basis of our evaluation for estimating incidental take. In this instance, no incidental take is expected to occur as the projected increase in short hydroperod biomass is expected, based on the biomass need of 50 kg of short hydroperiod fish biomass per nest, to provide a beneficial effect of an increase in nest productivity of 6.96 nest (348/50=6.96).

Changes in value of wood stork habitat adjacent to the project due to project related hydrological alterations:

During the mid 1970s, portions of the project site were converted to vegetable crop production. Additional development activities were also occurring to the west. This resulted in a system of berms being constructed, which effectively funneled the surface water from thousands of acres (which historically occurred as sheet flow over a broad area of ± 15 miles) into a highly restricted flow-way with relatively few outfalls to the Cocohatchee Canal. This water, directed into the project area and surrounding lands via the restrictions, routing, agricultural pumping and the berm adjacent to the Cocohatchee Canal, backs up across the project site for extended periods during the summer. Water lines, lichen lines, and adventitious roots on melaleuca trees are visible in most areas. These biological indicators reflect the water levels elevated by the off-site flows from the north. This altered hydrology caused the wetlands within the Project site and adjacent lands to expand through flooding and degradation of the upland communities.

However, the hydroperiod is extremely variable and ground water levels typically drop to more than four feet below grade during the dry season, facilitating the colonization of the area by melaleuca and debilitating the restoration of appropriate native communities. Over 55 percent of the project site has melaleuca densities of greater than 50 percent coverage. The applicant has incorporated into the on-site wetland preserves, and the adjacent preservation wetlands a series of control structures designed to regulate and temper the seasonal changes in hydroperiods. These changes, which are the basis of the Corps permit modification request, are expected to result in an increase in the amount and availability of fish biomass to wood stork foraging.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions reasonably certain to occur in the action area considered in this biological opinion. While future federal actions located within the action area affecting wood storks are technically not linked to this project and will be considered in separate section 7 consultations, the Service notes that several projects formerly linked by the flow-way are currently under review by the Corps and have been the subject of section 7 consultations resulting in biological opinions. These projects include Parklands and Mirasol. The Service issued a revised biological opinion for the Mirasol project on March 3, 2007, and is currently preparing a revised biological opinion for the Parklands project.

To determine the cumulative effects of the project on the wood stork, the Service has analyzed future actions reasonably certain to occur within an action area. For evaluation purposes, the Service is considering the action area for the wood stork to include the CFAs of all three nesting colonies as they encompass the project area or a portion of it (Figure 7). The process to identify cumulative effects follows the same procedure identified for the Florida panther.

Within the action area, past and ongoing State and County actions affecting wood stork habitat include: (1) State of Florida DRI Orders (2001 to 2004); (2) Comprehensive Plan Amendments (2003 to 2004); (3) Lee and Collier County Zoning Amendments (2003 to 2004); (3) Collier County's PUDs (2001 to 2004); (4) Lee County's PUDs (2003 to April 2004); and (5) South

Florida Water Management District's Environmental Resource Permits (2003 to 2004) (Figure 14). To evaluate these effects, the Service incorporated the Florida Land Use, Cover and Forms Classification System (FLUCCS) mapping to determine properties that may be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps. To determine which of these projects would likely be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps, we identified the percentage of the project site that was classified as wetland habitat, based on the FLUCCS mapping units. The mapping units relied on by the Service included the 600 series (wetland classifications) and the 411 and 419 pine flatwood classifications (hydric pine systems). For listing purposes, properties with less than 5 percent wetlands were considered by the Service to be generally exempt from regulatory review as these quantities of wetlands could be avoided by project design.

We initially identified 33 projects affecting 121.13 acres of wetlands associated with 3,602 acres. Of this list, we are aware or have reviewed 4 of these projects affecting 109.55 acres of wetlands associated with 2,990.14 acres. For our assessments purposes, we identified 29 projects within the combined wood stork foraging area encompassing about 611.86 acres affecting 11.58 acres of wetlands (Table 23, Figure 14). We added to this the 762 acres of wetlands associated with the proposed developments in Northern Golden Gate Estates and Lehigh Acres for a total of 773.58 acres of wetlands. The Service believes these 773.58 acres of wetlands may be developed without Federal review. As shown in Table 23, cumulative wetland impacts within the action area constitute less than 0.01 percent of all wetlands available to wood storks in the three CFAs.

Although these wetlands may be adversely affected by non-federally reviewed actions and the productivity as a foraging prey base for wood storks may be affected, we believe based on the status of species discussed previously and the status of the species in the action area, the loss/reduction of foraging value to the wood storks associated with these systems is not significant (0.02 percent).

SUMMARY OF EFFECTS

Wood stork

The project will result in the direct loss of 295.67 acres of wetland on the site, all of which are considered suitable for foraging by wood storks. Any loss of potential wood stork foraging habitat attributable to the project will be offset by the preservation and enhancement of about 475.80 acres of on-site and off-site lands, of which about 51.47 acres of wetlands would be enhanced and preserved within the developed portions of the project and 210 acres of wetlands in the adjacent preserve which is part of a larger regional slough system that extends off-site. The remaining wetland enhancements are associated with the 154 acres in CREW and the 60.33 acres of wetlands within the 107 acre Hendry County preserve. The 154 acres in CREW were not included in the biomass calculation. However, it is anticipated that the restoration of the land within CREW will have additional benefits to the wood stork in terms of increased biomass. Therefore, the Service's calculation of increase in biomass from mitigation is conservative.

However, as we discussed previously, we evaluate wood stork biomass productivity per hydroperiod class. On an individual hydroperiod analysis, the project development will result in the loss of 129.29 kg of fish biomass associated with a class 3 hydroperiod and an increase of 477.38 kg in the preserve, showing a net increase overall of 348.09 kg of short hydroperiod wetlands. Long hydroperiod wetlands, although, not present in the project site also show a net increase associated with preserve restoration of 21.54 kg. No incidental take is expected to occur as a projected increase in short hydroperod biomass is expected. Based on the biomass need of 50 kg of short hydroperiod fish biomass per nest, the proposed action is projected to provide a beneficial effect of an increase in nest productivity of 6.96 nests(348/50=6.96).

CONCLUSION

Wood stork

After reviewing the status of the wood stork, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the Service's biological opinion that the development of Terafina by as proposed, is not likely to jeopardize the continued existence of the wood stork. No critical habitat has been designated for this species; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct." "Harm" is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking, that is incidental to and not intended as part of the agency action, is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The terms and conditions described below are nondiscretionary and must be undertaken by the Corps so they become binding conditions of any grant or permit issued to G.L. Homes., as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require G.L. Homes, to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protection coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps or G.L. Homes, must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR § 402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Florida panther

The Service anticipates that incidental take of the Florida panther will be difficult to detect for the following reasons: (1) the Florida panther is wide-ranging; (2) the lands on the project site provide limited value to the Florida panther and panther prey species; and (3) lands adjacent to the project site consists of existing and proposed urban development that reduce their suitability for use by either resident or dispersing panthers. Therefore, the Service does not anticipate construction of the project will result in the direct mortality or injury of any Florida panthers. However, the Service anticipates indirect take of the panther in the form of harm and harassment because of potential increases in traffic and interspecific aggression within the 25-mile radius action area. This level of incidental take may be monitored with the loss of 437 acres of panther habitat within the Primary Zone.

Wood storks

The Service is not exempting incidental take of wood storks from the proposed actions. The loss of about 295.67 acres of available wood stork foraging habitat is estimated to provide about 129.29 kg of forage biomass available to the wood stork. However, the applicant has proposed conservation measures that will ultimately increase the amount of available foraging habitat and available forage biomass. As a result of the restoration and preservation of wetland within and outside of the project area, we determined the Terafina project will result in a net gain of 369.63 kg of fish biomass from the restoration and enhancement of the 321.8 acres of mainly short hydroperiod suitable wood stork foraging habitat biomass (261.47 + 60.33 = 321.8), although 475.8 acres of wetlands will be restored, (321.8 + 154 = 475.8).

The 369.63 kg of fish biomass represents 348.09 kg of short-hydroperiod and 21.54 kg of long-hydroperiod fish biomass productivity. Since we believe, in general, short-hydroperiod wetlands are critical limiting factors in the action area, the proposed action, with its preserve enhancements, will provide a net increase in nest productivity associated with short-hydroperiod wetlands of about 6.96 nests over base conditions (348.09 divided by 50 equals 6.96). We also note a corresponding increase of 21.54 kg of long hydroperiod wetland biomass corresponding to an increase in nest productivity of 0.14 nests (21.54 divided by 150 equals 0.14).

Although not part of our wood stork biomass assessment, the applicant is also proposing the acquisition and restoration of 154 acres of lands within the CREW watershed. Data on the habitat types and hydroperiods of these wetlands are not available at this time and therefore, were not included. Although, it is expected that the purchase and restoration of 154 acres within CREW will have an additional long-term benefit for the species.

In addition to direct effects on the non-nesting wood storks, increases in foraging opportunities resulting from the proposed action may also decrease the likelihood these non-nesting wood storks will compete for prey with nesting wood storks. Because we can not reliably predict the degree of competition or the number of non-nesting storks that forage in this area, we are unable to quantify any incidental take resulting from decreased competition.

The Service will not refer the incidental take of any migratory bird or bald eagle for prosecution under the Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703-712), or the Bald Eagle Protection Act of 1940, as amended (16 U.S.C. 668-668d), if such take is in compliance with the terms and conditions (including amount and/or number) specified herein.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined this level of anticipated take is not likely to result in jeopardy to listed species or destruction or adverse modification of critical habitat to either species.

REASONABLE AND PRUDENT MEASURES

The Service believes the Corps and the applicant have developed a project that has conservation measures necessary and appropriate to minimize the effect of incidental take of the Florida panther and wood stork. In summary, to compensate for impacts to 295.67 acres of wood stork habitat and 437 acres of panther habitat G.L. Homes, proposes to enhance and preserve 476 acres of habitat suitable for wood stork foraging and 471 acres of habitat suitable for panthers. Portions of the preserve lands are both within and adjacent to the project site. Additional conservation lands are off site in the adjacent CREW watershed and within Hendry County.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline reporting/monitoring requirements. The terms and conditions described below are non-discretionary, and must be undertaken by the Corps so they become binding conditions of any grant or permit issued to G.L. Homes., as appropriate, for the exemption in section 7(o)(2) to apply.

The Corps has a continuing duty to regulate the activity covered by this Incidental Take Statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require G.L. Homes to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protection coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps or G.L. Homes must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement (50 CFR § 402.14(i)(3)). Although we have not identified any specific Reasonable and Prudent Measures not incorporated in the project, we are providing the following for clarification:

1. The preservation sites will be managed in perpetuity for the control of invasive exotic vegetation as defined by the Florida Exotic Pest Plant Council's Pest Plant List Committee's 2001 List of Invasive Species (Category 1)(2005) and managed for the benefit of the Florida panther and wood stork in accordance to the management and monitoring plans provided as part of this action;

2. The Corps will provide a copy of the final permit to the Service upon issuance. The Corps will monitor the permit conditions regarding conservation measures to minimize incidental take of panthers by providing the Service a report on implementation and compliance with the conservation measure within 1 year of the issuance date of the permit;

3. Upon locating a dead, injured, or sick threatened or endangered species, initial notification must be made to the nearest Service Law Enforcement Office; Fish and Wildlife Service; 9549 Koger Boulevard, Suite 111; St. Petersburg, Florida 33702; 727-570-5398. Secondary notification should be made to the FWC; South Region; 3900 Drane Field Road; Lakeland, Florida; 33811-1299; 1-800-282-8002; and

4. Care should be taken in handling sick or injured specimens to ensure effective treatment and care or in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured panthers or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service is not proposing any conservation recommendations at this time.

REINITIATION NOTICE

This concludes formal consultation on the Terafina development project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; (3) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Thank you for your cooperation and effort in protecting fish and wildlife resources. If you have any questions regarding this project, please contact Allen Webb at 772-562-3909, extension 246.

Sincerely yours,

Paul Souza
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Table 1. *Targeted and Acquired Acreage Totals of Conservation Lands in South Florida directly Affecting the Panther within the Panther Focus Area.

Name	Targeted[1] Acreage	Acquired Acreage	Indian Reservation
Federal Conservation Lands			
Everglades National Park	1,508,537	1,508,537	--
Big Cypress National Preserve	720,000	720,000	--
Florida Panther National Wildlife Refuge	26,400	26,400	--
Subtotal	**2,254,937**	**2,254,937**	--
State of Florida: Florida Forever Program			
Belle Meade	28,505	19,107	--
Corkscrew Regional Ecosystem Watershed	69,500	24,028	--
Twelvemile Slough	15,653	7,530	--
Panther Glades	57,604	22,536	--
Devil's Garden	82,508	0	--
Caloosahatchee Ecoscape	18,497	2,994	--
Babcock Ranch	91,361	0	--
Fisheating Creek	176,760	59,910	--
Subtotal	**540,388**	**136,105**	--
State of Florida: Other State Acquisitions			
Water Conservation Area Number 3	491,506	491,506	--
Holey Land Wildlife Management Area	33,350	33,350	--
Rotenberger Wildlife Management Area	25,019	20,659	--
Fakahatchee Strand State Preserve	74,374	58,373	--
Picayune Strand State Forest	55,200	55,200	--
Okaloacoochee Slough State Forest and WMA	34,962	34,962	--
Babcock-Webb Wildlife Management Area	79,013	79,013	--
Subtotal	**793,424**	**773,063**	--
Indian Reservations[2]			
Miccosukee Indian Reservation	--	--	81,874
Big Cypress Seminole Indian Reservation	--	--	68,205
Brighton Seminole Indian Reservation	--	--	37,447
Subtotal	**--**	**--**	**187,526**
GRAND TOTALS	**3,588,749**	**3,164,105**	**187,526**

[1]Targeted acres not available for all lands. In Such cases, targeted equals acquired acreage.
[2] Indian lands are included due to their mention in the MSRP. Acreages taken from GIS data.
*Table 1 was excerpted from the Brief of Amicus (2003). However, the lands shown as acquired in this table may include some private in-holdings and may include lands currently under sales negotiations or condemnation actions.

Table 2. Habitat preservation efforts resulting from formal and informal consultations with the Service for projects affecting Florida panther habitat from March 1984 through August 2007.

Date	Service Log Number	Corps Application Number	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved On-site (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
03/29/84	4-1-83-195	83M-1317	Ford Test Track	Collier	530	0	0	0
02/21/85	4-1-85-018	unknown	I-75	Broward Collier	1,517	0	0	0
10/17/86	4-1-87-016 4-1-87-017	unknown	Exxon Master Plan	Collier	9	0	0	0
01/07/87	4-1-86-303	86IPM-20130	Citrus Grove	Collier	11,178	0	0	0
01/11/88	4-1-88-029	unknown	NERCO - Clements Energy	Collier	3	0	0	0
02/23/88	4-1-88-055	unknown	Shell Western E&P	Collier Dade Monroe	0	0	0	0
02/10/89	4-1-89-001	FAP IR-75-4(88)81	SR 29/I-75 Interchange	Collier	350	0	0	0
08/15/90	4-1-90-289	unknown	I-75 Recreational Access	Collier	150	0	0	0
09/24/90	4-1-90-212	89IPD-20207	U.S. Sugar Corporation	Hendry	28,740	700	0	700
03/12/91	4-1-91-229	90IPO-02507	Lourdes Cereceda	Dade	97	0	0	0
01/14/92	4-1-91-325	199101279	Dooner Gulf Coast Citrus	Collier	40	40	0	40
09/25/92	4-1-92-340	unknown	STOF, BCSIR Citrus Grove	Hendry	1,995	0	0	0
06/18/93	4-1-93-217	199200393	Corkscrew Road	Lee	107	0	0	0
02/25/94	4-1-94-209	199301131	Daniels Road Extension	Lee	65	0	0	0
05/09/94	4-1-93-251	199202019	Corkscrew Enterprises	Lee	900	100	100	200
10/27/94	4-1-94-430	199302371 199400807 199400808	Florida Gulf Coast University Treeline Boulevard	Lee	1,088	526	0	526
05/24/95	4-1-95-230	199302130	Turner River Access	Collier	1,936	0	0	0
08/07/95	4-1-95-274	199405501	Bonita Bay Properties	Collier	509	491	0	491
08/15/95	4-1-94-214	199301495	SW Florida Airport Access Road	Lee	14	0	0	0
09/19/96	4-1-95-F-230	199302052 199301404	I-75 Access Points	Broward	116	0	0	0
03/10/98	4-1-98-F-3	L30 (BICY)	Calumet Florida	Collier Broward Dade	0	0	0	0
03/27/98	4-1-97-F-635	199604158	Willow Run Quarry	Collier	359	190	0	190

Table 2. Continued.

Date	Service Log Number	Corps Application Number	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved On-site (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
06/11/99	4-1-98-F-398	199800622	STOF Water Conservation Plan	Hendry	1,091	0	0	0
09/27/99	4-1-98-F-310	199130802	Daniels Parkway	Lee	2,093	0	94	94
12/08/99	4-1-98-F-517	199607574	Cypress Creek Farms	Collier	239	0	24	24
04/17/00	4-1-98-F-428	199507483	Miromar	Lee	1,323	0	194	194
06/09/00	4-1-99-F-553	199900619	Naples Reserve	Collier	833	0	320	320
02/21/01	4-1-00-F-135	199803037	Corkscrew Ranch	Lee	106	0	0	0
04/17/01	4-1-00-F-584	200001436	Sun City	Lee	1,183	0	408	408
07/30/01	4-1-94-357	199003460	Naples Golf Estates	Collier	439	175	0	175
08/31/01	4-1-00-F-183	199900411	Colonial Golf Club	Lee	1,083	0	640	640
12/14/01	4-1-00-F-585	199301156	SW Florida Airport	Lee	8,058	0	6,986	6,986
03/07/02	4-1-00-F-178	199901251	Southern Marsh Golf	Collier	121	75	80	155
04/24/02	4-1-01-F-148	199901378	Hawk's Haven	Lee	1,531	267	0	267
09/24/02	4-1-01-F-135	200001574	Verandah	Lee	1,456	0	320	320
10/08/02	4-1-02-F-014	199602945	Winding Cypress	Collier	1,088	840	1,030	1,870
05/19/03	4-1-02-F-1741	200200970	Apex Center	Lee	95	10	18	28
06/10/03	4-1-01-F-1955	200003795	Walnut Lakes	Collier	157	21	145	166
06/18/03	4-1-01-F-136	199701947	Twin Eagles Phase II	Collier	593	57	98	155
06/23/03	4-1-01-F-143	199905571	Airport Technology	Lee	116	55	175	230
07/02/03	4-1-98-F-428	199507483	Miromar Lakes	Lee	342	158	340	498
09/04/03	4-1-02-F-1486	200206725	State Road 80	Lee	33	2	12	14
10/06/03	4-1-02-F-0027	200102043	Bonita Beach Road	Lee	1,117	145	640	785
12/29/03	4-1-02-F-1743	200202926	The Forum	Lee	650	0	310	310
01/18/05	4-1-04-F-4259	199702228	Bonita Springs Utilities	Lee	79	0	108	108
03/31/05	4-1-04-F-5656	200306759	Gateway Shoppes II	Collier	82	0	122	122
04/08/05	4-1-04-F-8176	2004-5312	Seminole Mine	Broward	110	0	220	220
04/29/05	4-1-04-F-5780 4-1-04-F-5982	2003-5331 2003-6965	Arborwood and Treeline Avenue	Lee	2,329	0	1,700	1,700

Table 2. Continued.

Date	Service Log Number	Corps Application Number	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved On-site (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
06/06/05	4-1-03-F-7855	2003-11156	Collier Regional Medical	Collier	44	0	64	64
02/22/05 03/16/05 06/29/05 04/04/06	4-1-04-F-6866	200309416	Ava Maria DRI	Collier	5,027	0	6,114	6,114
06/29/05	4-1-03-F-3915	199806220	Wenthworth Estates	Collier	917	0	458	458
07/15/05	4-1-04-F-5786	199405829	Land's End Preserve	Collier	231	0	61	61
09/08/05	4-1-04-F-5260	200106580	Parklands Collier	Collier	489	157	434	591
09/23/05 10/26/05	4-1-04-F-9348	200101122	Super Target-Tarpon Bay Plaza	Collier	34	0	20	20
11/23/05	4-1-04-F-6043	20034914	Summit Place	Collier	108	0	61	61
11/29/05	4-1-04-F-8847	20048995	STOF Administrative Complex	Collier	6	0	8	8
12/06/05	4-1-03-F-3483	200302409	SW Florida Commerce Center	Lee	207	0	305	305
12/06/05	4-1-04-F-6691	200310689	Rattlesnake Hammock Road Widening	Collier	23	0	23	23
01/04/06	4-1-04-F-8388	2004554	Immokalee Regional Airport - Phase I	Collier	67	0	43	43
01/04/06	4-1-04-F-9777	20048577	Logan Boulevard Extension	Collier	30	0	10	10
1/13/06	4-1-04-F-6707	20042404	Journey's End	Collier	66	0	34	34
01/26/06	4-1-04-F-8940	20047053	The Orchard	Lee	93	0	81	81
02/19/06	4-1-05-F-11724	2005834	Firano at Naples	Collier	24	0	19	19
02/22/06	4-1-04-F-6504	200491	Corkscrew Road	Lee	20	0	47	47
02/23/06	4-1-04-F-5244	200312276	Summit Church	Lee	10	0	13	13
03/31/06	4-1-05-F-11343	20051909	Coral Keys Homes	Miami-Dade	41	0	61	61
05/05/06	41420-2006-I-0274	20056176	Santa Barbera , Davis to Radio Road, Widening	Collier	6	0	3	3
05/9/06	41420-2006-I-0263	20056298	Santa Barbara and Radio Road Widening	Collier	29	0	20	20

Table 2. Continued.

Date	Service Log Number	Corps Application Number	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved On-site (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
05/9/06	41420-2006-F-0089	20043248	Collier Boulevard, Immokalee Rd. to Goldengate Blvd.	Collier	14	0	16	16
05/16/06	4-1-05-F-10309	19971924	Sabal Bay	Collier	1,017	1,313	223	1,536
06/05/06	4-1-05-I-8486	20041688	Seacrest School	Collier	31	0	16	16
06/09/06	4-1-05-I-10965	200303733	HHJ Development	Dade	3	0	4	4
06/14/06	4-1-05-F-11855	200411010	Keysgate School	Dade	39	0	62	62
06/15/06	41420-2006-FA-0811 and I-0362	20056149	Collier County Wellfield	Collier	29	0	36	36
07/12/06	41420-2006-F-0282	200311150	Cypress Shadows	Lee	244	0	160	160
07/28/06	4-1-04-F-12330	20047920	Hamilton Place	Dade	10	0	50	50
07/28/06	4-1-04-F-7279	20041695	Raffia Preserve	Collier	131	0	119	119
08/15/06	41420-2006-I-0151	20031963	Naples Custom Homes	Collier	10	0	9	9
08/21/06	4-1-03-F-3127	19956797	Atlantic Civil Agriculture Expansion	Dade	981	0	1553	1553
08/21/06	4-1-03-I-0540	20041813	ASGM Business Park	Collier	41	0	25	25
9/12/06	41420-2006-FA-0589 and F-0554	20037414	Miccosukee Government Complex	Dade	17	0	37	37
9/22/06	41420-2006-I-0355	20040047	Immokalee Seminole Reservation Road Improvements	Collier	17	0	35	35
10/16/06	41420-2006-FA-1488 and F-0442	199507483	Miromar Lakes Addition	Lee	366	0	390	390
10/05/06	41420-2006-I-0616	20065295	New Curve on Corkscrew Road	Lee	12	0	18	18
10/18/06	41420-2007-FA-0029 and F-0787	2004777	Treeline Preserve	Lee	97	0	95	95
10/25/06	41420-2006-FA-1129 and F-0442	20047046	Koreshan Boulevard Extension	Lee	14	0	31	31
10/26/06	41420-2006-FA-1636 and F-0787	200306755	Jetway Tradeport	Lee	38	0	51.5	52

Table 2. Continued.

Date	Service Log Number	Corps Application Number	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved On-site (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
10/26/06	41420-2006-I-0849	20055702	Marina Del Lago	Lee	49	0	36	36
10/27/06	41420-2006-I-0203	20057180	Living Word Family Church	Collier	18	0	35	35
10/30/06	41420-2006-I-0607	200604878	Seminole Tribe Access Road	Hendry	2	0	5	5
11/15/06	41420-2006-TA-0727	N/A	Liberty Landing	Collier	27	0	19	19
11/15/06	41420-2007-FA-0222	200412415	5th Avenue Estates	Dade	15	0	18	18
11/16/06	41420-2006-TA-0060	N/A	Collier County Elementary School K	Collier	26	0	17	17
12/5/06	41420-2006-I-0883	20057179	Roberts Group	Lee	46	0	18	18
12/7/06	41420-2006-I-0327	20041689	Cypress Landing	Collier	59	0	29	29
03/09/07	41420-2006-F-0850	200312445	Airport Interstate Commerce Park	Lee	323	0	371	371
03/09/07	4-1-04-F-6112	20021683	Alico Airpark (Haul Ventures)	Collier	241	75	414	489
04/13/07	41420-2007-TA-0618	NA	Collier County School Site J – Everglades Blvd.	Collier	39	0	56	56
02/21/03 03/09/05 03/02/07 05/03/07	4-1-01-F-607 41420-2007-F-0674	200001926	Mirasol	Collier	773	940	182	1,122
05/04/07	41420-2007-TA-0623	NA	Abercia North	Collier	25	0	31	31
05/07/07	41420-2007-I-0581	1999-4313	Savanna Lakes	Lee	124	0	140	140
06/14/04 03/21/05 08/28/07	4-1-04-F-5744 41420-2007-F-0677	199603501	Terafina	Collier	437	210	252	462
				Totals	88,838	6,547	26,517	33,064

Table 3: Undeveloped Privately Owned Land within Florida Panther Core Area.

	Acres	Primary Equivalent Factor	Primary Equivalent Acres
Primary	610,935	1.00	610,935
Dispersal	27,883	1.00	27,883
Secondary	503,481	0.69	347,402
Other	655,996*	0.33	216,479

*About 819,995 acres are at risk in the other zone with about 80 percent with resource value.

Table 4: Land Held for Conservation within the Florida Panther Core Area.

	Acres	Primary Equivalent Factor	Primary Equivalent Acres
Primary	1,659,657	1.00	1,659,657
Dispersal	0	1.00	0
Secondary	308,623	0.69	212,950
Other	609,872	0.33	201,258

Table 5. Landscape Compensation Multipliers.

Zone of Impacted Lands	Zone of Compensation Lands	Multiplier
Primary	Secondary	1.45
Secondary	Primary	0.69
Other	Secondary	0.48
Other	Primary	0.33

Table 6. Habitat suitability values for use in assessing habitat value to the Florida panther.

Land Cover Type	Value	Land Cover Type	Value	Land Cover Type	Value
Water	0	STA	4.5	Cypress swamp	9
Urban	0	Shrub swamp	5	Sand pine scrub	9
Coastal strand	1	Shrub and brush	5	Sandhill	9
Reservoir	1.5	Dry prairie	6	Hardwood-Pine forest	9
Mangrove swamp	2	Grassland/pasture	7	Pine forest	9
Salt marsh	2	Freshwater marsh	9	Xeric oak scrub	10
Exotic plants	3	Bottomland hardwood	9	Hardwood forest	10
Cropland	4	Bay swamp	9		
Orchards/groves	4	Hardwood swamp	9		

Table 7. Wood Stork Nesting Data in the Southeastern United States (Gawlik 1987, Service 2006).

YEAR	TOTAL		FLORIDA		GEORGIA		SOUTH CAROLINA		NORTH CAROLINA	
	Nesting Pairs	Colonies	Nesting Pairs	Colonies	Nesting Pairs	Colonies	Nesting Pairs	Colonies	Nesting Pairs	Colonies
1981	4,442	22	2,365	19	275	2	11	1		
1982	3,575	22	778	19	135	2	20	1		
1983	5,983	25	2,350	22	363	2	20	1		
1984	6,245	29	1,550	25	576	3	22	1		
1985	5,193	23	1,455	17	557	5	74	1		
1986	5,835	36	5,067	29	648	4	120	3		
1987			**		506	5	194	3		
1988			**		311	4	179	3		
1989			**		543	6	376	3		

YEAR	TOTAL		FLORIDA		GEORGIA		SOUTH CAROLINA		NORTH CAROLINA	
	Nesting Pairs	Colonies	Nesting Pairs	Colonies	Nesting Pairs	Colonies	Nesting Pairs	Colonies	Nesting Pairs	Colonies
1990			**		709	10	536	6		
1991	4,073	37	2,293	23	969	9	664	3		
1992			**		1,091	9	475	3		
1993	6,729	43	4,262	28	1,661	11	806	3		
1994	5,768	47	3,589	26	1,468	14	712	7		
1995	7,853	54	5,617	33	1,501	17	829	6		
1996			**		1,480	18	953	7		
1997	5,166	59	2,870	36	1,379	15	917	8		
1998			**		1,665	15	1,093	10		
1999	9,000	63	7341	42	1,139	13	520	8		
2000			**		566	7	1,236	11		
2001	4,998	44	2,662	22	1,162	12	1,174	9		
2002	7,855	70	5,463	48	1,256	14	1,136	10		
2003	9,551	78	6,449	49	1,653	18	1,356	11		
2004	8,857	93	5,227	63	1,596	17	2,034	13		
2005	5,560	74	2,336	41	1,817	19	1,407	14	32	1
2006	11,232	81	7,216	49	1,928	21	1,963	12	125	1

**Some data from Florida not readily available due to inconsistent survey or reporting.

Table 8. Total Number of Wood Stork Nesting Pairs within the Everglades and Big Cypress Basins, 1996 to Present**.**

Year	Nesting Pairs	3-Year Running Average
1996	600	-
1997	445	-
1998	475	507
1999	4,549	1,823
2000	3,996	3,007
2001	2,681	3,742
2002	2,880	3,186
2003	2,386	2,649
2004	1,015	2,094
2005	634	1,345
2006	2,710	1,453

Table 9. Panther-Vehicle Collisions within the Terafina Action Area as of August 22, 2007.

Distance from Project	Roadway	Year	Sex	Panther	Result
24 miles southeast	SR 29	1979	F	UCFP04	Death
22 miles east	SR 29	1980	M	UCFP05	Death
22 miles southeast	SR 84	1983	M	FP01	Death
20 miles southeast	SR 84	1984	F	UCFP12	Death
20 miles southeast	SR 84	1985	F	UCFP13	Death
21 miles southeast	SR 84	1985	M	FP04	Death
14 miles south	CR 951	1985	F	NONE	Injury
20 miles southeast	SR 84	1986	F	UCFP15	Death
23 miles east	CR 858	1987	M	FP20	Injury
22 miles east	SR 29	1988	M	FP13	Death
18 miles north	Daniels Road	1989	M	FP28	Injury
17 miles northeast	CR 850	1989	M	UCFP18	Death
24 miles southeast	SR 29	1990	M	FP37	Death
22 miles east	SR 29	1991	F	UCFP20	Death
14 northwest	Alico Road	1992	M	NONE	Injury
22 miles east	SR 29	1992	F	UCFP21	Death
18 miles northwest	Daniels Road	1993	M	UCFP22	Death
22 miles east	SR 29	1994	F	FP31	Death
23 miles northeast	CR 846	1995	F	FP52	Death
23 miles southeast	SR 29	1998	M	FP64	Death
23 miles southeast	SR 29	1998	M	FP51	Injury
21 miles east	CR 858	2000	M	K76	Death
21 miles northeast	CR 846	2000	M	UCFP35	Death
24 miles northeast	CR 846	2000	F	UCFP37	Death
22 miles east	SR 29	2001	M	UCFP41	Death
22 miles east	SR 29	2002	M	FP98	Death
22 miles northeast	CR 846	2002	F	UCFP49	Death
7 miles east	CR 846	2002	M	FP99	Death
14 miles northeast	CR 846	2003	M	UCFP50	Death
22 miles east	SR 29	2003	F	FP106	Death
22 miles east	SR 29	2003	F	UCFP53	Death
22 miles east	SR 29	2003	M	UCFP54	Death
14 miles northeast	CR 846	2003	F	UCFP58	Death
21 miles east	CR 858	2003	F	UCFP59	Death
23 miles southeast	US 41	2003	M	UCFP60	Death
10 miles southeast	I-75	2004	M	UCFP63	Death
23 miles southeast	SR 29	2004	M	UCFP65	Death
14 miles southeast	I-75	2004	M	UCFP66	Death
11 miles south	I-75	2004	M	K94	Death
22 miles east	SR 29	2004	F	UCFP69	Death
22 miles east	SR 29	2004	F	UCFP70	Death
14 miles south	CR 951	2005	M	UCFP73	Death
22 miles northeast	SR 29	2005	M	UCFP75	Death
11 miles south	CR 951	2005	M	K153	Death

Distance from Project	Roadway	Year	Sex	Panther	Result
17 miles south	US 41	2005	M	UCFP76	Death
7 miles east	CR 846	2006	F	UCFP79	Death
25 miles north	I-75	2006	M	UCFP81	Death
11 miles north	Corkscrew Road	2006	M	UCFP87	Death
17 miles south	US 41	2006	F	UCFP88	Death
11 miles north	Corkscrew Road	2007	M	UCFP93	Death
10.9 miles north	Corkscrew Road	2007	F	UCFP97	Death
11 miles south	I-75	2007	M	UCFP94	Death
19.1 miles north	SR 82	2007	M	UCFP99	Death
22.3 miles east	SR 29	2007	M	UCFP100	Death

Table 10. County and State Acquisitions within the Action Area (Acres).

Year	County	State
2000	413	2,200
2001	589	2,471
2002	2,033	3,830
2003	66	65
2004	0	0
2005	59	0
Totals	3,160	8,566

Table 11. Panther Habitat Units - Terafina Development.

		Development 437 acres				Onsite Preserve 210 acres				CREW 154 acres				Hendry County 107 acres			
Land Cover Type	*Score*	Acres Before	Panther Habitat Units	Acres After	Panther Habitat Units	Acres Before	Panther Habitat Units	Acres After	Panther Habitat Units	Acres Before	Panther Habitat Units	Acres After	Panther Habitat Units	Acres Before	Panther Habitat Units	Acres After	Panther Habitat Units
Water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Urban	0	4	0	437	0	2	0	0	0	0	0	0	0	0	0	0	0
Coastal strand	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reservoir	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mangrove swamp	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Salt marsh	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exotic plants	3	352	1056	0	0	168	504	0	0	23	69	0	0	27	80	0	0
Crop land	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orchards/groves	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STA	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shrub swamp	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shrub and brush	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry prairie	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grassland/pasture	7	0	0	0	0	0	0	0	0	0	0	0	0	6	45	6	45
Freshwater marsh	9	4	39	0	0	2	19	0	0	0	0	0	0	37	337	54	482
Bottomland hardwood	9	0	0	0	0	0	0	0	0	0	0	0	0	1	10	2	19
Bay swamp	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardwood swamp	9	0	0	0	0	0	0	0	0	0	0	0	0	2	19	3	29
Cypress swamp	9	13	118	0	0	6	57	158	1418	131	1178	154	1386	3	29	3	29
Sand pine scrub	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sandhill	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardwood-pine forest	9	0	0	0	0	0	0	0	0	0	0	0	0	1	10	1	10
Pine forest	9	63	567	0	0	32	284	53	473	0	0	0	0	29	260	37	337
Xeric oak scrub	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardwood forest	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		437	1780	437	0	210	863	210	1890	154	1247	154	1386	107	790	107	950

Table 12. Terafina Consultation Area Project List – Panthers.

Less than 5 percent Wetland Acres						
Project Name	**Wetland Acres**	**Total Acres**	**Percent Wetland Acres**	**DRI**	**PUD**	**District**
ALICO LAKES VILLAGE	0.00	10.79	0.00%			2005
APEX CENTER*	3.10	62.50	4.96%			2003
ARROWHEAD RESERVE	0.00	39.58	0.00%			2005
AVE MARIA PHASE 2*	35.97	965.58	3.73%			2005
AVE MARIA UNIVERSITY*	35.97	965.58	3.73%			2003
AVE MARIA UNIVERSITY AND TOWN*	35.97	965.58	3.73%			2005
BIG BEAR PLAZA	0.00	5.46	0.00%		2005	
BOBCAT OF NAPLES	0.00	3.57	0.00%			2004
CORKSCREW ROAD CURVES IMPROVEMENTS*	0.00	0.29	0.00%			2004
DQ GRILL AND CHILL AT SHERWOOD	0.00	1.20	0.00%			2005
EVERGLADES ECOTOUR LODGE	0.00	12.82	0.00%			2005
FIFTH THIRD BANK - FT MYERS	0.00	1.19	0.00%			2005
LEE BOULEVARD 130	0.00	24.00	0.00%			2003
LEE COUNTY GUN RANGE	0.00	9.59	0.00%			2003
LEE PARKLAND GOLF AND COUNTRY CLUB	0.13	47.19	0.28%			2004
LEE PARKLANDS - NORTHWEST MODIFICATIONS	0.00	43.80	0.00%			2003
LIVING WORD FAMILY CHURCH	0.00	17.95	0.00%			2005
MOBIL SERVICE STATION RAS NO 81285	0.00	1.39	0.00%			2004
NEW TRUCK TIRE SERVICE SHOP AND WAREHOUSE	0.00	1.20	0.00%			2005
ORANGE BLOSSOM RANCH	0.00	522.43	0.00%			2005
PARKLANDS WEST LEE PARKLANDS GOLF AND COUNTRY CLUB	0.00	7.81	0.00%			2004
PARKLANDS WEST-NORTHEAST MODIFICATIONS	0.00	7.81	0.00%			2003
PREVATT BORROW PIT	0.00	92.40	0.00%			2006
QUARRY LAKE ESTATES	0.00	42.98	0.00%			2004
REGAL ACRES	0.02	36.73	0.07%		2005	
VILLAGE WALK - BONITA SPRINGS	0.00	164.27	0.00%			2003
TOTAL		4,053.71				

*Projects have been reviewed under a separate Federal Action and acreage has been removed from the cumulative effects acreages. Cumulative effects acreage is 1,094.45.

Table 13. Foraging Suitability Values for Various Densities of Exotics.

Cover Type**	# of Species (S)	# of Individuals (I)	S * I	Foraging Suitability Value**
DMM[e]	1	2	2	0
DMS[d]	4	10	40	3
P75[c]	10	59	590	37
P50[b]	11	92	1012	64
MAR[a]	12	132	1584*	100

*Represents maximum number of individuals

** - Example 11*92=1012/1584*100=63.89 or 64 percent

Exotic Percentage**	Foraging Suitability (Percent)
Between 0 and 25 percent exotics	100
Between 25 and 50 percent exotics	64
Between 50 and 75 percent exotics	37
Between 75 and 90 percent exotics	3
Between 90 and 100 percent exotics	0

In our evaluation of a habitat's suitability, the field distinction between an exotic coverage of 90 percent and 100 percent in many situations is not definable, therefore unless otherwise noted in the field reports and in our analysis; we consider a suitability value of 3 percent to represent both system profiles.

Table 14. Acreages of Habitats within the Impact Footprint.

	Pre-Development Acreage Total	< 25% Melaleuca Coverage	25% - 50% Melaleuca Coverage	50% - 75% Melaleuca Coverage	75%-100% Melaleuca Coverage*	90%-100% Melaleuca Coverage
UPLANDS						
411 – Pine Flatwoods	67.33	67.33				
WETLANDS						
424 – Melaleuca	179.35				179.35	
621 – Cypress	0.35			0.35		
624 – Pine / Cypress Flatwood	9.9			9.09		
625 – Hydric Pine Flatwood	103.86		3.28	100.58		
643 – Disturbed Prairie	3.02	3.02				
DEVELOPMENT TOTAL	**363**	**70.35**	**3.28**	**110.02**	**179.35**	

*No distinctions were made between exotic coverage between 75 percent and 100 percent.

Table 15. Acres of Suitable Foraging Habitat within the Development Footprint.

	Pre-Development Acreage	< 25% Melaleuca Coverage	25% - 50% Melaleuca Coverage	50% - 75% Melaleuca Coverage	75% - 100% Melaleuca Coverage
424 – Melaleuca	179.35				179.35
621 – Cypress	0.35			0.35	
624 – Pine / Cypress Flatwood	9.9			9.09	
625 – Hydric Pine Flatwood	103.86		3.28	100.58	
643 – Disturbed Prairie	3.02	3.02			
TOTAL	**295.67**	**3.02**	**3.28**	**110.02**	**179.35**

Table 16. Hydroperiod Classes of Wetlands Suitable for Wood Stork Foraging in the Action Area.

Hydroperiod	Combined Suitable Wood Stork Core Foraging Area Acreage
Class 1 - 0 to 60 days	227,845
Class 2 - 60 to 120 days	
Class 3 - 120 to 180 days	
Class 4 - 180 to 240 days	253,821
Class 5 - 240 to 300 days	
Class 6 - 300 to 330 days	
Class 7 - 330 to 365 days	
TOTAL	**481,666**

Table 17. Acres per Hydroperiod Classes of Wetlands Suitable for Wood Stork Foraging in the Project Area.

Hydroperiod	Development Footprint Acres
Class 1 - 0 to 60 Days	
Class 2 - 60 to 120 Days	
Class 3 - 120 to 180 Days	295.67
Class 4 - 180 to 240 Days	
Class 5 - 240 to 300 Days	
Class 6 - 300 to 330 Days	
Class 7 - 330 to 365 days	
TOTAL	**295.67**

Table 18. Acres per Hydroperiod Classes of Wetlands Suitable for Wood Stork Foraging in the Preserve Area. (Pre and Post enhancement activities).

Hydroperiod	Preserve Area Footprint Pre-Enhancement -Acres	Preserve Area Footprint Post-Enhancement - Acres
Class 1 - 0 to 60 Days		
Class 2 - 60 to 120 Days		
Class 3 - 120 to 180 Days	256.76	251.90
Class 4 - 180 to 240 Days	4.71	9.56
Class 5 - 240 to 300 Days		
Class 6 - 300 to 330 Days		
Class 7 - 330 to 365 days		
TOTAL	**261.47**	**261.47**

Table 19. Acres per Hydroperiod Classes of Wetlands Suitable for Wood Stork Foraging in the Hendry County Preserve Area. (Pre and Post enhancement activities).

Hydroperiod	Preserve Area Footprint Pre-Enhancement - Acres	Preserve Area Footprint Post-Enhancement -Acres
Class 1 - 0 to 60 Days		
Class 2 - 60 to 120 Days		
Class 3 - 120 to 180 Days	11.23	11.23
Class 4 - 180 to 240 Days	49.10	49.10
Class 5 - 240 to 300 Days		
Class 6 - 300 to 330 Days		
Class 7 - 330 to 365 days		
TOTAL	**60.33**	**60.33**

Table 20. Acreage and Biomass in Individual Hydroperiod Classes of Wetlands Suitable for Wood Stork Foraging in the Development and the pre and post Restoration of the Preserves.

Hydroperiod	Existing Footprint		Preserve Areas				Net Change*	
			Pre Enhancement		Post Enhancement			
	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams
Class 1 - 0 to 60 Days								
Class 2 - 60 to 120 Days								
Class 3 - 120 to 180 Days	295.67	129.29	267.99	184.43	263.13	661.81	(300.53)	348.09
Class 4 - 180 to 240 Days			53.81	252.64	58.67	274.18	4.86	21.54
Class 5 - 240 to 300 Days								
Class 6 - 300 to 330 Days								
Class 7 - 330 to 365 days								
TOTAL	**295.67**	**129.29**	**321.80**	**437.07**	**321.80**	**935.99**	**(295.67)**	**369.63**

- The acreage net change is based on the overall increase/decrease in suitable wood stork foraging habitat within the project. In this analysis all wetlands were considered suitable for wood stork foraging, although of various levels of exotics. The project will result in the loss of 295.67 acres of Class 3 wetlands within the development footprint and the loss of 4.86 acres of Class 3 wetlands in the adjacent on-site preserve. The loss in the Class 3 on-site preserve wetlands is associated with the conversion of 4.86 acres from Class 3 to Class 4 wetlands to create concentration pools in the adjacent on-site preserve. The corresponding increase in Class 4 wetlands is the result of the Class 3/Class 4 conversion.

- The biomass net change is based on the overall increase/decrease of fish biomass available to wood storks. The proposed development will provide a loss of 129.29 kg of biomass. The preserves, prior to enhancement, provide a biomass of 437.07 kg, with a post enhancement value of 935.99 kg, equating to an increase of 498.92 kg of biomass. Subtraction the development loss from the biomass increase from the preserve restorations, the proposed action provides a net increase of 369.63 kg of biomass available for wood stork foraging, with a corresponding Class 3 increase of 348.09 kg and 21.54 kg increase in Class 4.

Table 21. Terafina Wood Stork Suitable Foraging Prey Base Loss (Development Area).

USFWS Habitat Code	Wetland Restoration (Acres)	Wetland Restoration (m^2)	Foraging Suitability Value	Biomass/Hydroperiod (grams/ m^2)	Wood Stork Consumption Percentage	Fish Biomass (Kg)
DM	179.35	725,803.70	0.03	1.13	0.55	13.53
HP75	100.58	407,032.82	0.37	1.13	0.55	93.60
HP50	3.28	13,273.69	0.70	1.13	0.55	5.77
HP	-	-	-	-	-	-
C75	0.35	1,416.40	0.37	1.13	0.55	0.33
C50	-	-	-	-	-	-
C	-	-	-	-	-	-
PC75	9.09	36,785.92	0.37	1.13	0.55	8.46
PC50	-	-	-	-	-	-
PC	-	-	-	-	-	-
WS50	-	-	-	-	-	-
WS	-	-	-	-	-	-
M50	-	-	-	-	-	-
M	3.02	12,221.51	1.00	1.13	0.55	7.60
Totals	**295.67**	**1,196,534.04**	**-**	**-**	**-**	**129.29**

USFWS = U.S. Fish and Wildlife Service
DM = Dense Melaleuca (>75% Coverage)
HP75 = Hydric Pine (50-75% Coverage)
HP50 = Hydric Pine (25-50% Coverage)
HP = Hydric Pine (0-24% Coverage)
C75 = Cypress (50-75% Coverage)
C50 = Cypress (25-50% Coverage)
C = Cypress (0-24% Coverage)
PC75 = Pine/Cypress (25-50% Coverage)
PC50 = Cypress (25-24% Coverage)
PC = Pine/Cypress (0-24% Coverage)
WP = Wetland Prairie (0-24% Coverage)
WS50 = Wetland (25-50% Coverage)
WS = Wetland Shrub (0-24% Coverage)
M50 = Marsh (25-50% Coverage)
M = Marsh (0-24% Coverage)

Table 21a. Terafina Preserve – Wood Stork Suitable Foraging Prey Base Pre-Enhancement – On-site.

USFWS Habitat Code	Wetland Restoration (Acres)	Wetland Restoration (m^2)	Foraging Suitability Value	Biomass/Hydroperiod (grams/ m^2)	Wood Stork Consumption Percentage	Fish Biomass (Kg)
DM	35.60	548,753.73	0.03	1.13	0.55	10.23
HP75	68.85	278,626.06	0.37	1.13	0.55	64.07
HP50	7.19	29,089.68	0.70	1.13	0.55	12.66
HP	1.08	4,370.60	1.00	1.13	0.55	2.72
C75	15.03	60,824.25	0.37	1.13	0.55	13.99
C50	18.68	75,595.28	0.70	1.13	0.55	32.89
C	5.09	20,593.39	1.00	1.13	0.55	12.80
PC75	0.68	2,751.18	0.37	1.13	0.55	0.63
PC50	2.53	10,236.01	0.70	1.13	0.55	4.45
PC	0.56	2,265.68	1.00	1.13	0.55	1.41
WP	0.06	242.81	1.00	1.13	0.55	0.15
WS50	3.56	14,403.24	0.70	2.10	0.55	11.65
WS	1.15	4,652.73	1.00	2.10	0.55	5.37
M50	0.10	404.59	0.70	1.13	0.55	0.18
M	1.31	5,300.07	1.00	2.10	0.55	6.12
Totals	**261.47**	**1,030,840.19**	-	-	-	**179.32**

Table 21b. Terafina Preserve – Wood Stork Suitable Foraging Prey Base Post Enhancement – On-site.

USFWS Habitat Code	Wetland Restoration (Acres)	Wetland Restoration (m^2)	Foraging Suitability Value	Biomass/Hydroperiod (grams/ m^2)	Wood Stork Consumption Percentage	Fish Biomass (Kg)
DM	-	-	-	-	-	-
HP75	-	-	-	-	-	-
HP50	-	-	-	-	-	-
HP	77.12	312,093.57	1.00	1.13	0.55	193.97
C75	-	-	-	-	-	-
C50	-	-	-	-	-	-
C	92.81	375,588.74	1.00	1.13	0.55	233.43
PC75	-	-	-	-	-	-
PC50	-	-	-	-	-	-
PC	34.40	139,211.86	1.00	1.13	0.55	86.52
WP	0.06	242.81	1.00	1.13	0.55	0.15
WS50	-	-	-	-	-	-
WS	4.71	19,055.97	1.00	2.10	0.55	22.01
M50	-	-	-	-	-	-
M	47.52	192,306.62	1.00	1.13	0.55	119.52

USFWS Habitat Code	Wetland Restoration (Acres)	Wetland Restoration (m^2)	Foraging Suitability Value	Biomass/Hydroperiod (grams/ m^2)	Wood Stork Consumption Percentage	Fish Biomass (Kg)
M	4.85	19,627.25	1.00	2.10	0.55	22.67
Totals	**261.47**	839,556.11	-	-	-	**678.27**

Table 22. Terafina Preserve – Wood Stork Suitable Foraging Prey Base Post Enhancement – Hendry County Site.

USFWS Habitat Code	Wetland Restoration (Acres)	Wetland Restoration (m^2)	Foraging Suitability Value*	Biomass/Hydroperiod (grams/ m^2)	Wood Stork Consumption Percentage	Fish Biomass (Kg)
HP	2.45	9,914.80	1.00	1.13	0.55	6.16
WS	6.69	27,073.47	1.00	1.13	0.55	16.83
WP	2.09	8,457.93	1.00	1.13	0.55	5.26
M	49.10	198,700.65	1.00	2.10	0.55	229.50
Totals	**60.33**	**244,146.85**	-	-	-	**257.75**

- **Exotics averaged less than 25 percent, therefore there is no calculated biomass lift associated with restoration**

There is also no calculated lift associated with the proposed acquisition of 154 acres of wetlands in CREW as the location, hydroperiod, and exotic levels within these wetlands is unknown at this time.

Table 23. Terafina Consultation Area Project List – Wood Storks.

Less than 5 percent Wetland Acres						
Project Name	**Total Acres**	**Wetland Acres**	**Percent Wetland Acres**	**DRI**	**PUD**	**District**
ESTERO COMMUNITY PARK	54.28	0.13	0.25%			2005
ALICO LAKES VILLAGE	31.71	0.09	0.27%			2005
BIG CYPRESS ELEMENTARY SCHOOL	19.55	0.06	0.32%			2002
Robb and Stucky Warehouse	19.28	0.08	0.42%		2004	
COLLIER COUNTY PUBLIC SCHOOL BUS GARAGE	4.15	0.02	0.42%			2001
Eagle Ridge Park	2.43	0.01	0.44%		2004	
CROWN POINTE	15.63	0.07	0.48%			
Big Bend Development, LLC	0.87	0	0.51%		2005	
DAIRY QUEEN AT IMPERIAL - BONITA PLAZA	1.66	0.01	0.52%			2003
BAYSIDE MARKETPLACE	6.34	0.04	0.63%			2002
AMERIMED CENTER	8.5	0.06	0.69%			
Williams Three Oaks CPD	9.92	0.11	1.06%		2004	
Whispering Lakes II fka Bethany Place	79.21	0.89	1.12%		2005	
CODY LEE ROAD EXTENSION	29.78	0.43	1.44%			2005
DANIELS FALLS	29.78	0.43	1.44%			2005
COLLIER REGIONAL MEDICAL	0.44	0.01	1.45%			2002
COLLIER REGIONAL MEDICAL CENTER	0.44	0.01	1.45%			2002
APEX CENTER*	93.47	1.7	1.81%			2004
Galleria West	14.49	0.27	1.84%		2003	
Gulf Coast Hospital Medical Center	46.66	1.29	2.77%		2005	
C-1 CANAL AT 10TH STREET SE	10.92	0.33	3.02%			2002
CAROLINA VILLAGE	15.54	0.47	3.06%		2005	
EVERGLADES ECOTOUR LODGE	65.25	2.04	3.12%			2001
Blessed Pope John 23rd Church	39.38	1.26	3.19%		2003	
BLESSED POPE JOHN XXIII - PHASE 1 AND 2	39.26	1.26	3.20%			2004
IMPERIAL ST 4 LANING - BONITA BEACH RD TO E TERRY ST	13.39	0.45	3.36%			2005
JASMINE BAY AT WEST BAY CLUB	4.64	0.16	3.41%			2003
AVE MARIA PHASE 2*	965.58	35.95	3.72%			2002
AVE MARIA UNIVERSITY*	965.58	35.95	3.72%			2002
AVE MARIA UNIVERSITY AND TOWN*	965.58	35.95	3.72%			2002
Phillip Lee Homes CPD	1.32	0.05	3.89%		2006	
HOPE LUTHERAN CHURCH	35.21	1.41	4.00%			2003
JOEL BLVD SIDEWALK IMPROVEMENTS (CTY RD 884)	11.83	0.14	1.00%			2004
	3602.07	**121.13**				

*Projects have been reviewed under a separate Federal Action and acreage has been removed from the cumulative effects acreages. Cumulative effects acreage is 611.86 acres affecting 11.58 acres.

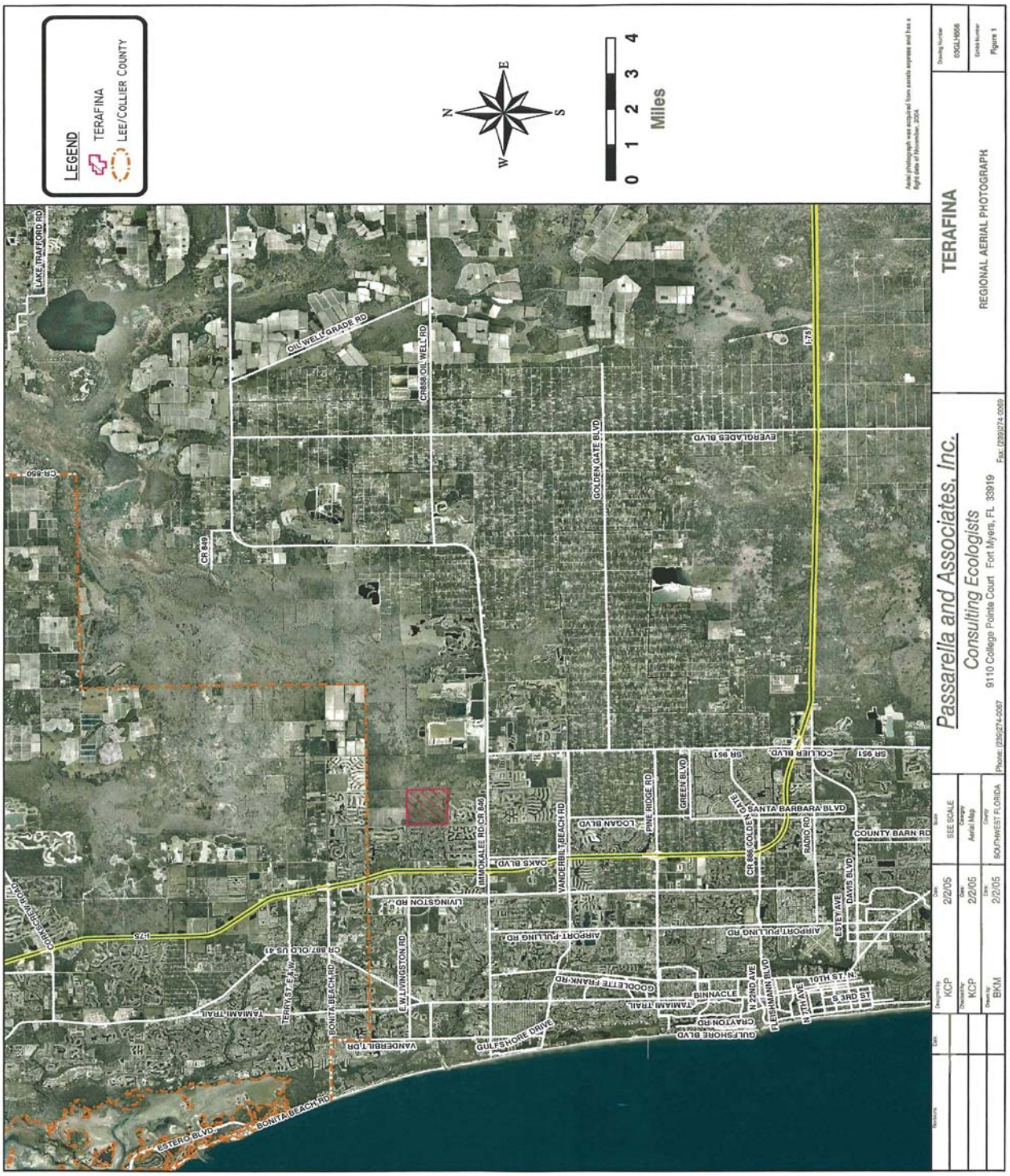

Figure 1. Map of the "Terafina" development project site.

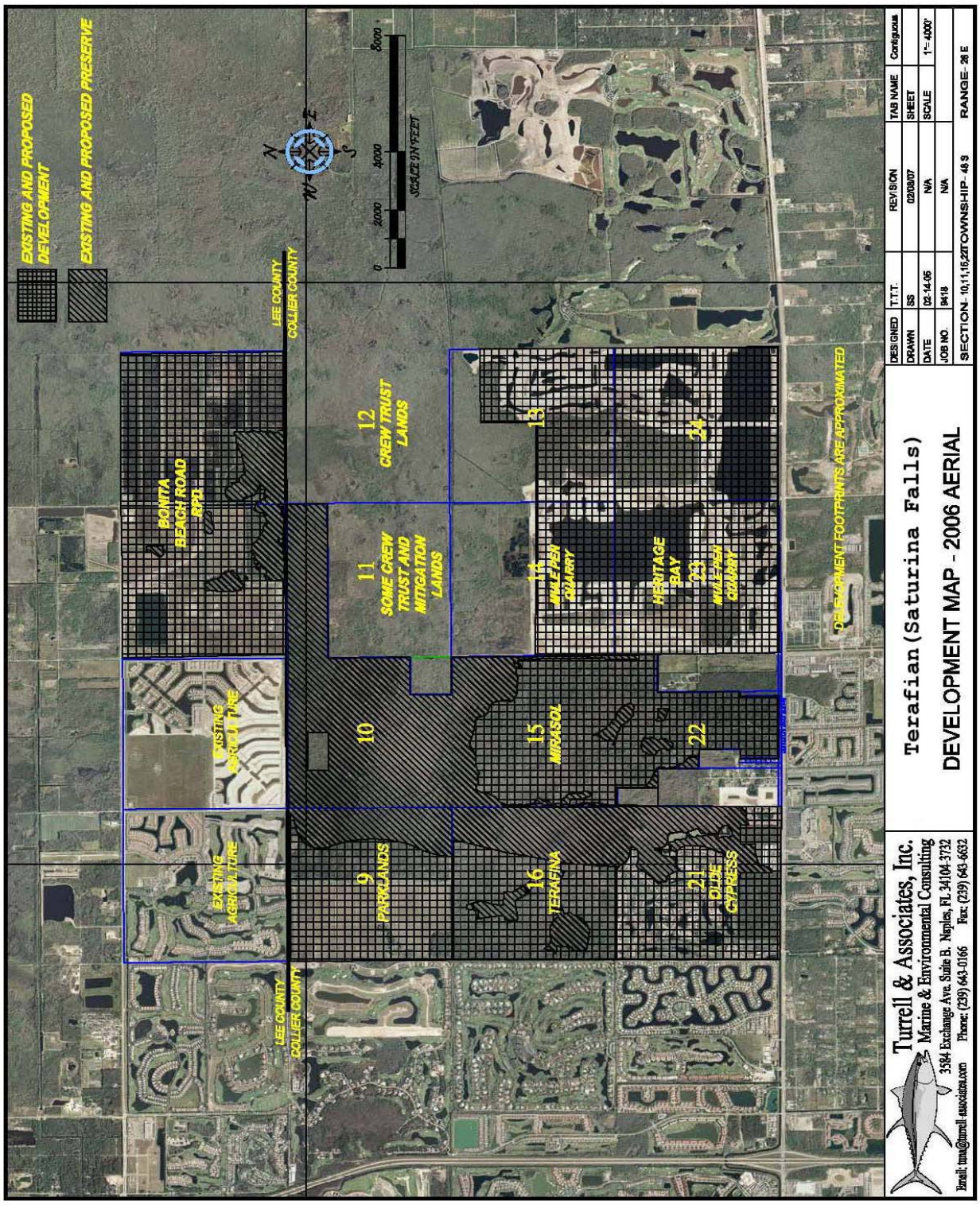

Figure 2. Proposed Terafina Development.

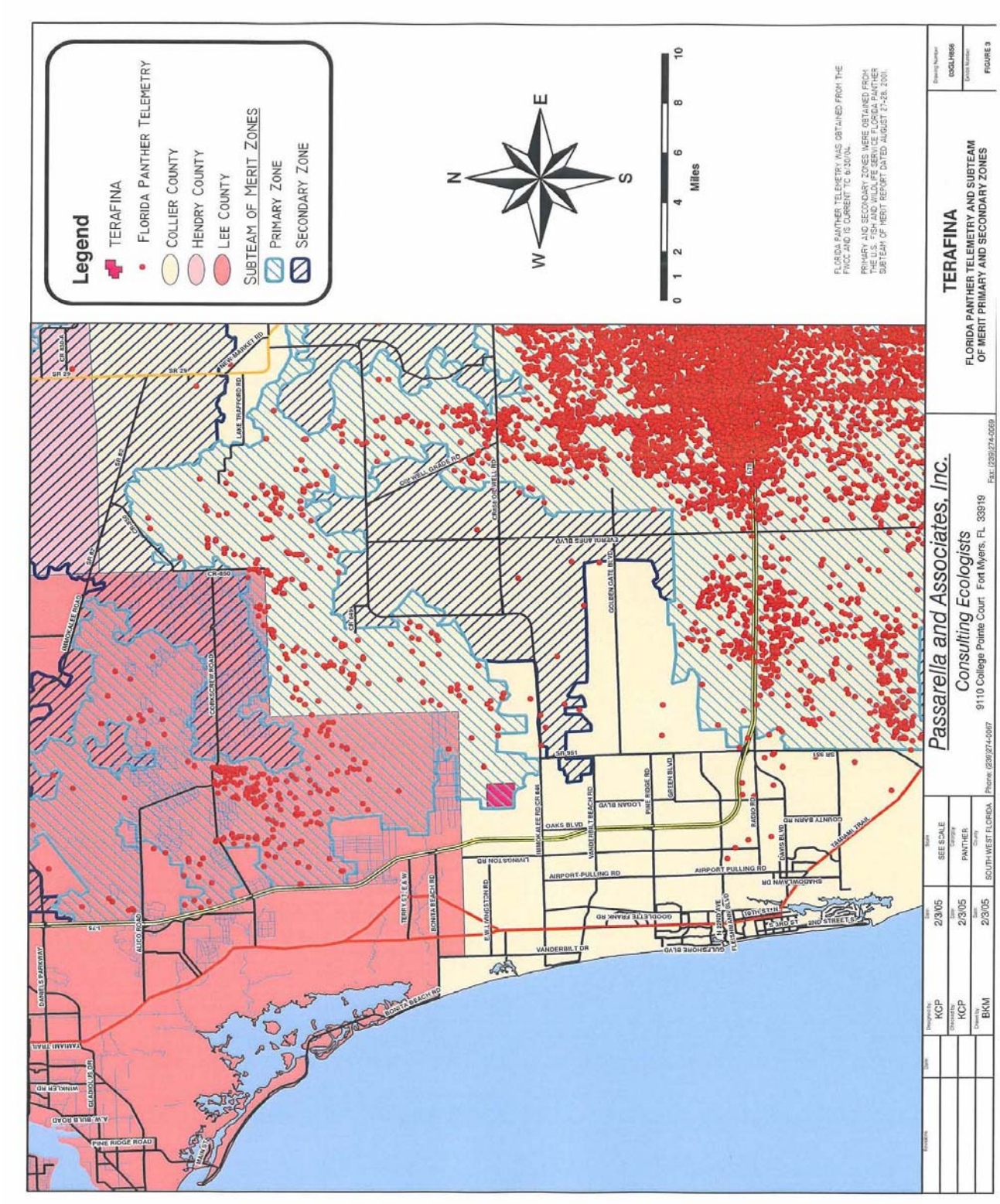

Figure 3. Terafina Development in relation to panther Primary and Secondary Zones and telemetry.

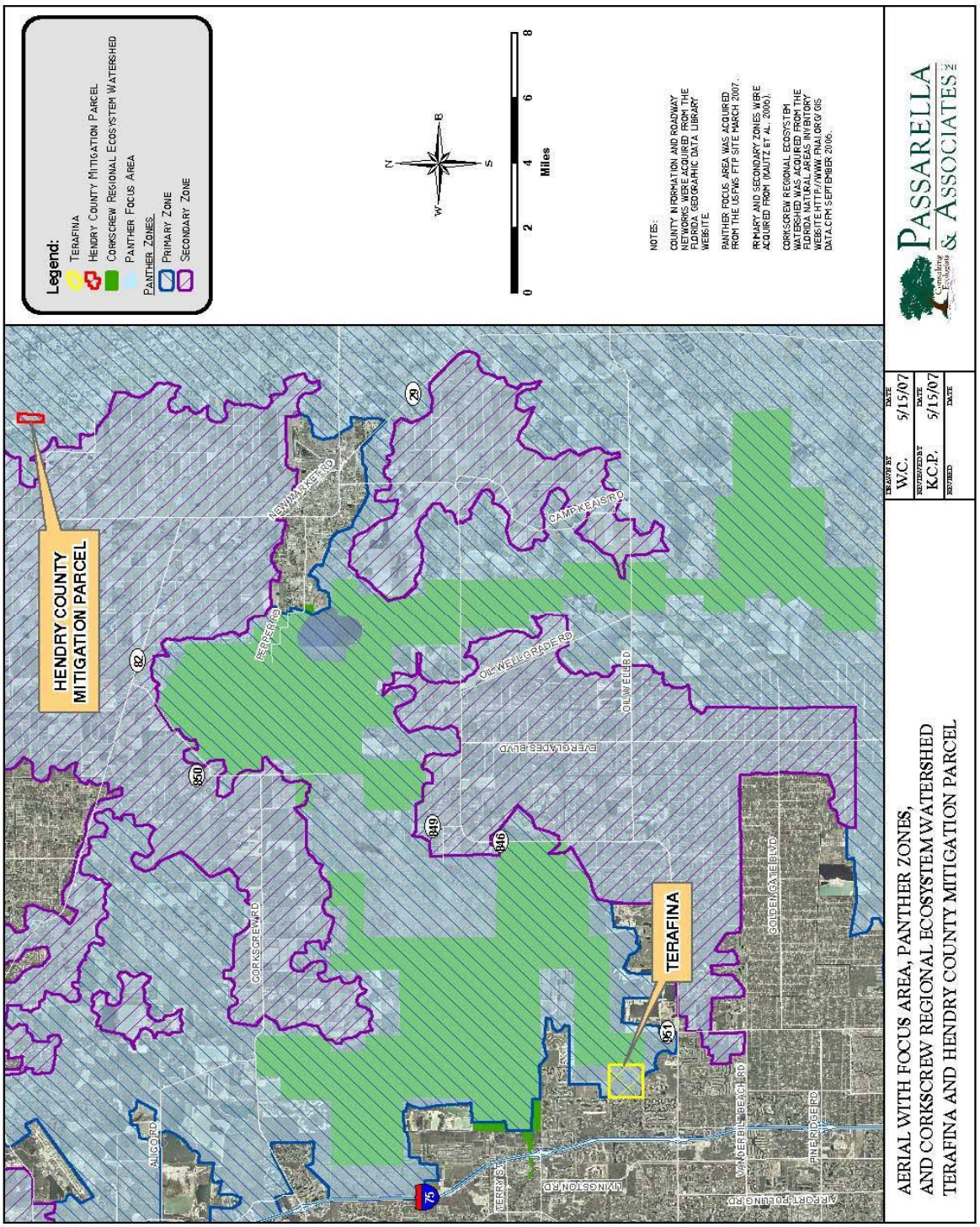

Figure 4a. 107-acre Hendry County Compensation Site.

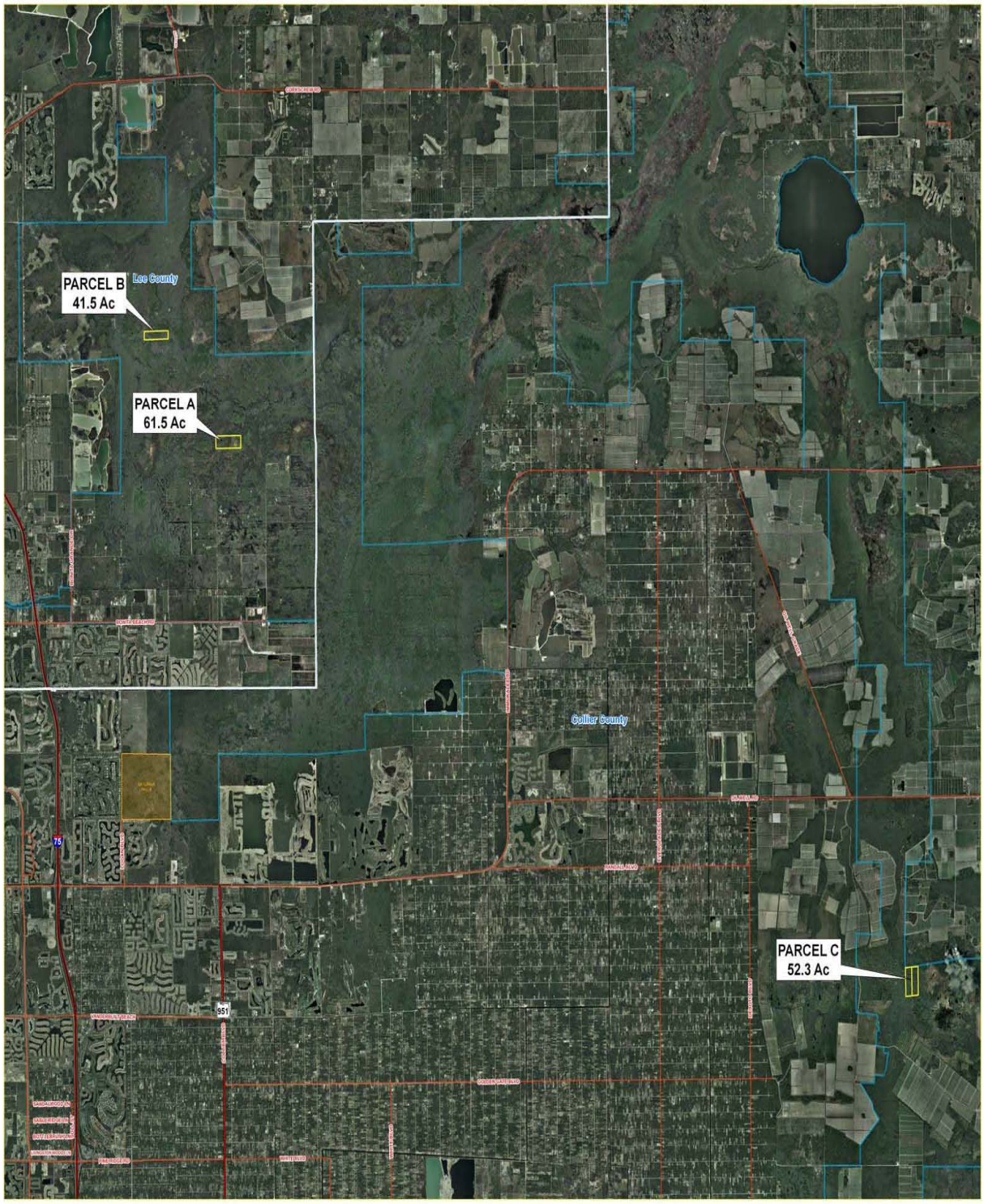

Figure 4b. 154 acres of Crew Compensation Sites.

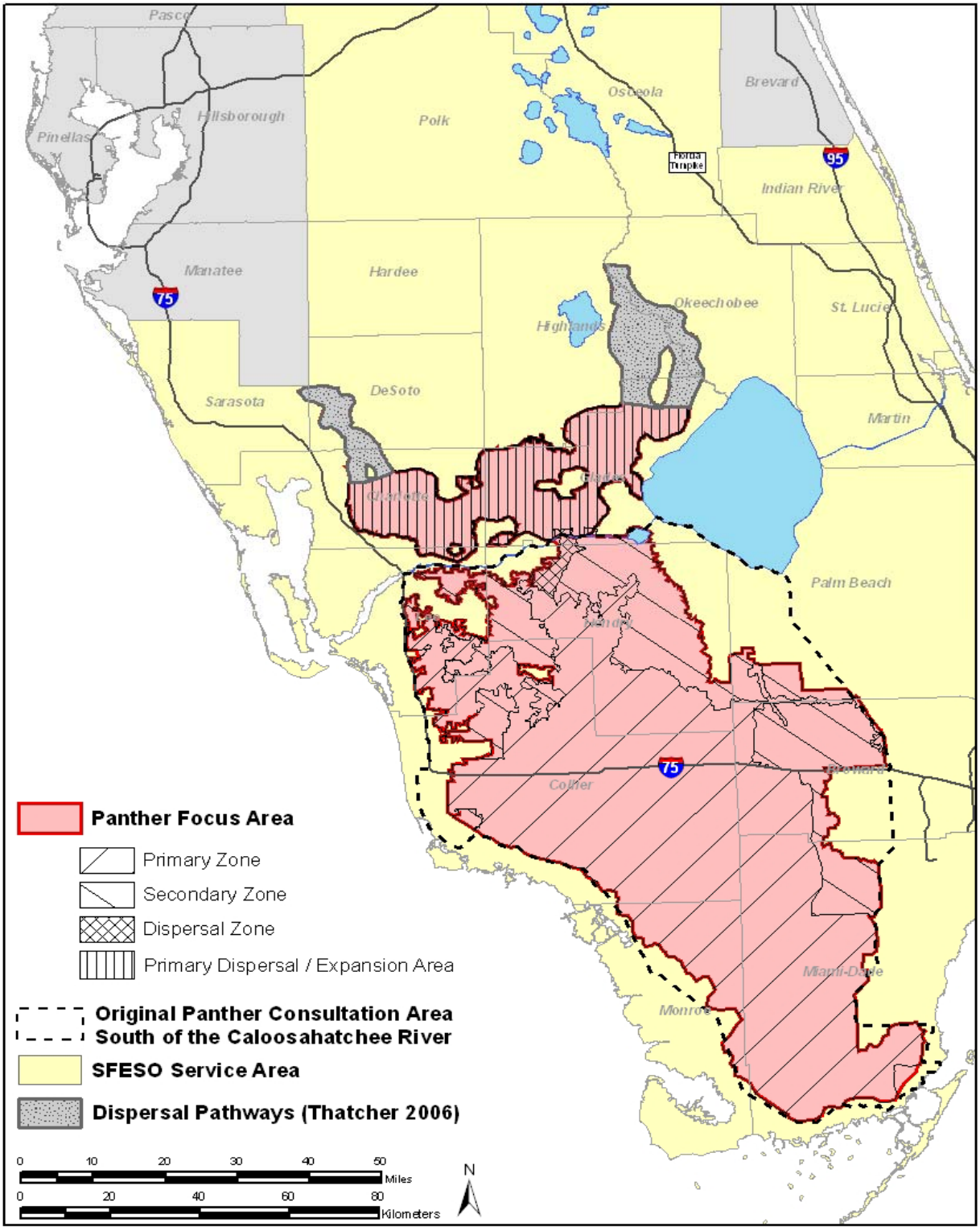

Figure 5. Florida Panther Focus Area.

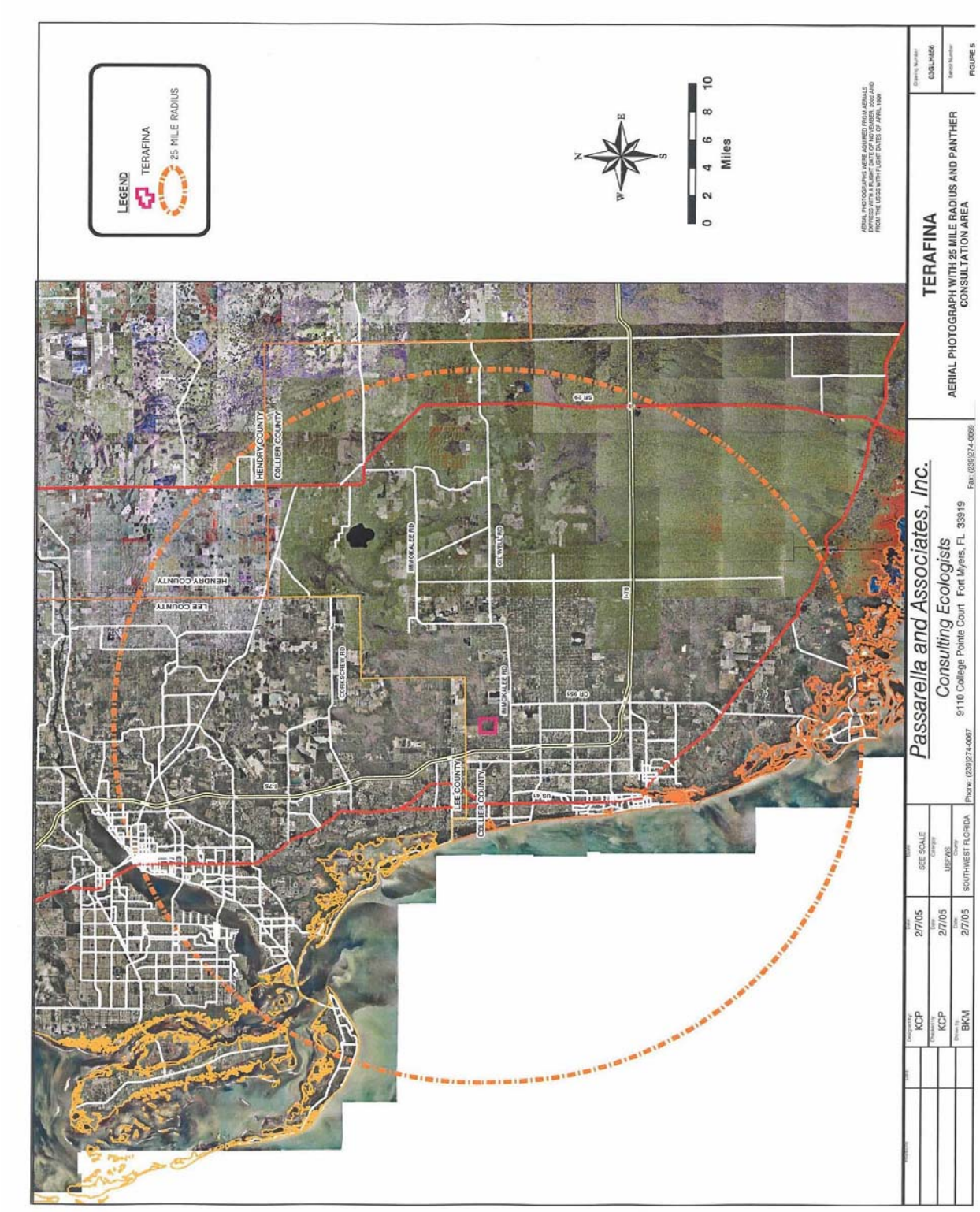

Figure 6. Regional aerial map showing 25-mile action area for the panther.

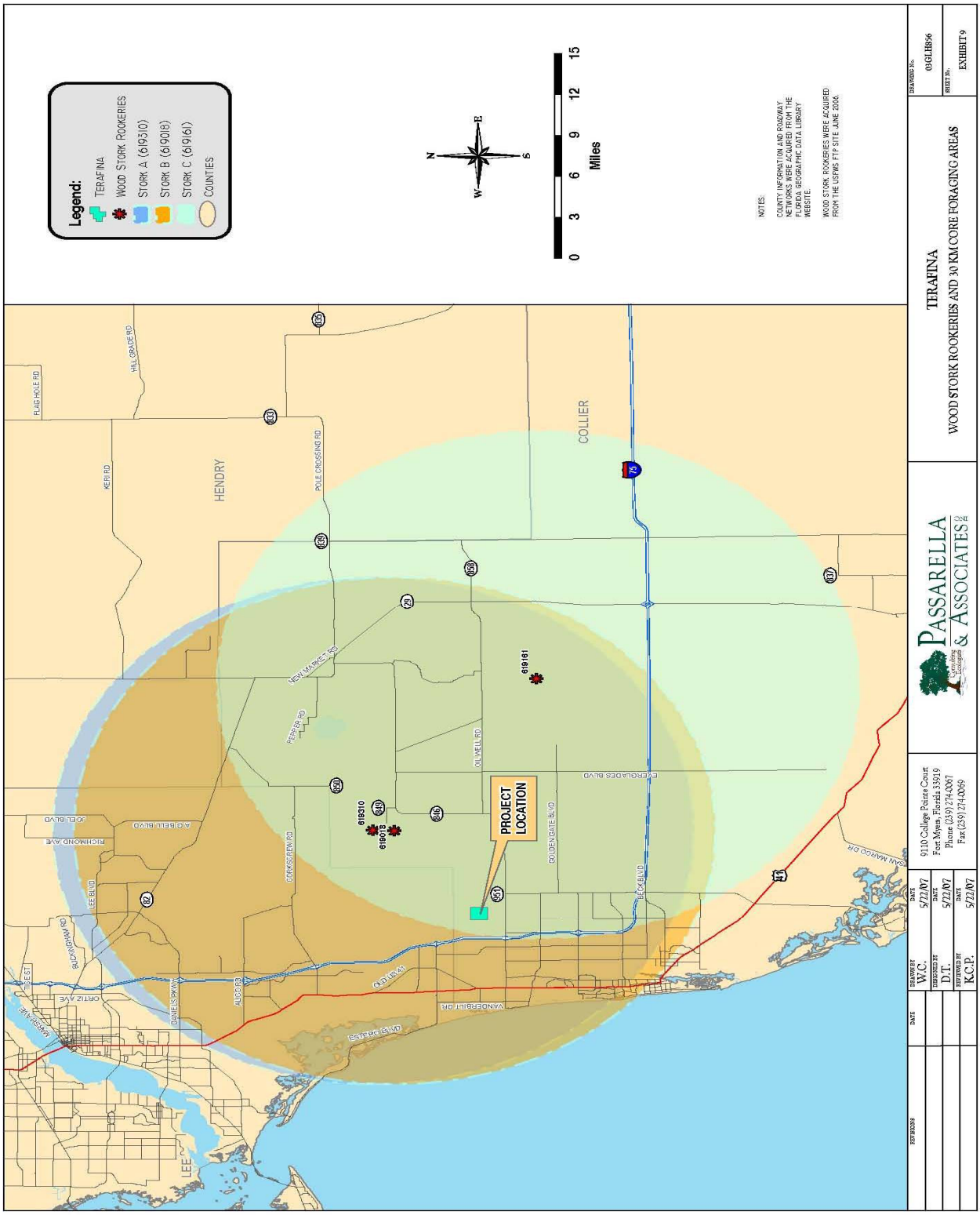

Figure 7. Action area for the wood stork.

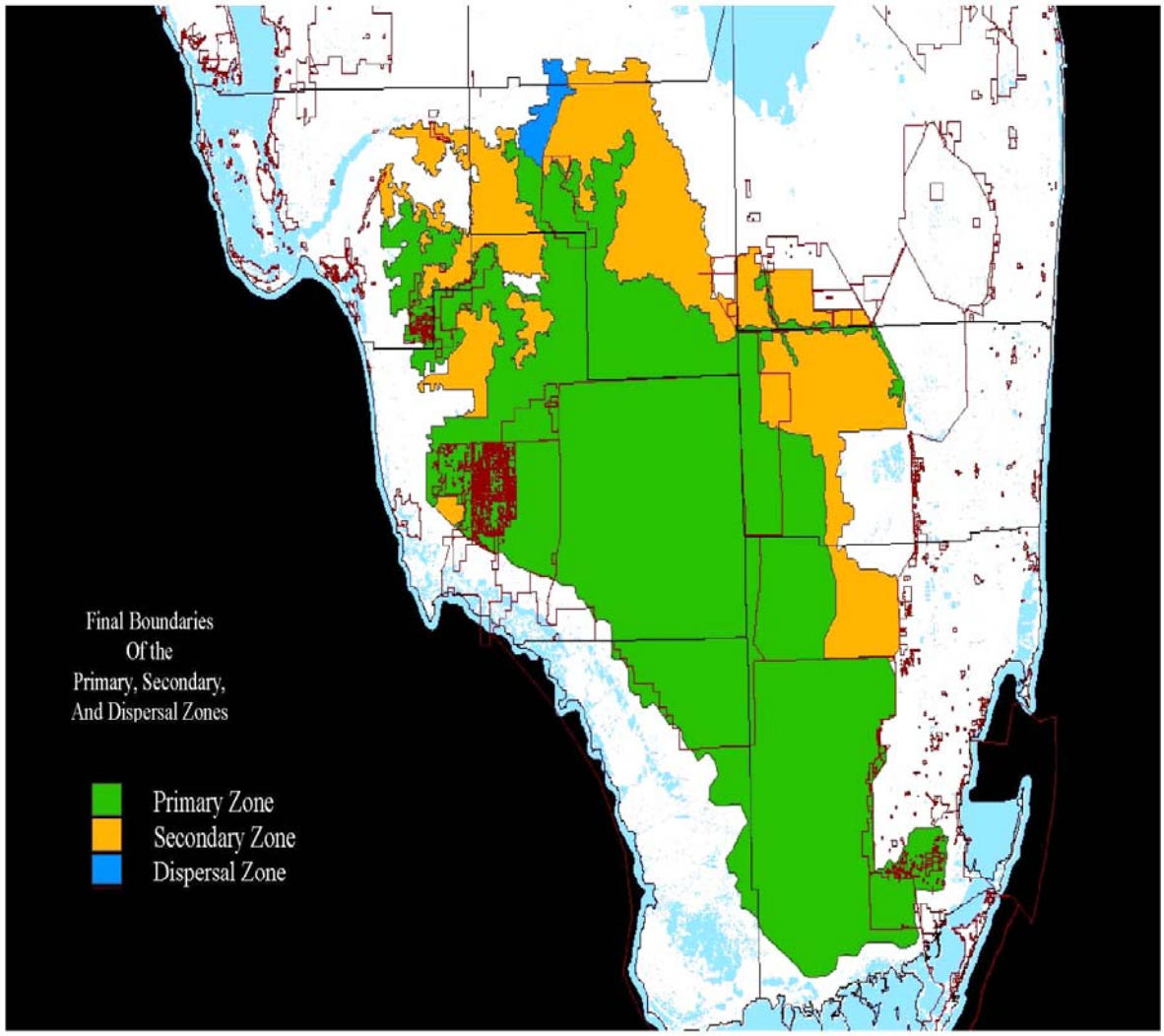

Figure 8. Primary, Secondary, and Dispersal Zones Kautz et al. (2006).

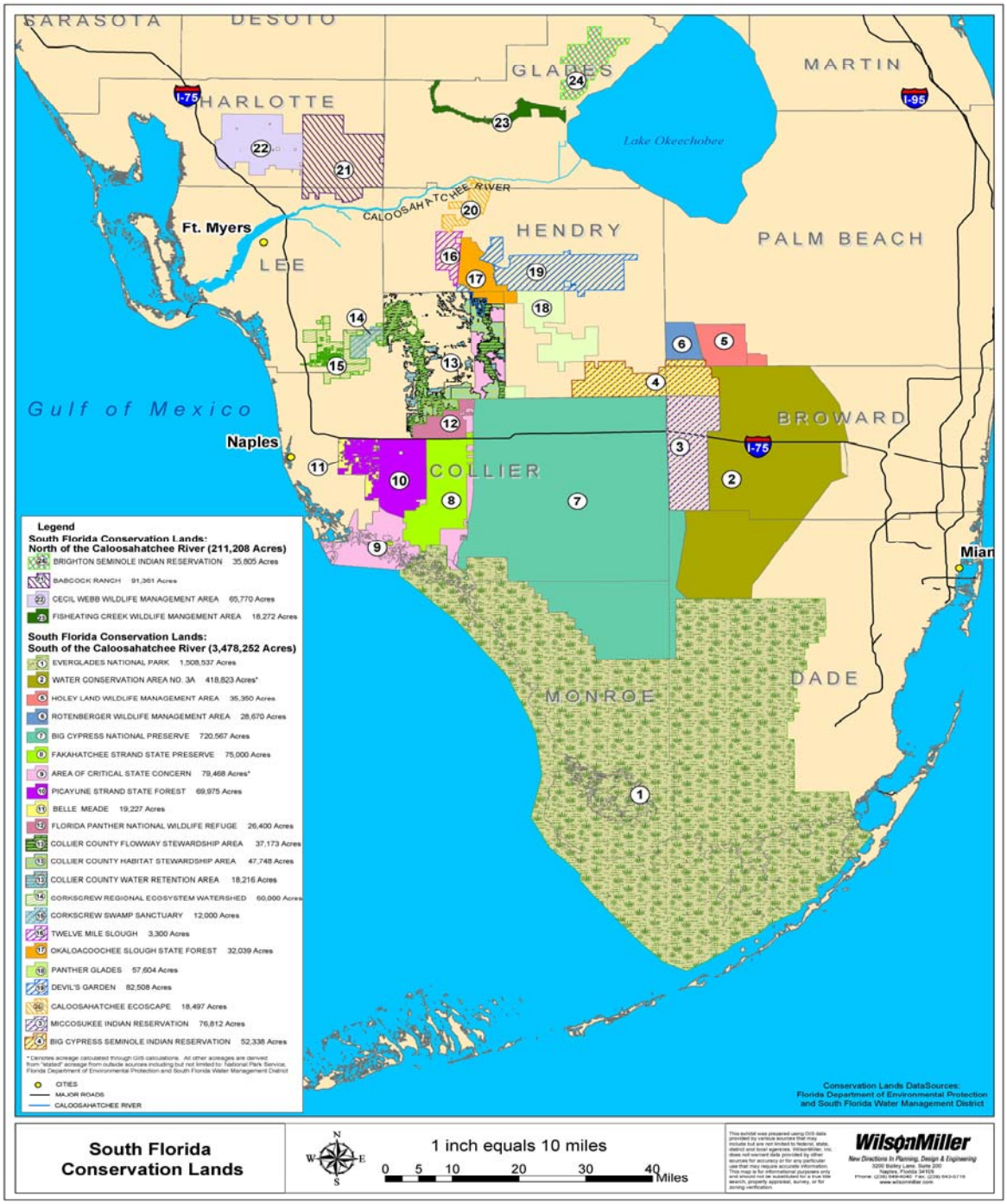

Figure 9. Southwest Florida conservation lands.

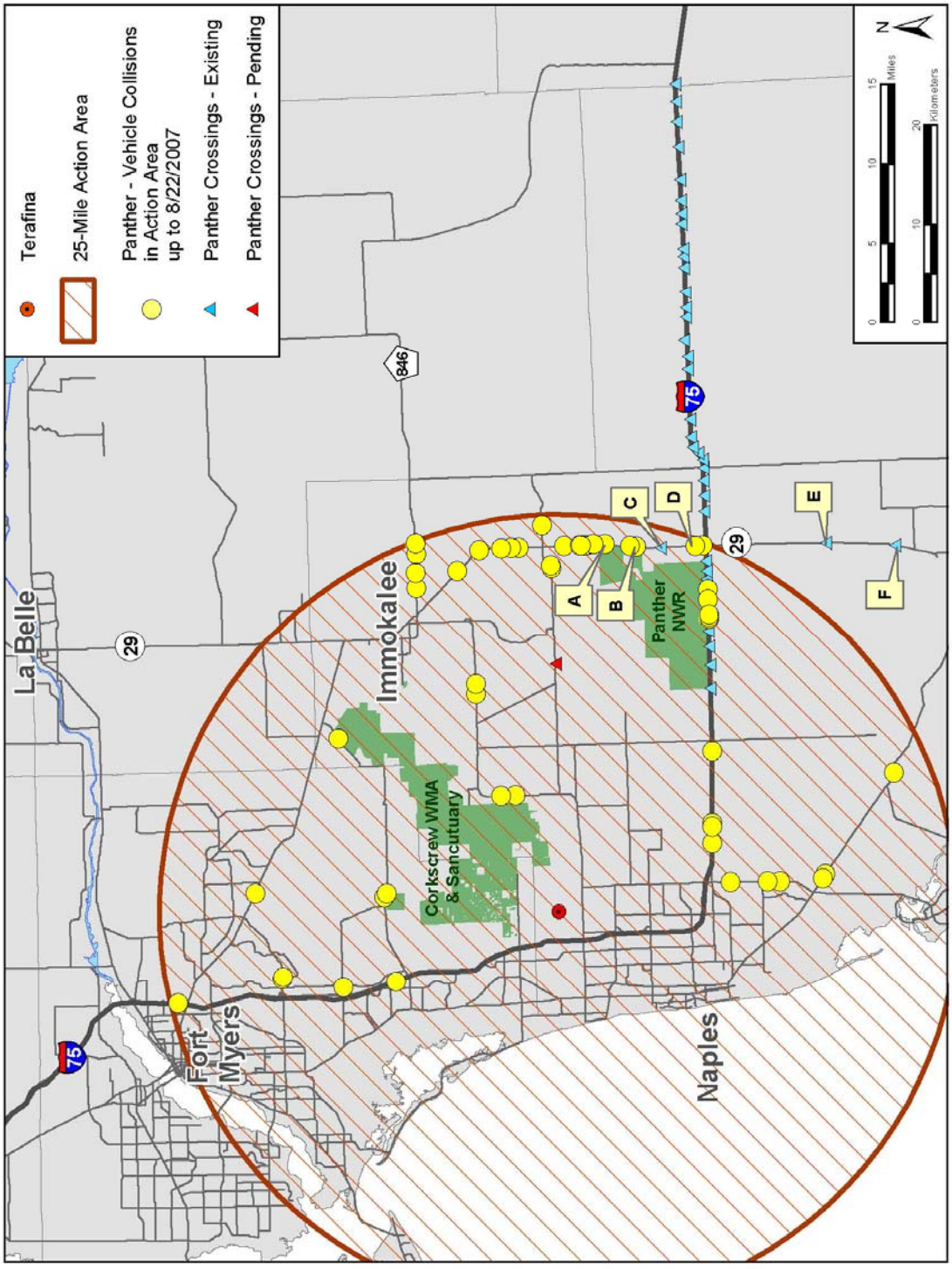

Figure 10. Panther – Vehicle Collisions within Action Area.

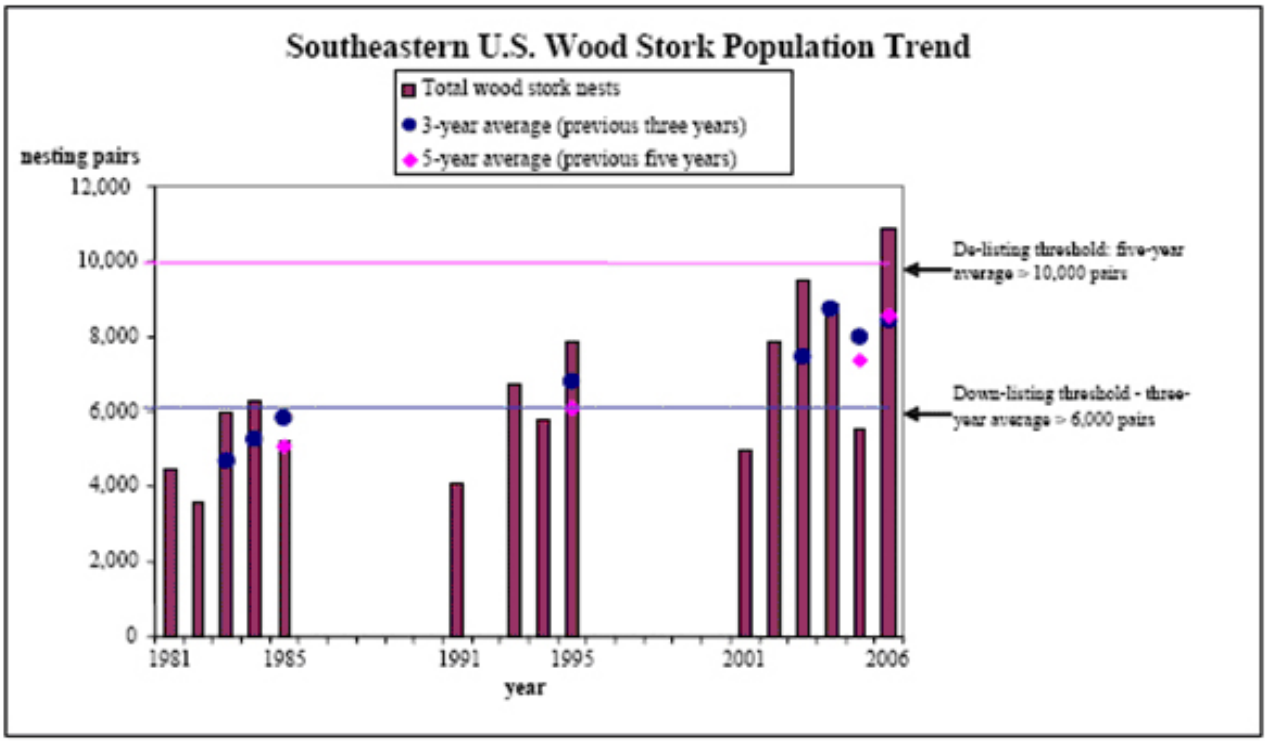

Figure 11. Total Wood Stork Nesting in the Southeastern United States in Relation to Recovery Criteria.

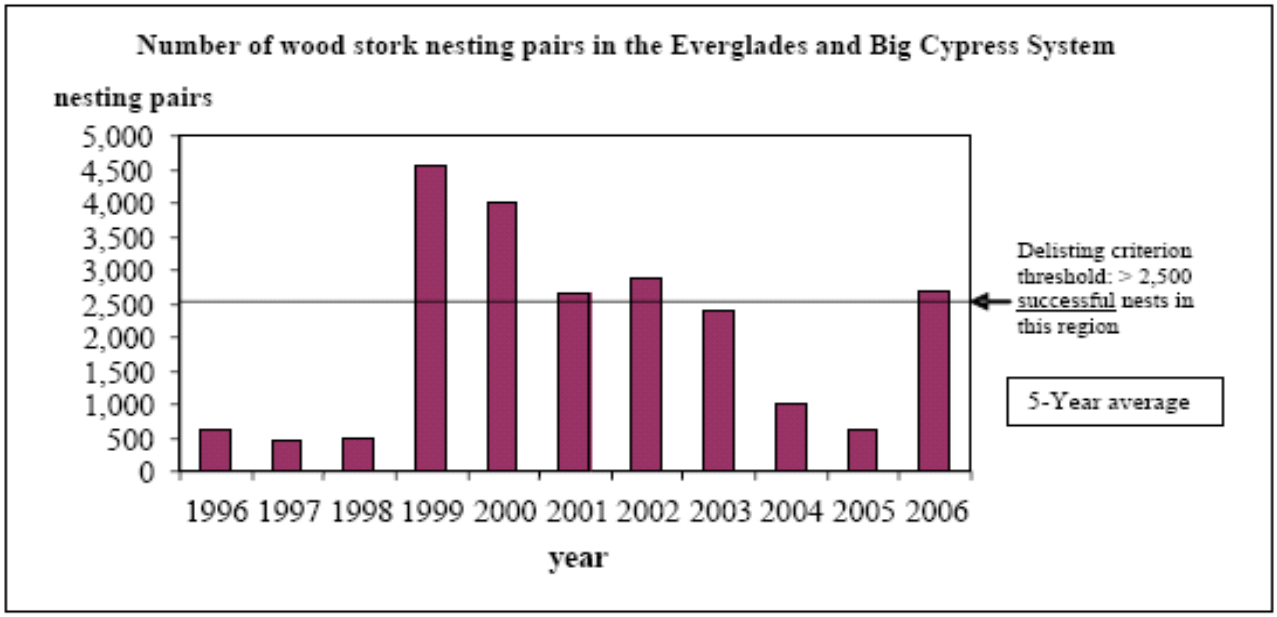

Figure 12. Graph of Wood Stork Nesting in Everglades and Big Cypress System.

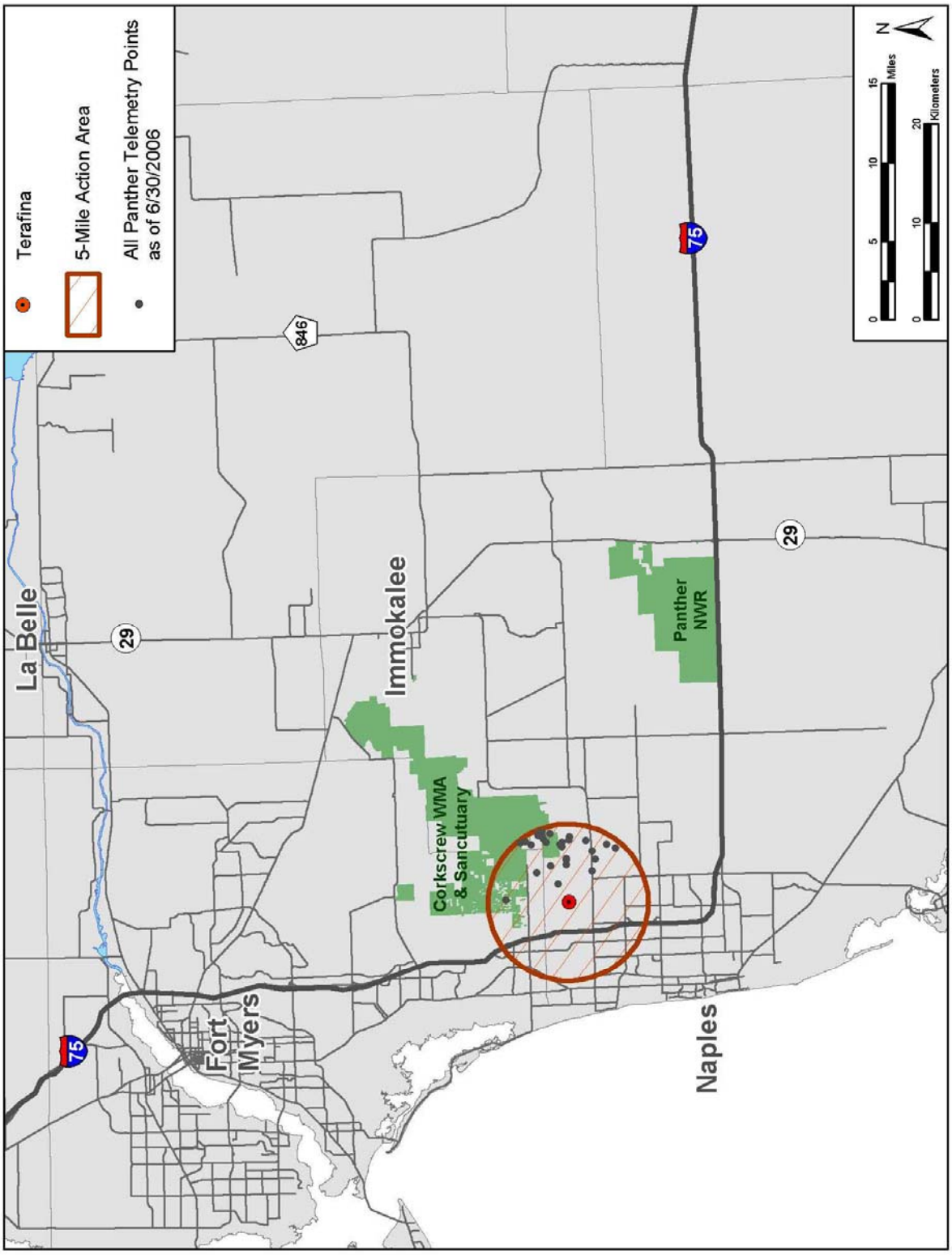

Figure 13. Telemetry showing panther activity within 5-mile radius of Terafina project.

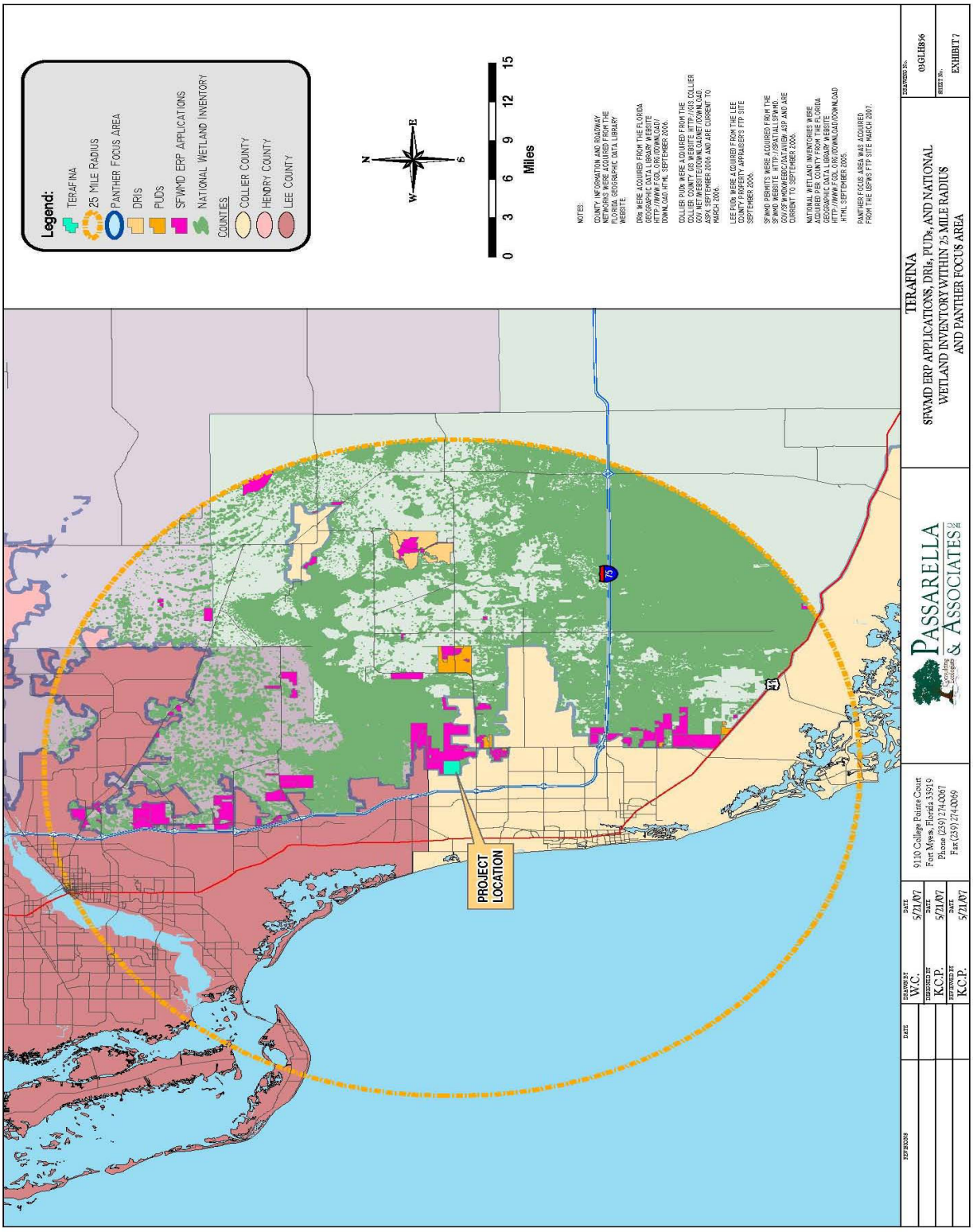

Figure 14. Projects in cumulative impact analysis.

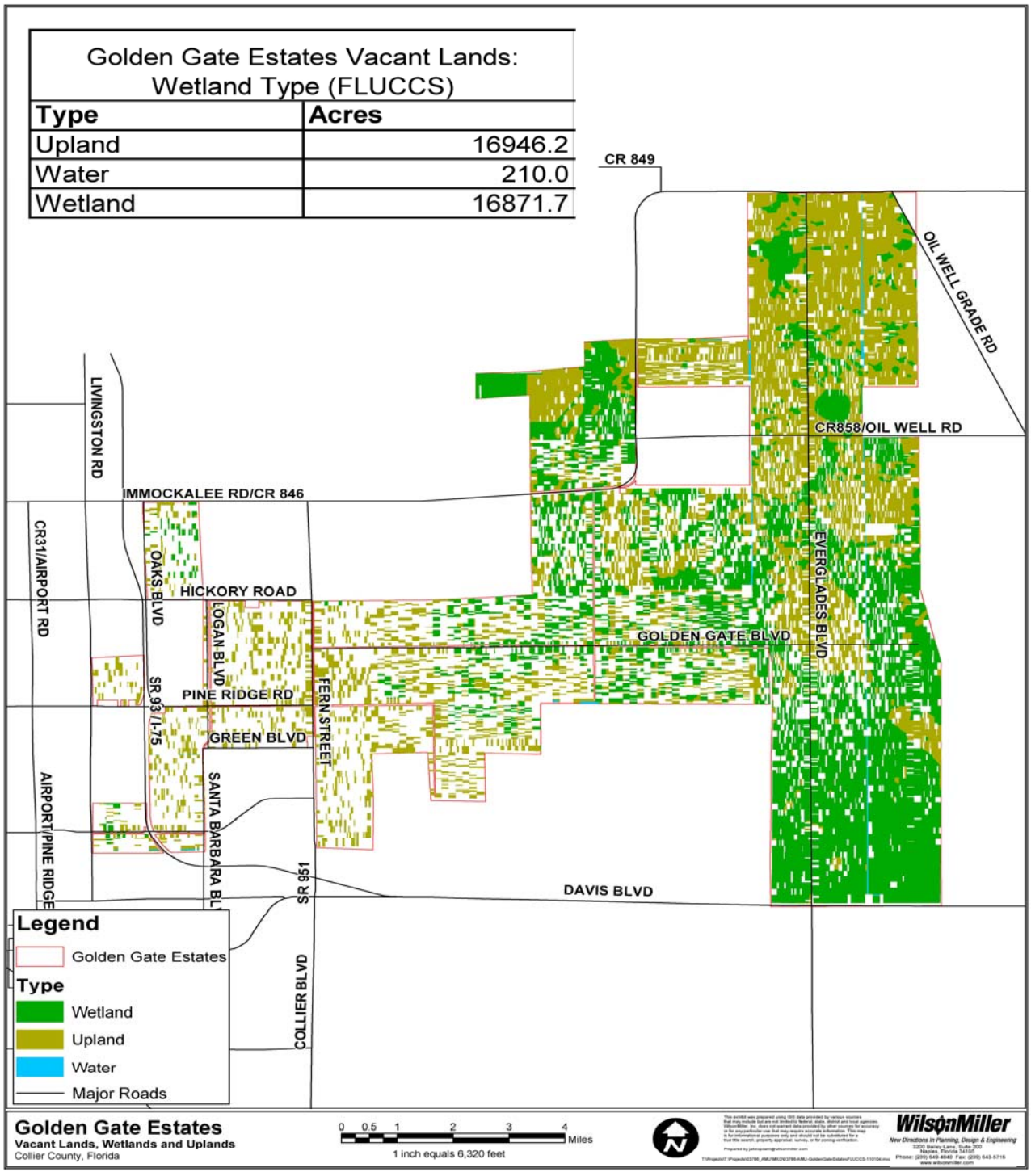

Figure 15. Northern Golden Gate Estates vacant lots.

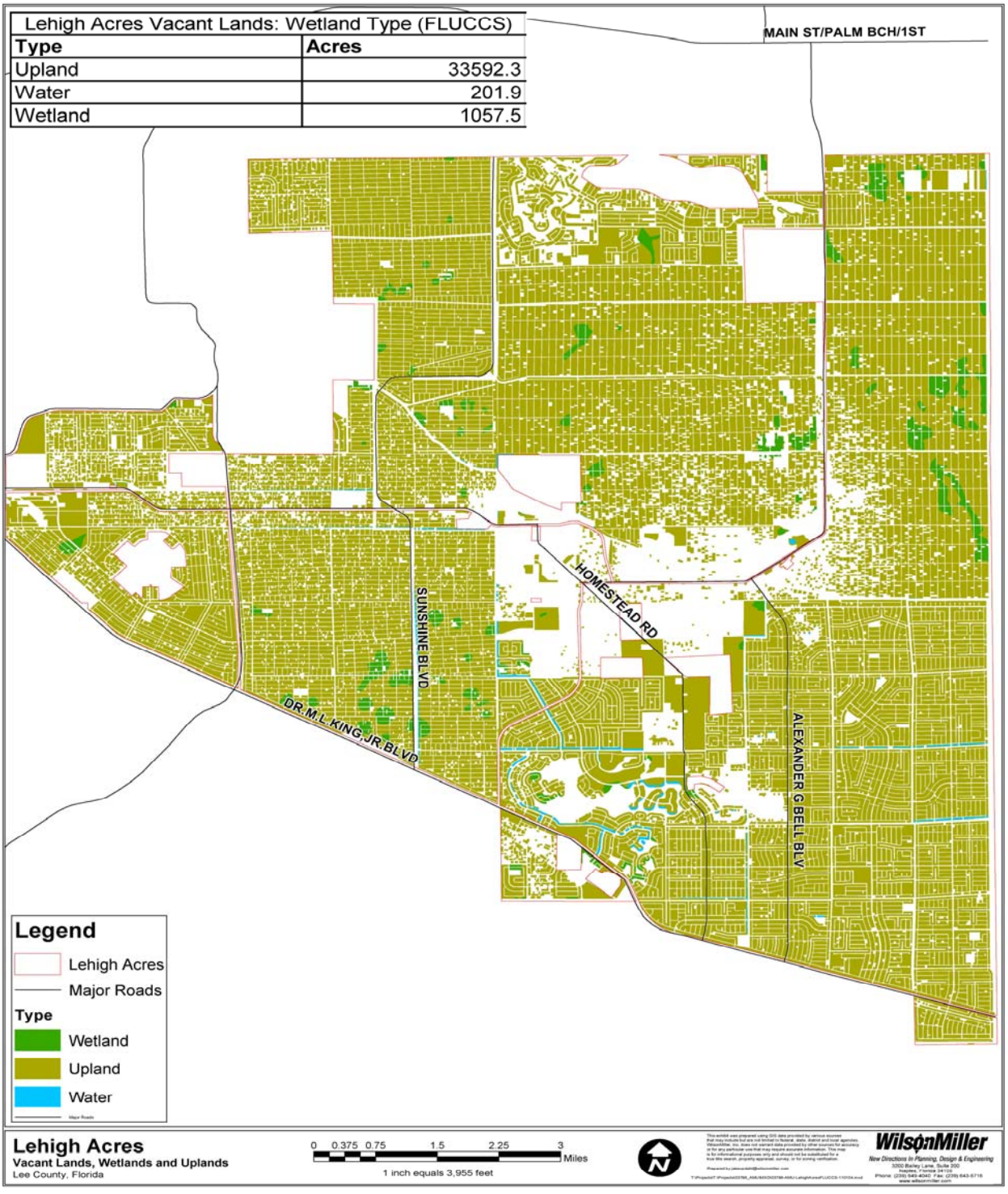

Figure 16. Lehigh Acres vacant lands.

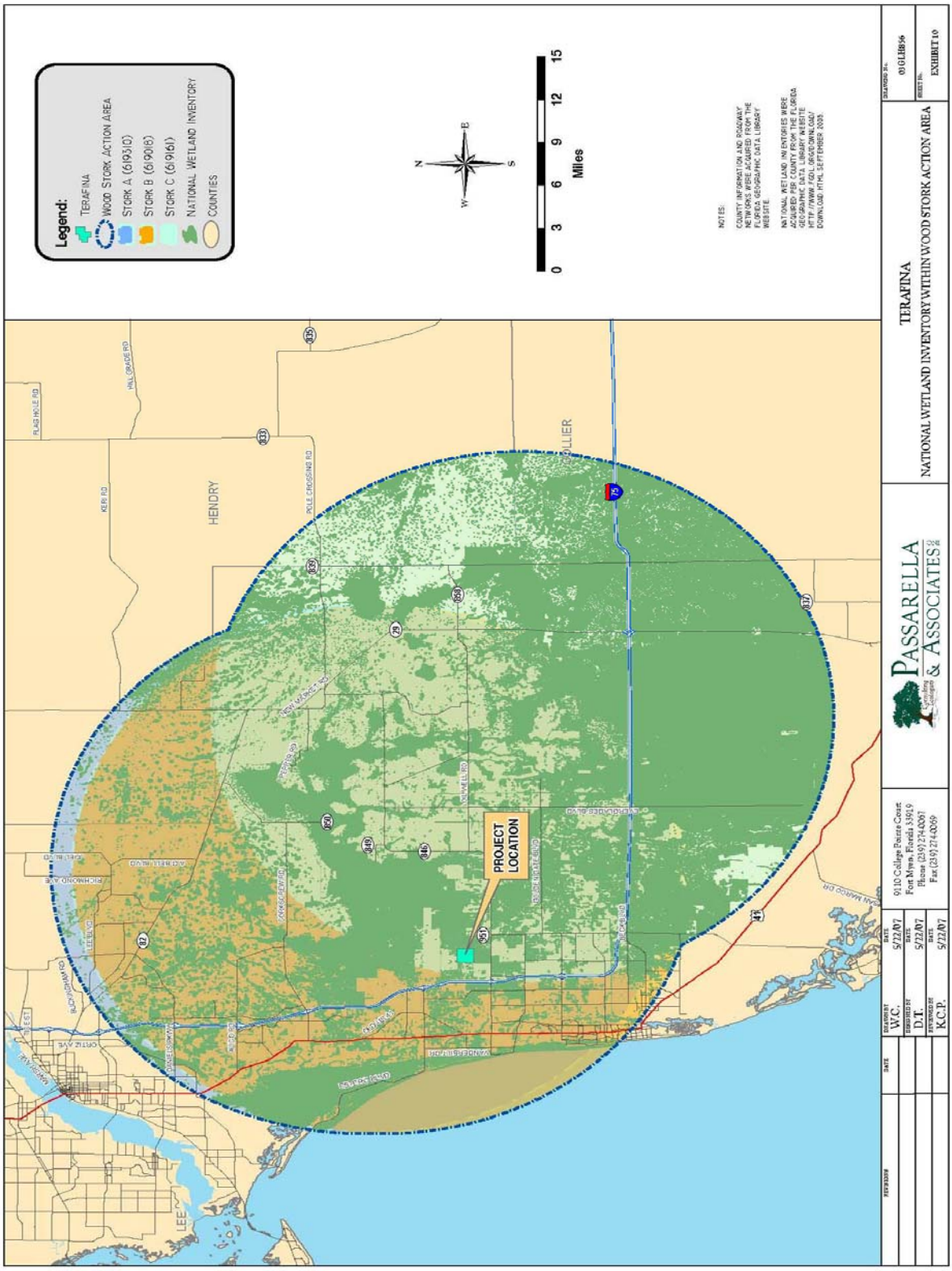

Figure 17. Wetlands in and Around Wood stork Action Area.

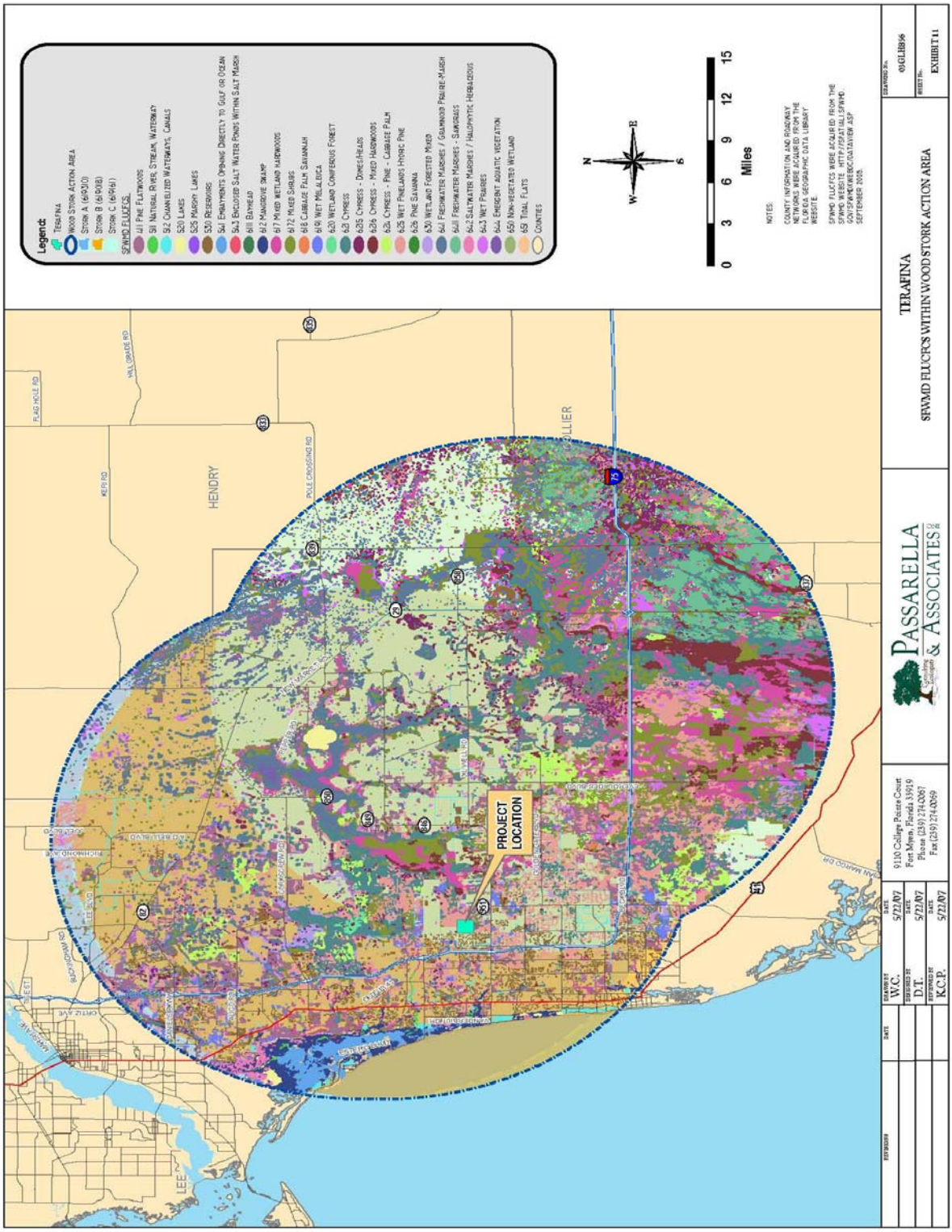

Figure 18. FLUCCS Codes in and around Wood stork Core Foraging Area.