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

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Applicant: South Florida Water Management District

Project: Caloosahatchee River (C-43) West Basin Storage Reservoir Project

County: Hendry

Dear Colonel Grosskruger:

This document transmits the Fish and Wildlife Service's (Service) Biological Opinion for the U.S. Army Corps of Engineers' (Corps) to issue a permit for the construction and operation of the Caloosahatchee River (C-43) West Basin Storage Reservoir project (C-43 West Reservoir project) and its effects on the endangered Florida panther (*Puma concolor coryi*), the threatened Audubon's crested caracara (*Polyborus plancus audubonii*), and the threatened eastern indigo snake (*Drymarchon corais couperi*) 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 C-43 West Reservoir project is an Acceler8 component of the Comprehensive Everglades Restoration Plan (CERP), authorized under the Water Resources Development Act of 2000. The purpose of the C-43 West Reservoir project is to restore ecosystem function in the Caloosahatchee Estuary by reducing the number and severity of events where harmful amounts of freshwater from basin runoff and Lake Okeechobee regulatory releases are discharged into the estuarine system via the Caloosahatchee River and to maintain a desirable minimum flow of freshwater to the estuary during dry periods. The C-43 West Reservoir project was designed to capture high freshwater flows from the Caloosahatchee River during the wet season, and store water temporarily in a 10,492-acre (ac) reservoir before discharging it back into the river during the dry season to restore a healthy estuarine salinity balance in the Caloosahatchee River Estuary and Pine Island Sound. The proposed 10,492-ac reservoir footprint and adjacent 110-ac access road parcel are located in portions of Sections 31 through 36, Township 43 South, Range 28

East; Sections 6 and 31, Township 43 South, Range 29 East; and Sections 1 through 12, Township 44 South, Range 28 East, Hendry County, Florida (Figure 1).

Within the C-43 West Storage Reservoir project area, 267 ac were previously impacted during construction of the C-43 West Reservoir Test Cell project (Test Cell project) (Figure 1). The Test Cell project was constructed to evaluate the on-site seepage potential and effectiveness of seepage control measures, the suitability of on-site materials for embankment construction and slope protection, and the effects of water residence time and seepage on water quality. That project included two 500-foot by 500-foot test cells with offset seepage canals, a borrow area, settling ponds, and staging areas and was authorized under Department of Army (DA) Permit number 2005-6598 (IP-TKW) issued December 6, 2005. A total of 29 ac of jurisdictional wetlands and waters of the United States (US) were impacted during construction of the Test Cell project and included 1.9 ac of excavated open-water, 4.5 ac of wet prairie, and 26.0 ac of tertiary, agricultural drainage canals.

This Biological Opinion is based on information provided in the November 9, 2006, Department of Army (DA) permit application; the Corps' January 10, 2007, letter to the Service requesting initiation of formal consultation; the December 2006 Biological Assessment (BA) prepared by Scheda Ecological Associates, Inc. (SEA) for the South Florida Water Management District (District); the Corps' March 22, 2007, letter to the Service providing additional information; the Corps' April 2007 *CERP C-43 West Reservoir project, Draft Project Implementation Report* (DPIR); the Corps' April 30, 2007, Public Notice (PN); and maps, meetings, field investigations, telephone conversations, email correspondence, and other sources of information. A complete administrative record is on file at the Service's Ecological Service sub-office co-located at the J.N. "Ding" Darling National Wildlife Refuge in Sanibel, Florida.

The Corps' letters and the BA referenced above describe the potential effects of the proposed C-43 West Reservoir project on federally listed threatened and endangered species. The Corps determined that the C-43 West Reservoir project will have "no effect" on the bald eagle (*Haliaeetus leucocephalus*), Florida scrub jay (*Aphelocoma coerulescens*), Florida grasshopper sparrow (*Ammodramus savannarum floridanus*), red-cockaded woodpecker (*Picoides borealis*), Okeechobee gourd (*Cucurbita okeechobeensis*), and the beautiful pawpaw (*Deeringothamnus pulchellus*); and "may affect, but is not likely to adversely affect" the West Indian manatee (*Trichechus manatus*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*), and the wood stork (*Mycteria americana*). The Corps also provided a "may affect and is likely to adversely affect" determination for the Audubon's crested caracara, eastern indigo snake, and Florida panther.

The following discussion pertains to the nine federally listed threatened or endangered species for which the Corps provided an effect determination of either "may affect, not likely to adversely affect" or "no effect." For these species, consultation was informal.

According to the BA, the Florida scrub jay, Florida grasshopper sparrow, red-cockaded woodpecker, Okeechobee gourd, and the beautiful pawpaw, or suitable habitat for those species, do not occur within or adjacent to the project area. Thus, the Corps has determined that the

proposed C-43 West Reservoir project will have no effect on those federally listed species. The Service concurs with the Corps' effect determinations for those species.

Bald Eagle

Likewise, the bald eagle is unlikely to be present within or adjacent to the project area. The closest documented nest is located 3.4 miles east of the project area and has not been active since 2003. No new nest locations were documented within 3,000 feet (ft) of the reservoir footprint during field surveys conducted during summer 2004 and spring 2006. Additionally, the Service has recently determined that the bald eagle has recovered and published the Final Rule to delist the bald eagle in the Federal Register on July 9, 2007. Removal of the bald eagle from the list of endangered and threatened wildlife will be effective August 8, 2007. Based on this information, the Corps has determined that the proposed C-43 West Reservoir project will have no effect on the bald eagle. The Service concurs with the Corps' effect determination.

West Indian Manatee

The endangered manatee is known to occur in all coastal waters of south Florida including estuaries, bays, rivers, creeks, and canals (Service 2001). They have been documented within major inland freshwater waterways and canals, including the Caloosahatchee River from Lake Okeechobee to the Gulf of Mexico (*i.e.*, Glades, Hendry, and Lee Counties). Additionally, the Caloosahatchee River is a significant winter aggregation area for manatees. Manatees are highly mobile and may be found in all waters accessible to them. Access to some water bodies may be prevented by weirs, salinity control structures, and locks.

According to the BA and additional information provided, manatees are known to occur in the Townsend Canal which connects the C-43 West Reservoir project area to the Caloosahatchee River through the existing agricultural canal system. Manatees are capable of passing over the weir at the confluence of the Townsend Canal and the river during high water levels and of passing through existing flap gates in the weir into the Townsend Canal during periods of inflow. Manatees are currently prevented from accessing the remaining canals in the project area due to differences in canal elevations at the intersection of the Townsend and Header Canals. The Header Canal is adjacent to and provides water for the project area and is approximately 10 ft above the Townsend Canal at their intersection. The existing pump station located at that intersection takes water in from the Townsend Canal and releases it into the Header Canal at the higher elevation.

The proposed C-43 West Reservoir project includes removal of the weir at the confluence of the Townsend Canal and the Caloosahatchee River. That structure will be replaced with one that serves either as permanent barrier or seasonal barrier which restricts manatee access to the Townsend Canal only during the winter season (November 1 through March 31). Thus, manatees in the river will either have no access if a permanent barrier is erected, or continue to have seasonal access to the Townsend Canal where the two reservoir intake pump stations (*i.e.*, C-43PS-1 and C-43PS-4) will be located. However, both intake pumps will include bar screens and trash rake systems that will prevent manatees from becoming trapped in the intake pipes as

well as from entering the reservoir through C-43PS-1 or the perimeter canal through C-43PS-4, and reduce the likelihood of injury to manatees by the rake systems. The screens consist of vertical bars spaced 6 to 8 inches apart extending from above the water surface to the canal bottom. C43PS-1 includes a monorail picker rake system that extends across and along each intake bay. A Duperon (manatee friendly) trash rake system could not be used at C43PS-1 because Duperon does not manufacture a system that is as wide and deep as the C43PS-1 intake bays. However, through consultation with the Service, the following manatee-friendly components were incorporated into the picker rake system:

1. Slowing the descent speed of the picker rake;
2. Minimizing the width of the automated gripper to 24 inches (unless manually controlled); and,
3. Incorporating a bar across the picker teeth to prevent the tines from crossing.

C43PS-4 includes the Duperon system that extends across and along each intake bay. The Duperon system is considered manatee-friendly because there are no gripper or teeth. The system consists of a rotating cup attached to each bar screen that “scoops” the trash collected against the bar screen up to the trash rack on top of the screen to the trash conveyor.

Likewise, it is unlikely that manatees would be able to access the perimeter canal through any of the discharge structures or gated culverts. The main outfall structure, C-43S-11, is 10 to 12 ft higher in elevation than the Townsend Canal. The double box culverts at the Fort Simmons Branch and the Banana Branch Canals (*i.e.*, C43S-9 and C43S-7, respectively) are each controlled by a slide gate and a weir gate. The slide gates will remain closed except under extreme high flow conditions. The C43S-9 weir gate is supported by a 5-foot high “knee wall” and C43S-7 weir gate is supported by a 3-foot high “knee wall.”

As referenced in the BA and discussed during the during the May 15, 2007, interagency meeting between the Corps, District, and Service, and subsequent teleconferences, manatee protection measures will be implemented as part of the proposed project. The Corps and District will follow the CERP Interagency Task Force’s October 2006 *Guidelines for Manatee Conservation During Comprehensive Everglades Restoration Plan Implementation* (CERP Manatee Guidelines), particularly those summarized below:

1. Marine Species Observer Experience Requirements, including acceptable level of observer experience corresponding to the expected level of risk to manatees and location for a particular project. As described in the CERP Manatee Guidelines Appendix A-1, Manatee Observers must be approved by the Florida Fish and Wildlife Conservation Commission (FWC) by submitting a resume and a completed form titled Observer Experience and Education Documentation for Marine Species Watch Programs (June 2006). The C-43 West Reservoir project does not include the use of explosives (*i.e.*, blasting) and is not located in an Important Manatee Area. Therefore, observers qualified at Watch Level 2 or higher may fulfill permit requirements. All manatee observations for the C-43 West Reservoir project will be conducted by FWC approved Level 2 Manatee Observers through the Corps’ existing volunteer manatee observer program for the Okeechobee Waterway.

2. Standard Manatee Construction Conditions (July 2005) should be followed, including education of construction personnel regarding manatee presence, speed zones, and that civil and criminal penalties exist for harming, harassing, or killing manatees under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act; siltation and turbidity barriers shall not entangle or entrap manatees nor impede their movements; in-water operations and vessels must be shut down if a manatee(s) comes within 50 feet of the operation and will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation without being herded or harassed into leaving, or until 30 minutes elapses without the manatee(s) reappearing within 50 feet of the operation; any collision with or injury to manatees shall immediately be reported to the FWC Hotline at 1-888-404-FWCC and the Service's Vero Beach Office at 561-562-3909; and finally, temporary manatee signs that have already been approved by the FWC and described in the CERP Manatee Guidelines Appendix A-2 must be posted in prominently visible locations prior to and during all in-water project activities.
3. Minimization and Avoidance of Manatee Entrapment, including pre- and post-construction guidelines should be incorporated to avoid manatee entrapment during installation of the trash rakes on the intake pumps (*i.e.*, C43PS-1 and PS-4). As described in the CERP Manatee Guidelines Appendix A-3, the Corps or District should conduct ground surveys of the waterway prior to installation of the last section of any temporary or permanent barriers so that manatees are not trapped in the waterway between the pump stations and the bar screen and trash rake systems. Surveys should be conducted by qualified observers with conference with the Service and FWC. If no manatees are sighted within the exclusion area, the waterway should be closed off immediately. Otherwise, the manatees should be observed to see if they move beyond the proposed barrier on their own accord. Once the barrier is installed, the barrier and waterway should be monitored by land once daily for a period of one week to check for presence of manatees. The area should also be surveyed for manatee presence prior to initial operation of the pump stations. If manatees are sighted within the exclusion area, the FWC should be contacted at 888-404-FWCC.
4. Thermal Guidelines in Manatee Accessible Waters should be followed during the winter season, typically between November 1 to March 31, and include monitoring reservoir discharge water temperatures at both the reservoir discharge point (*i.e.*, C43S-11) and the receiving waters (*i.e.*, the confluence of the Townsend Canal and Caloosahatchee River) on a daily basis until the effect of the discharge has been determined. Intermittent reservoir discharges shall not increase the ambient temperature of receiving waters above 20° C and create an unreliable warm-water refugia that will not sustain manatees through cold periods (CERP Manatee Guidelines, Appendix A-5).
5. A report summarizing project construction and related manatee observations, including dates, names of qualified observers, and the duration and results of observation will be submitted to the Service annually, until construction is completed.

To achieve Guideline 4 above, the Corps and District agreed during the May 15, 2007, interagency meeting and subsequent teleconferences, to construct at least a seasonal barrier at the confluence of the Townsend Canal and Caloosahatchee River to prevent manatee access to the Townsend during the winter season (November 1 through March 31), and to implement the following monitoring plan during the winter season:

1. During reservoir releases conducted between November 1 to March 31 of each year, continuous recorders will be used to monitor water temperature daily at three locations: 1) the temperature of the reservoir discharge water will be monitored at the discharge point (*i.e.*, C43S-11); 2) ambient water temperature in the Caloosahatchee River will be monitored at the Ortona Lock (*i.e.*, S-78); and 3) the effect of reservoir discharge on the water temperature in the Caloosahatchee River will be monitored at the barrier that will be constructed at the confluence of the Townsend Canal and the Caloosahatchee River. Hourly data points should be downloaded and examined daily to determine the presence and downstream effect of the warm water plume.
2. If the reservoir discharges raise the ambient temperature of the water at the confluence of the Townsend Canal and the Caloosahatchee River greater than or equal to 20°C, or if less than 20°C but increases the water temperature at that location above the ambient water temperature, manatee observations will be conducted daily in the Caloosahatchee River at its confluence with the Townsend Canal to detect any shifts in manatee winter-use patterns and movements to the area. Observations should be conducted in four 10-minute intervals over a 2-hour period every morning. All manatee observations for the C-43 West Reservoir project will be conducted by FWC approved Level 2 Manatee Observers through the Corps' existing volunteer manatee observer program for the Okeechobee Waterway.
3. If manatees move to the area as result of the reservoir discharges and have been observed within the Caloosahatchee River at its confluence with the Townsend Canal during two consecutive observation days or during two of three consecutive observation days, then the Corps should notify the Service and the FWC immediately. The Corps shall continue the manatee observations and the FWC may monitor manatee health as appropriate. If reservoir releases are discontinued based on flows at S-79 during the cold season and the FWC determines that manatees exhibit signs of cold stress following cessation of reservoir discharges, then the Corps and District will reinitiate consultation with the Service.
4. Reports summarizing the water temperature monitoring and manatee observations conducted during the winter period will be submitted to the Service and the FWC, annually. Those reports should include: a) the water temperatures observed at the C-43S-11, S-78, and the barrier constructed at the Townsend and Caloosahatchee River from November 1 through March 31; b) the date, time, and duration of each observation, the name of the approved Level 2 observers, and the results of each observation; and c) if the Service and FWC were notified of manatee presence as outlined above, the date the agencies were contacted as well as the date and results of any additional monitoring of manatee health conducted by FWC.

5. After the reservoir has been in operation a minimum of 5 years, monitoring needs may be re-evaluated. At that time, the range of climatological and hydrological conditions (*i.e.*, occurrence of an extreme cold year, extreme drought year, etc.) under which the reservoir was operated will be considered in the re-evaluation of water temperature monitoring needs and manatee observations.

Based on the above information, the Corps has determined that the proposed C-43 West Reservoir project “may affect, but is not likely to adversely affect” the manatee. The Service concurs with the Corps’ effect determination.

No designated manatee critical habitat occurs within the proposed project area. However, the C-43 West Reservoir project will benefit designated critical habitat downstream by improving salinity conditions in the Caloosahatchee Estuary, particularly during the dry season. Therefore, designated West Indian manatee critical habitat will not be adversely affected by the proposed C-43 West Reservoir project.

Everglade Snail Kite

Suitable habitat for the endangered snail kite consists of freshwater marshes, wet prairies, and the shallow vegetated edges of man-made or natural lakes where apple snails (*Pomacea paludosa*) can be found. The closest known nesting concentrations of snail kites and their designated critical habitat occur in the Lake Okeechobee watershed, east of the project area. Snail kites are occasionally known to occur in marshes west of Lake Okeechobee, along the Caloosahatchee River, and west of the project area in Lehigh Acres and borrow canals in Lee County. During February 2006 field surveys, SEA staff observed one snail kite eating a snail while perched on a power transmission line along State Road (SR) 80 approximately 0.75 miles west of the reservoir footprint. However, no snail kites and little suitable foraging habitat (*i.e.*, less than 10 ac) are known to occur within the C-43 West Reservoir project area, including the Test Cell project footprint.

No suitable snail kite habitat would be created within the 110-ac access road parcel. However, the construction and operation of the proposed reservoir may intermittently provide wetland habitats suitable for snail kite use within the 10,492 ac currently under citrus production when the reservoir is drawn down or within the 109 ac of littoral zones that will be constructed as part of the seepage canal. Citrus operations in the project area and elsewhere have routinely applied heavy copper (Cu) treatments as a fungicide for many years, resulting in extensive Cu contamination in the soil. Potential Cu risk to the endangered snail kite may occur due to Cu accumulation in the kite’s primary food item, the apple snail (URS 2003). Snail kites have a specific diet comprised almost entirely of apple snails. Apple snails have been found in the larger agricultural canals and in 4.8 ac of retention marsh within the C-43 West Reservoir project area. Thus, wetlands created as a result of the project may occasionally attract foraging snail kites during drawdown conditions.

The Service is conducting an ongoing field study to develop a method to predict Cu concentrations in apple snails based on Cu concentrations in soils and to ultimately predict Cu

concentrations in apple snails in wetlands constructed on former Cu-contaminated citrus properties. Preliminary results of that study indicate a positive relationship between Cu concentrations in soil sediments and Cu concentrations in apple snails (Barger et al. 2005). An interim effects level of 85 milligrams per kilogram (mg/kg) of Cu concentrations in sediments was agreed upon by the Service and the District until that study is completed.

A total of seven grids (*i.e.*, grids 56, 58, 124, 125, 134, 135, and 143) in the Berry Labelle – Congen Groves portion of the project area will require remediation due to Cu contamination (Figure 2). The Service recommended remediation for the entirety of Grids 124, 125, 134, 135, and 143 (250 ac) and for the portions of Grids 56 and 58 that will be within the footprint of the proposed reservoir. The District's remediation plan includes excavation of approximately one foot of soil from those contaminated areas to be remediated and utilizing that soil within the reservoir embankments, burying the soils such that surface water will not contact the Cu-contaminated soil. The Service concurred in a letter dated September 14, 2006, that removing contamination from those seven grids would adequately reduce Cu concentrations in those grids to below the interim screening value for risk to the snail kite and would not likely have direct impacts on other trust resources for which the Service is responsible. However, the Service noted that the remaining Cu concentration in some areas of the property may be high enough to adversely impact benthic organisms. The Service also recommended that no further Cu applications be permitted in Grids 38, 39, and 145 since Cu concentrations in soils from those grids were close to the interim screening value, and that the proposed remediation not commence until project construction is initiated. According to information provided by the Corps in their March 22, 2007, letter, those recommendations have been followed and no additional Cu has been applied within the project area since soil sampling was conducted. Therefore, the Corps has determined that the proposed C-43 West Reservoir project “may affect, but is not likely to adversely affect” the Everglade snail kite. The Service concurs with the Corps’ effect determination. No designated critical habitat occurs within or adjacent to the project area and therefore, none will be affected.

Wood Stork

Endangered wood storks utilize wetlands for foraging year-round. Regional declines in wood stork populations can be attributed to the loss and degradation of feeding habitat. Depending on local rainfall and habitat conditions, wood storks may forage in 50 to 200 wetlands within 5 to 40 miles of a rookery site. The Service has identified a Core Foraging Area (CFA) of 18.6 miles around known wood stork rookeries to minimize potential adverse effects to their foraging habitat. Although no wood storks are known to have nested within the project area, approximately 85 percent (*i.e.*, 8,995 ac) of the C-43 West Storage Reservoir project area including the access road parcel (*i.e.*, 10,602 ac), is within 18.6 miles of three wood stork rookeries known to be active (Figure 3). Two rookeries are located to the west in the Caloosahatchee estuary in Lee County, and one rookery is located south of the project area in Collier County just south of Okaloacoochee Slough State Forest (OSSF) and Wildlife Management Area (WMA). Wood storks were observed during listed species surveys and other field inspections of the project area foraging within secondary agricultural canals, loafing along

access roads and borrow ditches, and feeding on prey trapped in vegetation cast aside during mechanical ditch maintenance.

Typical foraging sites for the wood stork include freshwater marshes, stock ponds, shallow and seasonally flooded roadside or agricultural ditches, narrow tidal creeks, shallow tidal pools, managed impoundments, and depressions in cypress heads, swamps, and sloughs. Because of their specialized feeding behavior, wood storks forage most effectively in shallow (*i.e.*, 2 to 15 inches) water areas with highly concentrated prey. Almost any shallow wetland depression where fish become concentrated, either through local reproduction or receding water levels, may be used as feeding habitat during some portion of the year.

The project will result in the loss of approximately 126.7 ac of wetlands and 934.6 ac of other jurisdictional surface waters on the site (Figure 4). The land will be converted primarily to an open-water, above-ground reservoir including associated structures and a seepage canal. However, suitable wood stork foraging habitat is limited within the project area and habitat quality for wood storks is generally poor. On-site freshwater wetlands are primarily impacted wetlands functioning as agricultural retention and detention areas. Secondary and tertiary agricultural canals and ditches may provide shallow-water foraging habitat and concentrate prey during low water periods and their hydrology is dependent on rainfall and irrigation. As a result, agricultural canals and ditches may often receive nutrient and chemical (*i.e.*, fertilizers, pesticides, and fungicides) laden runoff directly from the grove beds. Approximately 6.9 ac of emergent wetlands and depressions in cypress heads were determined to provide suitable wood stork foraging habitat within the C-43 West Reservoir project area and access road parcel during onsite field inspections and examination of aerial photography and photographs of onsite wetlands taken during helicopter surveys. Secondary (191.6 ac) and tertiary (558.5 ac) agricultural canals and ditches within the project area provide an additional 750.1 ac of potential foraging habitat within the CFA of three known rookeries (Figure 5) when hydrological conditions are suitable. The loss of approximately 17.2 ac of tertiary ditches that provide potential wood stork foraging habitat within the Test Cell project boundary was already compensated for under informal consultation for that project as described in our November 22, 2005, letter.

The Uniform Mitigation Assessment Method (UMAM) (Chapter 62-345, F.A.C. [effective date 02-04-2004]) was used to evaluate the current condition (*i.e.*, wetland value) of the existing wetlands (6.9 ac) and drainage canals and ditches ($750.1 - 17.2 = 732.9$ ac) within the project area that provide potential wood stork foraging habitat and the proposed compensation for the loss of that foraging habitat. During a May 15, 2007, interagency meeting, the Corps, District, Service, and Environmental Protection Agency (EPA) agreed to use the UMAM evaluations of onsite wetlands and agricultural canals and ditches conducted by an interagency team comprised of the Corps, District, and Service, during June and July of 2004. Thus, a total of 96.9 functional wetland units will be lost as a result of the C-43 West Storage Reservoir project (Table 1).

The purpose of the C-43 West Storage Reservoir project is to restore ecosystem function in the Caloosahatchee Estuary by reducing the number and severity of events where harmful amounts of freshwater from basin runoff and Lake Okeechobee releases are discharged into the estuarine

system and to maintain a desirable minimum flow of fresh water to the estuary during dry periods. Altered salinity in the estuary has resulted from hydrological modifications that have dramatically changed the natural quantity, quality, timing, and distribution of freshwater flows to the estuary, often without regard to the health of the estuarine community (Haunert et al. 2000). Salinity is a major ecological variable that controls important aspects of the estuarine community structure and food web (Myers and Ewel 1990). Flow alterations have impacted the natural biodiversity of the estuary by affecting food availability, predation pressure, and reproductive success, as well as directly causing chronic and acute stress on biota. Altered freshwater inflow can also influence primary productivity, zooplankton biomass, and nekton abundance by influencing nutrient concentrations and light attenuation.

The excessive variation in discharge and salinity in the Caloosahatchee Estuary (Figure 6) maintains estuarine biota in a constant flux between those favoring higher salinity and those favoring lower salinity (Chamberlain and Doering 1998a; Bulger et al. 1990). Optimal salinity conditions may not last long enough for organisms to complete their life cycle and the estuary can become devoid of some populations, even keystone species that support major ecosystem components along the estuary's salinity gradient such as oysters or submerged aquatic vegetation. The tapegrass (*Valisneria* sp.) beds in the upper estuary provide important breeding, feeding, and escape cover for a variety of estuarine-dependent species, including foraging habitat for two of the rookeries impacted by construction of the reservoir. During the dry season, the combination of limited rainfall, lack of water storage in the basin and withdrawals to meet human demands for irrigation and potable water often results in periods of no freshwater discharge to the estuary. Saltwater can intrude upstream to the Franklin Lock and Dam (S-79), threatening the survival of the tapegrass beds and other species that require low salinity to complete their life cycle (Chamberlain and Doering 1998a; 1998b, Doering et al. 2002; District 2002). For example, tapegrass beds had essentially vanished from the upper estuary as a result of extremely high salinity levels during the 2001 drought. Tapegrass density remained low and started a slight increasing trend during the growing season of 2003. The beds began to recover while salinity conditions were favorable during the spring and summer growing seasons of Water Year (WY) 2004 and WY 2006. However, due to the unusually high salinity associated with the 2007 dry season the tapegrass beds have again almost disappeared.

The optimum S-79 flow ranges and delivery patterns for the estuary were initially designed to protect tapegrass upstream of Fort Myers and formed the basis for development of hydrologic performance measures for CERP, including the C-43 West Storage Reservoir project; the Southwest Florida Feasibility Study; and the Lake Okeechobee Regulation Schedule; as well as meeting legislative mandates for the establishment of the Caloosahatchee River and Estuary Minimum Flow and Level (MFL) (District 2000, 2003). The MFL was based on a flow-salinity relationship that was based on flows at S-79 and downstream salinity levels (Chamberlain and Doering 1998b; Doering et al. 2002).

Although wood storks may be impacted by the loss of foraging habitat within the project footprint, when implemented, the C-43 West Storage Reservoir project has the potential to significantly contribute towards restoration of tapegrass in the upper Caloosahatchee estuary. The C-43 West Reservoir project will improve estuarine health particularly by reducing the

number of damaging low flow events at S-79. Negative project effects to wood stork foraging habitat within the C-43 West Reservoir project area will be offset by the enhancement of about 4,130 ac of submerged tapegrass beds in the upper Caloosahatchee estuary (Figure 3) which will directly benefit two of the three wood stork rookeries in the project vicinity. Restoration and enhancement of the tapegrass beds in the upper estuary will provide approximately 446 wetland mitigation credits and is consistent with the Service's wood stork goal to acquire, enhance, preserve, and recover natural hydropatterns within foraging habitat of the wood stork. We anticipate that the hydrologic improvements would result in significant increases in the cover and density of tapegrass beds in the upper estuary and therefore, result in increases in the spatial extent and productivity of available wood stork foraging habitat. Based on the model results described in the DPIR, the proposed design and operation of the C-43 West Reservoir are effective at augmenting flows below 450 cubic feet per second (cfs) at S-79 to meet MFL criteria than at reducing the extreme high flows (Corps 2007). The MFL salinity criteria are also beneficial for other organisms that utilize this low salinity region of the estuary, including wood stork prey species. The Service, Corps, and EPA used UMAM to evaluate the future condition of the tapegrass beds based on the model results and project benefits analyses described in the DPIR. Restoration and enhancement of the tapegrass beds in the upper estuary will provide approximately 446 wetland mitigation credits and is consistent with the Service's wood stork goal to acquire, enhance, preserve, and recover natural hydropatterns within foraging habitat of the wood stork.

The District has also proposed to construct 109.3 ac of shallow-sloped littoral zones along portions of the C-43 West Storage Reservoir seepage canal. Although this habitat will not be considered as compensation for the loss of wood stork foraging habitat or as mitigation for functional wetland units lost as a result of the proposed project, the littoral zones may provide additional wood stork foraging habitat.

Accordingly, the restoration and enhancement of 4,130 ac of tapegrass beds in the upper Caloosahatchee estuary will compensate for the loss of approximately 749.8 ac primarily consisting of impacted wetlands and agricultural canals and ditches that provide wood stork foraging habitat within the reservoir footprint. Additional wetland habitat will be provided by the construction of 109 ac of littoral zones along C-43 West Storage Reservoir seepage canal. Based on this information, the Corps has determined that the proposed C-43 West Storage Reservoir project "may affect, but is not likely to adversely affect" the wood stork. The Service concurs with the Corps' determination.

This concludes the informal consultation for this project on the species presented above, and these species will not be addressed further in this Biological Opinion.

Audubon's Crested Caracara

Suitable nesting habitat for the threatened Audubon's crested caracara includes wet and dry prairies with scattered saw palmetto, scrub oak, or cypress, and improved or semi-improved pastures and range lands. Two documented caracara nest locations were identified in the project vicinity during species specific surveys conducted February through May of 2006, although none

occur within the proposed reservoir footprint. Project-related activities and resultant land cover changes would occur within the primary (985-foot radius from the nest tree) or secondary (6,600-foot radius from the nest tree) protection zones of one or both caracara nest sites. Therefore, the Corps has determined that the proposed project “may adversely affect” the crested caracara. The Service concurs with the Corps’ determination.

Eastern Indigo Snake

The eastern indigo snake is listed by the Service and the FWC as a threatened species. Eastern indigo snakes require a mosaic of habitats. Because eastern indigo snakes are found throughout Florida and use a variety of habitat types, including citrus groves, its presence in the project area is likely. No individuals have been observed during project field surveys, although the Service observed a black snake on the site on February 21, 2007, that may have been an eastern indigo snake. While no gopher tortoise burrows have been observed on the project site, armadillo burrows are frequently observed along canal banks and may provide refuge for indigo snakes.

Following construction, very minimal habitat for the eastern indigo snake will be available in the project area. The interior slopes of the reservoir cells and the interior cell dam embankment will be lined with soil cement, thus making the majority of the reservoir site unsuitable habitat. A perimeter canal will make access to the reservoir difficult. In addition, the access road and other maintenance roads will mainly be all-weather roads consisting of a limerock base with gravel substrate surface. The entrance road and small portions of the perimeter access road and maintenance roads will be paved. The only portions of the C-43 West Reservoir project that may provide limited habitat for the eastern indigo snake are the embankments that will be constructed between the crest of the dam and the project boundary. These embankments will consist of overburden from the project area and maintained sod. Because these embankments will be regularly mowed, they will not provide highly desirable cover or habitat for the species. Therefore, the Corps has determined that the proposed project “may adversely affect” the eastern indigo snake due to the loss of 10,602 ac of potentially suitable habitat. The Service concurs with the Corps’ determination.

Florida Panther

The proposed C-43 West Storage Reservoir project is within the Service’s Panther Focus Area for the Florida panther (Figure 7) and provides habitat suitable for use for foraging and dispersal. The total construction footprint, including both wetlands and uplands, will be approximately 10,602 ac of which 10,492 ac are within the reservoir and 110 ac are within the access road parcel. In a January 10, 2007, letter, the Corps determined that the C-43 West Storage Reservoir project “may affect” the Florida panther and requested initiation of formal consultation. On January 24, 2007 and March 8, 2007, the Service requested the Corps to provide additional information on manatees, wood storks, snail kites, and panthers. The District provided that information in their March 22, 2007, letter received by the Service on March 26, 2007.

The overall purpose of the CERP is to restore the Everglades ecosystem and species assemblages. Implementation of CERP is expected to provide large-scale, long-term benefits to

the ecosystem and listed species, though individual actions may result in smaller-scale or short-term adverse effects to one or more listed species. Because CERP is a regional ecosystem restoration program with one project sponsor (*i.e.* the District), the Corps and the Service have agreed to evaluate the effects of the complex, long-term, inter-dependent nature of CERP on listed species using a programmatic or regional approach. Thus, the resultant positive (*e.g.*, habitat acquisition and restoration) and negative (*e.g.*, construction-related habitat loss) effects to the panther in south Florida will be evaluated by bands of projects identified in the Master Implementation Sequencing Plan (MISP). Band 1 consists of projects that will be constructed by 2010 including the state-expedited Acceler8 Projects of which the C-43 West Reservoir project is a component. Figure 8 shows the location of these Band 1 projects in relation to the various panther zones in south Florida. In addition to evaluating the effects of the proposed C-43 West Reservoir project in the Biological Opinion, the Service also aggregated the Band1/Acceler8 projects and evaluated them as a group using the method described in Analyses for the Effects of the Action to assess the overall effects of this phase of CERP implementation on Florida panthers and habitat used by the Florida panther. The Service will also assess other Band 1/Acceler8 projects individually in subsequent Biological Opinions as the Corps and District finalize plans for implementation and request consultation on those projects.

The proposed C-43 West Storage Reservoir project is one of several Band1/Acceler8 projects that fall within the Florida Panther Focus Area (Figure 8). The reservoir project will result in the direct loss of 10,602 ac of habitat the panther may use, of which 267 ac were already compensated for under formal consultation for the Test Cell project (DA Permit 2005-6598 [IP-TKW]). The remaining habitat loss (*i.e.*, 10,335 ac) provides approximately 19,438 panther habitat units (PHUs) (see definition in the Effects of the Action) with a recommended compensation of 46,933 PHUs. The Band 1/Acceler8 projects located within the core panther conservation area collectively provide compensation for the loss of 10,602 ac of panther foraging and dispersal habitat on the C-43 West Storage Reservoir project site through the off-site acquisition and restoration of approximately 100,492 ac of habitat used by the panther (Figure 8) (Analyses for Effects of the Action). CERP's ecosystem approach to habitat restoration and preservation will provide long-term net benefits to the Florida panther.

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). In addition, the Service has examined Kautz et al. (2006) for its

scientific validity, specifically with regards to comments and recommendations by other reviewers.

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.

Kautz et al. (2006)

The Florida Panther Subteam was charged with developing a landscape-level strategy for the conservation of the Florida panther population in south Florida. The Subteam produced the draft Landscape Conservation Strategy for the Florida Panther in South Florida in December 2002 and provided it to the Service. Upon receipt, the Service began to use the information in the draft Landscape Conservation Strategy in its decision making processes and documents since it was part of the best scientific information available to the Service at the time. Since then some portions of the science and findings in the draft Landscape Conservation Strategy have been challenged. Many, but not all, of the Subteam members have refined the methodology, further analyzed the data, and better defined the results of the Landscape Conservation Strategy into the publication, referred to here as Kautz et al. (2006). Therefore, Kautz et al. (2006) and the analyses contained therein, along with all other best scientific and commercial data available, is referred to in this document and will be used in our decision making process until or unless new information suggests revisions are necessary.

Consultation History

The Service received a Phase I and II environmental Assessment Report for the Berry Labelle-Congen Grove dated December 6, 1999.

In response to the Corps' February 25, 2002, request, the Service provided information on fish and wildlife resources included federally-listed species that may be within the proposed reservoir locations or affected by the activities of the C-43 Basin Storage Reservoir in our April 11, 2002, Planning Aid Letter (PAL). The site-selection sub-team used this information guide the site selection process by focusing on suitable reservoir locations that would minimize impacts to fish and wildlife resources.

On March 20, 2003, site selection sub-team led by the Service, presented new updated preliminary site locations for potential reservoirs in the Caloosahatchee Basin overlayed on various GIS cover type maps.

On March 31, 2003, the Service met with Jim Beever (FWC) and Sandy Scheda (SEA) to review the new reservoir location maps and to apply the matrix to the revised map. Two sites dropped out due to conflicts with panther habitat, specifically, the Caloosahatchee escoscape.

The Service assisted the Corps by providing listed species maps within Caloosahatchee Basin for use in the reservoir siting process and explained these maps at an Environmental Stakeholders meeting on April 30, 2003 and public meeting on May 1, 2003.

In a letter dated May 19, 2003, the Service provided comments on the March 3, 2003, Phase I and II Environmental Site Assessment for the Griffin Brothers property. In that letter, the Service recommended further delineation of pentachlorophenol (PCP) in the canal in the vicinity of the S5 sample location.

The Service provided scoping comments under the National Environmental Policy Act (NEPA) for development of the Draft Environmental Impact Statement for the C-43 Basin Storage Reservoir Project, including information on federally-listed species that may be affected by the proposed project.

The Service provided information on listed species distributions to Alternative Selection sub-team on June 13 and June 26 to refine the list of potential reservoir locations in the Caloosahatchee Basin.

On July 14, 2003, the Service provided comments on the March 25, 2003, Phase I and II Environmental Site Assessment for the Winthrop Citrus Investors property (Winthrop property). In that letter, the Service recommended delineation of aldrin contamination.

The Service provided additional information on direct and indirect impacts to significant fish and wildlife resources in the project area in an August 13, 2003, PAL. That letter addressed wetland and upland habitats of significant importance, federally-listed species, and potential contaminant issues.

On March 31, 2004, the Service received a proposal for the Phase I and II Environmental Site Assessment for the Brian Paul Citrus Grove. The Service requested that zinc be added to list of metals analyzed via an April 8, 2004, email.

Service, Corps, and District staff conducted wetland assessments (Wetland Rapid Assessment Procedure and Uniform Mitigation Assessment Method) of Berry Groves and other potential reservoir sites in the Caloosahatchee River Basin. Ground surveys were conducted on June 8, 9, and 10, 2004, followed by aerial surveys on June 14 and 15, 2004.

Service, Corps, and District staff completed ground and aerial wetland assessment (Wetland Rapid Assessment Procedure and Uniform Mitigation Assessment Method) at Berry Groves July 13, 14, and 15, 2004.

The Service reviewed additional information provided by Environmental Consulting and Technology, Incorporated, (ECT) regarding aldrin contamination on the Winthrop property and agreed in a July 1, 2004, letter, that no further aldrin delineation was necessary.

Service staff met with SFWMD, FWC, and Scheda Ecological Associates on July 20, 2004, to discuss the boundary change for the Berry Groves reservoir. Due to the change in the project boundary, additional consultation on potential project impacts to federally-listed species, including the Florida panther, Audubon's crested caracara, Everglades snail kite, wood stork, and Florida grasshopper sparrow, will be necessary. The southern boundary was expanded to include Duda property in the southwest and southeast corners. The southeast corner contains pine flatwoods, cypress slough, saw palmetto, and lightly wooded pasture that was previously farmed. That area has also been identified as Primary and Secondary Zones for the panther.

Additional information on PCP contamination on the Griffin Brothers property was provided by the District via an August 11, 2004, letter, prepared by ECT. Based on that information, the Service agreed no further delineation of PCP was needed in an October 13, 2004, letter.

On August 17, 2004, the Service received the Phase I and II Environmental Site Assessment report for the Bryan Paul Citrus Grove. In our September 20, 2004, letter, the Service requested further evaluation and remediation for Chlordane. Additional information regarding our letter was provided by Tetra Tech on December 22, 2004.

On December 1, 2004, ECT recommended further delineation of chlordane on the Bryan Paul Citrus Grove in their Screening Level Ecological Risk Assessment for that site.

The Service reviewed and provided comments via a January 25, 2005, email on the November 17, 2004, proposal for the Phase I and II Environmental Site Assessment for the Bob Paul Citrus Grove. The Service requested complete sampling in the former row crop area.

On February 3, 2005, Service staff met with FWC staff to discuss fish and wildlife resource concerns associated with the C-43 West Reservoir location and the remaining potential alternatives.

On March 22, 2005, the Service held an interagency meeting at the District office in Fort Myers to discuss potential project impacts on federally and State-listed species. Representatives from the District, Corps, FWC, and the Service's Vero Beach office were in attendance. The discussion focused primarily on the accelerated C-43 West Reservoir component but also applies to the selected alternative plan that will be addressed in the Corps' Project Implementation Report.

On March 29, 2005, Service staff provided a PAL recommending that the Corps and the District design the C-43 West Reservoir to provide water quality benefits by reducing nutrient loads in accordance with CERP Guidance Memorandum Number-Revision 023.01. That letter also included information regarding federally-listed species in the Caloosahatchee estuary.

On May 5, 2005, the Service received the April 29, 2005, draft scope of work for the C-43 West Storage Reservoir Temporary Test (Embankment) Cells from the District.

On May 26, 2005, Service staff met with the Corps, District, SCI, FWC, and SEA to discuss potential adverse effects to threatened and endangered species that may occur as a result of the C-43 West Reservoir Project or the Test Cell Project. The meeting focused on: 1) the latest method for assessing habitat compensation recommended when adverse project effects to habitat used by the Florida panther cannot be avoided or when adverse effects have been minimized but loss will still occur; and 2) the Test Cell Project design, 404 permit needs, and listed species consultation.

On June 27, 2005, the Corps conducted an interagency site visit to delineate wetland boundaries and assess current conditions within the Test Cell Project footprint. Service, District, SCI, and SEA staff participated in the site visit.

On July 1, 2005, the Service provided comments on the May 27, 2005, Phase I and II Environmental Site Assessment for the Bob Paul Citrus Grove. In that letter, the Service recommended that the District consult with DEP regarding on-site burial of contaminated soil.

On July 25, 2005, the Corps issued a Public Notice for permit application SAJ-2005-5958 (IP-TKW) indicating the District applied for a permit to construct two temporary test cells within the proposed 11,000-acre footprint of the C-43 West Storage Reservoir. The proposed Test Cell Project would dredge, fill, or flood 4.5 acres of jurisdictional wetlands and 24.5 acres of “other surface waters.” To mitigate for wetland impacts, the applicant has proposed to include wetland features in the C-43 West Reservoir design and/or other Acceler8 projects. They also requested the Corps to consider downstream environmental benefits that will result from construction and operation of the C-43 West Storage Reservoir during their project evaluation.

On July 28, 2005, Service staff met with the District, Corps, EPA, FDACS, and SEA staff to review and finalize WRAP scores for the wetlands occurring within the Test Cell Project footprint.

On July 29, 2005, the Service received the draft Biological Assessment prepared by SEA for the Test Cell Project via email.

On August 5, 2005, the Service emailed informal comments on the draft Biological Assessment to the District.

On August 19, 2005, the Corps submitted the final Biological Assessment for the Test Cell Project to the Service with a letter of the same date. In the letter, the Corps determined that the Test Cell Project will have “no effect” on the West Indian manatee, and “may affect, but is not likely to adversely affect” the bald eagle, Audubon’s crested caracara, Everglade snail kite, eastern indigo snake, and wood stork. The Corps also provided a “may adversely affect” determination for the endangered Florida panther and requested the Service initiate formal consultation.

On August 29, 2005, the Service telephoned and emailed the Corps requesting additional information necessary to evaluate project effects to the Florida panther.

Service attended a November 9, 2005, interagency meeting to discuss preliminary designs to incorporate littoral zones for fish and wildlife habitat adjacent to the seepage canal bordering the C-43 West Reservoir. Designs will be further developed by SEA and distributed to the group for review. The extent of wetland acreage is much smaller than originally discussed (*i.e.*, total is less than 30 acres) and will be spaced every 500 feet between areas reserved for potential ASR wells. The littoral zones will be used as compensation for the loss of wood stork foraging habitat as result of the Test Cell project.

On November 9, 2005, the District provided the additional information necessary to evaluate project effects to the panther to the Service, including information on living radio-collared panthers with home ranges overlapping the project area, locations of known panther vehicle collisions within the project area, and surrounding land use and permitted projects in the Test Cell Project area.

On November 18, 2005, the Service requested the District to provide information on state and local land acquisitions in the Test Cell project action area from 1999 to present via email.

The District provided the information on state and local land acquisitions in the project area on November 18, 2005, via email.

On November 30, 2005, the Service completed formal and informal consultation on the Test Cell project via a letter and accompanying Biological Opinion addressing project effects on the Florida panther.

The Service received a December 28, 2005, Closure Assessment Report on contaminants for the Griffin Brothers property.

On January 3, 2006, the Service email to Corps and District regarding follow up on the Test Cell project 404 permit and T&E educational materials; caracara and indigo snake surveys for the full reservoir footprint; and the design, location, and acres of littoral zones and other fish and wildlife features.

The Service met with the SFWMD and the Corps on the February 6, 2006, to review the March 28, 2005, draft Fish and Wildlife Recommendations for Comprehensive Everglades Restoration Plan (CERP) Stormwater Treatment Area and Reservoir Operation and Design developed by the Service and the Fish and Wildlife Commission and discuss incorporating those recommendations in the design of the 10,000-acre C-43 West Reservoir. The District will not incorporate any of those recommendations in the reservoir design that might encourage birds to nest in the vicinity. Additionally, the interior slopes of the reservoir levees will be lined with a concrete soil mixture to prevent erosion, reduce seepage, and increase levee stability. The current reservoir design does include construction of 9 to 28 acres of shallow wetland habitat adjacent to the seepage canal that

will be constructed 80 to 100 feet from the outside perimeter of the reservoir. Any existing canals and new borrow pits/canals dredged during levee construction will not be filled to provide deep water habitat for fish during periods of drought or when the reservoir is drawn down.

The Service received an informal summary of the first caracara surveys conducted by SEA in compliance with our survey protocol on March 6, 2006, via email and a formal Memorandum summarizing that first survey on March 22, 2006.

The Service received a formal Memorandum summarizing the second caracara surveys conducted by SEA in compliance with our survey protocol via email on March 24, 2006.

On March 30, 2006, Service staff participated in the third caracara surveys conducted by SEA and received a Memorandum summarizing those surveys via email on April 10, 2006.

The Service received the March 31, 2006, Work Plan for Additional soil Investigations to delineate chlordane contamination on the Bryan Paul Citrus Grove. The Service concurred with the work plan via an April 4, 2006, email.

By letter dated April 18, 2006, the Service provided comments on the October 13, 2003, Ecological Risk Assessment for the Berry Labelle-Congen Grove. In that letter, the Service recommended remediation of areas known to be contaminated with copper and that additional soil sampling for copper be conducted.

On April 24 and 25, 2006, the Service attended the C-43 West Reservoir Critical Criteria Meeting in Labelle, Florida. On April 25, 2006, a breakout session was held to review information needs for upcoming permit applications, including information on federally-listed species. Reservoir fill rates protective of indigo snakes recommended for other CERP projects (*i.e.*, C-44) were discussed. The District indicated that those rates were acceptable and that they probably couldn't fill the reservoir faster anyway.

On April 26, 2006 and May 15, 2005, the Service provided information to the Corps and District via email, on the need for and appropriate methodology to conduct panther prey surveys to adequately address project impacts and associated habitat loss to the Florida panther.

The Service held an internal meeting on May 24, 2006, in Vero Beach, Florida, on Eastern Indigo Snake section 7 consultation issues.

Service staff reviewed and provided comments on Acceler8's preliminary design for the C-43 West Reservoir Design. Comments and recommendations included: development of 3 sets of operating criteria for the reservoir based on current conditions and predicted long-term climatological conditions such as drought, normal, and above average rainfall years; ensure manatee protection measures will be incorporated in design of all water control structures where necessary; ensure inclusion of Indigo snake protection measures in construction contracts; potential decreased surface water elevations in wetlands southwest of the project area in primary panther habitat indicated by preliminary model results need to be evaluated in more detail; and to

ensure that current proposed recreation plans for the project area do not conflict with project goals.

The Service reviewed the July 21, 2006, Additional Soil Assessment Report for the Bryan Paul Citrus Grove. Chlordane contamination was identified to be within a 20-acre area. The Service concurred with the 18ug/kg target clean-up level for chlordane in our August 9, 2006, letter.

The Service provided comments on the Additional Soil Investigations, Berry Labelle-Congen Groves report submitted to the District by URS Corporation by letter dated July 26, 2006. In that letter, the Service recommended that further sampling be conducted to accurately delineate the spatial extent of copper contamination and that soil remediation be considered for grids 56 and 145.

On August 14, 2006, Service staff participated in an interagency (Corps, District, Service, and EPA) helicopter survey of the Caloosahatchee River basin and estuary to assess basin-wide project benefits for the Corps' mitigation ledger.

The Service provided comments on the July 20, 2006, document titled "Additional U.S. Fish and Wildlife Service Soil Investigations, Berry Labelle-Congen Groves" in a September 14, 2006, letter. In that letter, the Service concurred that copper contamination was adequately delineated and that grids 56, 58, 124, 125, 134, 135, and 143 require remediation.

On October 30, 2006, the Service responded to the Response to Corps' October 27, 2006 email regarding section 7 consultation process and keeping the Corps' C-43 West Reservoir Project Implementation Report and the District's Acceler8 C-43 West Storage Reservoir project on the same timeline with one consultation. The Service reiterated that formal consultation would be needed for three species, the caracara, indigo snake, and panther, and requested advanced review of the Biological Assessment before the Corps requested formal consultation.

The Service reviewed and provided comments to the Corps on the Draft Biological Assessment for the C-43 West Storage Reservoir Project, Hendry County, Florida on November 9, 2006.

On November 10, 2006, the Corps submitted the Service's and the Corps' comments submitted to the District.

The Service received combined Department of Army and state of Florida Environmental Resource Permit Application for C-43 project on November 20, 2006.

On December 1 and 7, 2006, the Corps and Service discussed the timing of the initial tree clearing on the project site via email. The District has proposed to clear existing citrus trees onsite after completion of section 7 consultation but prior to 404 permit issuance. They have proposed to avoid wetlands during the initial clearing. We also discussed project effects on snail kites as a result of copper contamination. If no additional copper has been applied to the project area and copper remediation occurs on the grids identified in our September 14, 2006, letter, then the project is probably not likely to adversely affect snail kites.

Via January 10, 2007, email correspondence, the Service reviewed the Corps' preliminary C-43 project effects determinations for listed species and identified information needed to complete consultation on manatees, including effects of reservoir operations.

The Service received a letter and a Biological Assessment from the Corps of Engineers on January 12, 2007, requesting initiation of formal consultation on the C-43 West Reservoir Project.

Service staff reviewed the information provided and requested additional information pertaining to consultation for wood storks and snail kites during a January 24, 2007, telephone conversation and by email on January 30, 2007.

The Service met with the Corps of Engineers and South Florida Water Management District on February 7, 2007, to discuss outstanding threatened and endangered species issues and additional information needed for consultation on wood storks, snail kites, caracara, and manatees; and information regarding potential project impacts to upstream wetlands in the vicinity of the Spirit-or-the-Wild Wildlife Management Area and the Okaloachoochee Slough State Forest and Wildlife Management Area.

Service staff conducted two site visits, February 7 and 8, 2007, to determine if the caracara territory and nest site off State Road 80 is active this year. A pair of caracaras were observed perched near the nest tree used last year. Although the territory is occupied, no nesting activity was observed.

The Service participated in the February 21, 2007, interagency site visit to evaluate wetlands and potential wood stork foraging habitat within the C-43 West Reservoir footprint.

On February 23, 2003, the Corps inquired through email correspondence if changes in the Service's Florida panther consultation area would change consultation needs for the C-43 West Reservoir project. The Service confirmed that compensation for project effects to panther habitat would still be needed.

Information presented during a March 6, 2007, C-43 West Reservoir Project Delivery Team meeting in LaBelle, Florida, included an access road parcel that was not included in the Biological Assessment or consultation initiation package. Through email correspondence on March 8, 2007, the Service requested that more information on that parcel be provided including size, preliminary site plan, and potential habitat alterations. The Service also requested more information on the pump stations and manatee excluders.

The Service received additional information requested from the Corps in a March 26, 2007, letter. The information provided included information on wood stork foraging habitat, copper applications and remediation in the project footprint, wetland impacts, manatees, and additional impacts to panther and caracara habitat associated with the access road parcel. Upon receipt of this information, the Service initiated formal consultation under section 7 of the Act.

Service staff met internally with our caracara species lead on April 14, 2007, to discuss C-43 West Storage Reservoir impacts to caracara habitat, estimating take, potential compensation for habitat loss and monitoring needs.

The Service met with the Corps and District on May 15, 2007, to discuss outstanding threatened and endangered species issues in order to complete informal and formal consultation on the effects of the C-43 project. Outstanding issues included incorporation of CERP Thermal Guidelines in Manatee-Accessible Waters in the project monitoring plan, compensation for impacts to wood stork foraging habitat, and compensation for impacts to crested caracara habitat. The Service attended the May 17, 2007, public meeting in LaBelle, Florida, on the C-43 West Storage reservoir project. The public asked questions regarding the status of endangered species consultation for the project.

The Service received an email on May 18, 2007, from the Corps committing to a monitoring and research project as compensation for impacts to caracara resulting from the proposed reservoir, and committing to using the Corps existing volunteer manatee observer program for the Okeechobee Waterway for manatee observations for the C-43 reservoir project as discussed during the May 15, 2007, meeting.

On May 22, 2007, the Service met with the Superintendent of Duda Farms and their consultant to confirm the location of the caracara nest on Duda property southeast of the reservoir.

In response to an information request made by telephone, the Service received additional information on the trash rake systems that serve as manatee excluders at the pump stations via a May 23, 2007, email. In response to that request, the Service also received information on the elevations of the Townsend Canal and the reservoir intake canal via an email dated May 24, 2007.

The Service sent the draft manatee section of the concurrence letter for the proposed project to the Corps, District, FWC, and other Service staff to review on May 24, 2007.

The Service received information on the construction schedule for the proposed project from the District via email on May 24, 2007.

On May 30, 2007, the Service received comments on the draft manatee section of the concurrence letter for the proposed project from the Corps and District via separate emails. The District did not agree with some of the project modifications to prevent harm to the manatee associated with the CERP Thermal Guidelines in Manatee-Accessible Waters.

The Service provided a map of the confirmed caracara nest location on private property southeast of the project area to the District via email on June 1, 2007.

On June 4, 2007, the Service requested updated habitat acres by Florida Land Use, Cover and Forms Classification System (FLUCCS) within the C-43 reservoir footprint. The Public Notice

identified a total of 10,492 acres within the reservoir footprint and the BA identified 10,361 acres within the reservoir footprint.

The Service held a conference call with the Corps and District on June 5, 2007, to discuss the outstanding issue regarding incorporation of CERP Thermal Guidelines in Manatee-Accessible Waters in the project design and monitoring plan. Both operational and structural modifications to the reservoir project were discussed.

The Service received the Intermediate Design Report (*i.e.*, 60 percent design) via overnight mail on June 7, 2007, and the associated design plans on June 8, 2007.

On June 7, 2007, another interagency conference call was held to discuss the thermal guidelines for manatees. The District obtained temperature data for the Townsend Canal and the Caloosahatchee River in the vicinity of the Townsend Canal from the Florida Department of Environmental Protection and provided that data as well as temperature data from the Test Cell project to the participants on the conference call.

On June 7, 2007, the Service and FWC further developed monitoring protocol to define what constitutes a shift in manatee distribution as a result of warm-water discharges into the Townsend Canal.

Through email correspondence on June 7, 2007, the Corps and the Service agreed to further discuss ways to prevent potential cold stress to manatees as a result of reservoir releases during the winter including replacing the weir at the Townsend and Caloosahatchee River. Two conference calls were held on June 13 and 14, 2007, to discuss what the potential impacts to manatees are related to thermal stress and potential barriers or other solutions that could prevent the situation from occurring.

On June 8, 2007, the Service received additional temperature data from the District for Test Cell 2 which was not included in the data provided on June 7, 2007, and the raw data provided to the District from DEP. DEP provided shapefiles of the water quality station locations via email.

On June 11, 2007, the Service received updated habitat acreages by FLUCCS code within the reservoir footprint and data on state acquisitions with 25 miles of the project footprint.

On June 11, 2007, the Service received temperature data for the Townsend Canal and Caloosahatchee River from the DEP. They searched the STORET database and the IWR database. The two datasets were essentially the same.

The Corps, EPA and the Service participated in a teleconference on June 12, 2007, to finalize the Uniform Mitigation Assessment Method Scores for the Caloosahatchee River and estuary and the tapegrass beds in the upper Caloosahatchee estuary that will be used for mitigation for on-site wetland impacts and compensation for the loss of on-site wood stork foraging habitat.

The Service provided bar graphs of temperature data and monthly flow comparison data developed by the District, and a spread sheet of temperature data provided by DEP and a map of the station locations to the Corps and FWC for review for the June 13 and 14, 2007, teleconferences referenced above.

The Service confirmed the reservoir fill rate that would reduce take of indigo snakes and reduce negative impacts to other wildlife species via email on June 14 and 15, 2007.

On June 15, 2007, Service contaminants staff reiterated that the copper remediation of all impacted grids in the reservoir footprint to less than 85 ppm will be protective of snail kites and other species, including the indigo snake, via email.

On June 20, 2007, the Service, Corps and District held a conference call to discuss a timeline for resolving the outstanding manatee issues. The Corps and District are researching appropriate weirs or gates that would serve as a barrier to prevent manatee access to the Townsend Canal while still achieving desired flow rates through the canal. The Corps requested more time to research barriers and develop cost estimates for construction and operation and maintenance of a structure. They requested we reach a resolution by August 1, 2007.

On June 20, 2007, the Service requested that the District provide updated habitat acreages by FLUCCS code within the reservoir footprint that was consistent with the jurisdictional wetland data and 10,492-acre reservoir footprint referenced in the Corps' Public Notice. That data was provided via email on June 20, 2007.

On June 21, 2007, the Service requested that the District provide information on cumulative panther habitat impacts (*i.e.*, Developments of Regional Impact, Planned Unit Developments, and South Florida Water Management District Environmental Resource Permits) in a concise manner that could easily be interpreted and used for the analyses in the Biological Opinion and that is consistent with our standard request for additional information for panther consultations.

On June 22, 2007, the Service provided a draft Biological Opinion to the Corps and the District for review.

The district provided information on a potential manatee barrier for the Townsend Canal and the associated cost to the Service and the Corps on June 25, 2007.

On July 3, 2007, the Service received comments from the District on the June 22, 2007, draft Biological Opinion. The District identified concerns regarding the manatee thermal guidelines; the recommended reservoir filling rates for the initial fill and subsequent rehydration events to protect indigo snakes; and the timing, duration, and site access for the caracara research and monitoring plan.

On July 10, 2007, the Service participated in an interagency conference call to discuss construction of a manatee barrier at the confluence of the Townsend canal and the Caloosahatchee River and temperature and manatee monitoring needs.

On July 10, 2007, the Service received information from the District on proposed volumetric reservoir filling rates instead of manually monitoring the depth as the reservoir is filled.

On July 11, 2007, the Service held an internal conference on manatee monitoring needs and the Service and the Corps agreed to a manatee monitoring plan to address the CERP manatee thermal guidelines.

On July 12, 2007, the Service received the revised data for the cumulative effects analyses for the Florida panther.

On July 13, 2007, the Service held an interagency conference call to discuss the District's concerns: the District and Corps agreed to install a barrier to prevent manatee access to the Townsend canal during the winter period; modifications to the temperature monitoring and manatee observation plan were discussed; the volumetric curves and reservoir fill rates were discussed, including the length of time to fill the reservoir at the $\frac{1}{2}$ inch per day rate for the first 6 inches; and the site access, timing, and duration of caracara research and monitoring plan were discussed.

On July 16, 2007, the Service held an internal conference on indigo snakes and the volumetric fill data provided by the District on July 10, 2007.

On July 17, 2007, the Service requested additional information on filling the reservoir at 3 inches and 6 inches per day including the incremental fill times and plots of areas flooded at each interval.

On July 19, 2007, the District provided the incremental fill times and plots of the area flooded at each interval for a fill rate of 1 foot per day. The 1 foot per day was used due to the time needed to generate the plots at the slower pumping rates. Based on this information, the Service recommended an initial fill rate of 6 inches per day and a rehydration rate of 1 foot per day. The Service also recommended inclusion of an indigo snake monitoring plan to determine the effect of rehydration on snakes and the extent of their use of the reservoir during drawdown events.

On July 20, 2007, the service participated in an interagency teleconference to confirm acceptance of the fill rates and monitoring recommendations for indigo snakes.

The Service has reviewed all information received pertinent to the Florida panther, the crested caracara, and the indigo snake for the C-43 West Storage Reservoir project and concurs with the Corps' determination that this proposed project "may affect and is likely to adversely affect" the Florida panther, the crested caracara, and the indigo snake. As of March 26, 2007, the Service received all information necessary for initiation of formal consultation on the Florida panther, the crested caracara, and the indigo snake for this project as required in the regulations governing interagency consultations (50 CFR § 402.14). The Service is providing this Biological Opinion in conclusion of formal consultation.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Proposed Action

The C-43 West Storage Reservoir project is a component of CERP and is included in the Band 1/Acceler8 Projects. The overall purpose of the CERP is to restore the Everglades ecosystem and species assemblages. Together, implementation of the CERP and Acceler8 is expected to provide large-scale, long-term benefits to the ecosystem and listed species, though individual actions may result in smaller-scale or short-term adverse effects to one or more listed species. The C-43 West Storage Reservoir project is located in portions of Sections 31 through 36, Township 43 South, Range 28 East; Sections 6 and 31, Township 43 South, Range 29 East; and Sections 1 through 12, Township 44 South, Range 28 East, Hendry County, Florida (Figure 1).

According to the DPIR/EIS and PN, the Corps and District propose to construct an approximately 10,492-ac above-ground reservoir surrounded by a perimeter embankment and canal. Reservoir access and recreational facilities will be located within an adjacent 110-ac access road parcel (Figure 1). The proposed project is designed to pump water from the Caloosahatchee River into the proposed reservoir via the Townsend Canal and capture basin runoff from the Townsend Canal, store water in the reservoir to reduce damaging high freshwater flows to the Caloosahatchee Estuary, and discharge water back to the Caloosahatchee River via the Townsend Canal to augment low flow events during the dry season and maintain a minimum flow of 450 cfs at S-79. The reservoir will consist of two cells capable of storing a total of 170,000 acre-feet of water at an approximate depth of 20 ft. Major features of the proposed project are described in Section 7 and Appendix A of the DPIR and include (Figure 9):

- 16.3 miles of external (dam) embankments varying in height between 27 and 38 ft above the existing grade;
- Soil-Bentonite slurry walls within and beneath the external embankments;
- 2.8 miles of internal (dam) embankment separating the two cells with an approximate height of 31 ft above existing grade;
- An inflow pump station (C43PS-1) consisting of four diesel-powered pumps with a total pumping capacity of 1,500 cfs (i.e., two 500 cfs pumps and two 250 cfs pumps);
- 14.7 miles of perimeter canal;
- A perimeter canal pump station consisting of electric-powered pumps with a total pumping capacity of 195 cfs (i.e., three pumps of 65 cfs);
- Numerous spillways, culverts, and perimeter canal structures; an internal cell balancing structure; and outlet structures; and
- Two discharge structures (C43S-1 and C43S-8) each with a discharge capacity of 500 cfs.

Water control structures C43S-16, C43S-17, C43S-18, and C43S-19 were included in the DPIR but have since been removed from the C-43 West Storage Reservoir project and are not included in the District's Corps permit application.

The C-43 West Storage Reservoir project site contains a total of 10,602 ac, including the reservoir footprint and access road parcel, currently under active citrus production. Land use and cover consists primarily of agricultural land and associated roads and other urban lands (9,540.7 ac). Jurisdictional wetlands and waters of the United States (US) cover 1,061.3 ac of the project site and include 934.6 ac of man-made agricultural ditches and canals used for irrigation and drainage conveyances for the citrus operations and 126.7 ac of jurisdictional wetlands (Figure 4).

Approximately 267 ac within the C-43 West Storage Reservoir project area were previously impacted during construction of the C-43 West Reservoir Test Cell project (Test Cell project), including 29 ac of jurisdictional wetlands and waters of the US (Figure 4). The Test Cell project was constructed to evaluate the on-site seepage potential and effectiveness of seepage control measures, the suitability of on-site materials for embankment construction and slope protection, and the effects of water residence time and seepage on water quality. That project included two 500-foot by 500-foot test cells with offset seepage canals, a borrow area, settling ponds, and staging areas and was authorized under DA Permit number 2005-6598 (IP-TKW) issued December 6, 2005. Impacted jurisdictional areas included 1.9 ac of excavated open-water, 4.5 ac of wet prairie, and 26.0 ac of tertiary, agricultural drainage canals.

The Service understands that the Corps will account for the unavoidable adverse impacts to wetlands and other aquatic resources resulting from both the C-43 West Storage Reservoir project and Test Cell project in an Acceler8 system-wide mitigation ledger. As described in the Corps' PN, that ledger includes accounting for system-wide interdependencies and watershed benefits of the District's Acceler8 projects (*i.e.*, Band 1 projects) in satisfying the regulatory mitigation requirements for wetland and other aquatic resource impacts resulting from construction of individual Acceler8 projects. The Corps is using the UMAM to assess the function and value of aquatic resources adversely impacted by construction of the C-43 West Storage Reservoir and Test Cell projects and to assess the anticipated environmental lift to the Caloosahatchee estuary as a result of implementation of the proposed project and remaining Acceler8 projects.

Although not considered as compensatory mitigation, the proposed C-43 West Storage Reservoir project incorporates features that will enhance fish and wildlife habitat. The existing agricultural canals and interior borrow areas excavated for fill material will provide deep-water refugia for fish and other aquatic organisms within the reservoir during drawdown conditions. The exterior face of the external embankments will be planted and maintained as grass. However, the interior face of the external embankments will be covered in concrete to reduce erosion potential and will not possess a vegetated littoral area. The perimeter canal will include approximately 109 ac of littoral zones to provide foraging and nursery habitat for aquatic fauna (*e.g.*, wading birds, fish, herpetofauna, etc.). Also, portions of the test cell embankments will be left in places to provide roosting habitat for birds, turtles, and other fauna when the reservoir is full.

The C-43 West Storage Reservoir will result in the direct loss of 10,602 ac of habitat suitable for foraging and dispersal by the Florida panther (see discussion under Wildlife Assessment), of which 267 ac were already compensated for under formal consultation for the Test Cell project (DA Permit 2005-6598 [IP-TKW]). The remaining habitat loss (*i.e.*, 10,335 ac) represents

19,438 PHUs with a recommended compensation of 46,933 PHUs (see discussion under Habitat Assessment Methodology). The project overlaps with the Service’s Panther Focus Area (Figure 7) for the Florida panther and contains both Florida panther Primary and Secondary habitat (Kautz et al. 2006) (Figure 10).

The District will provide compensation for loss of the remaining 10,335 ac of low quality habitat used by the panther through the acquisition and restoration of approximately 59,294 ac of habitat used by the panther in the Primary Zone and approximately 41,198 ac in the Other Zone through the implementation of Acceler8 Projects under CERP. This gain equates to over 548,000 functional units of habitat used by the panther (see definition in the Effects of the Action). The Acceler8 Projects proposed for compensation will consist of bottomland hardwoods, freshwater marshes, hardwood swamps, cypress swamps, and other wetland habitats. The majority of compensation areas are also surrounded by other Primary Zone habitat used by the panther and protected conservation lands that are used by the Florida panther (Figure 8).

Action Area

The CERP implementation area in South Florida overlaps the Service’s Panther Focus Area for the Florida panther (Figure 8). The Panther Focus Area 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 8). 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 11) as all lands within a 25-mile radius of the C-43 West Storage Reservoir 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.

The CERP planning area overlaps the action area defined above for this consultation, as well as the Service's Panther Focus Area for the Florida panther (Figure 8) and the area currently used by the panther, and therefore, the CERP implementation will affect the Florida panther and habitat used by the panther. Though the overall purpose of the CERP is to restore the Everglades ecosystem and species assemblages, not all projects will benefit Florida panthers or all federally listed species. Implementation of the suite of Band1/Acceler8 projects is, however, likely to provide direct and indirect beneficial effects to the natural ecosystems and native species communities in the Everglades landscape within the area currently used by the Florida panther resulting in a net positive balance for Florida panthers.

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE - Florida Panther

Status - Panther Biology and 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 U.S. (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 believed 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 (*Odocoileus virginianus*), 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 Act in 1973. In addition, 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 currently required by section 4(a)(1) of the Act. However, the technical and 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 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 7 ft (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 6 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 U.S. 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 reproducing populations of panthers have been found outside of south Florida for at least 30 years despite intensive searches to document them (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 breeding range. Reproduction is known only in the Big Cypress Swamp and Everglades physiographic region in Collier, Lee, Hendry, Miami-Dade, and Monroe Counties south of the Caloosahatchee River (Belden et al. 1991). Although confirmed panther sign, male radiocollared panthers, and uncollared males killed by vehicles have been recorded outside of south Florida in recent years, no female panthers have 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 not more than ten individual 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 population estimate based on a substantial body of field data (Beier et al. 2003). Maehr et al. (1991) estimated a density of 1 panther per 27,520 ac [911,137 hectares [ha]] based on 17 concurrently radiocollared and four uncollared panthers. They extrapolated this density to the area occupied (1,245,435 ac [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) obtained 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 96 in 2006 (R. McBride, Personal Communication, 2006).

McBride (2002) documented an increase in the number of uncollared panthers captured each year between 2000 and 2002 relative to 1981 through 1999, while Shindle et al. (2001) reported data showing an apparent increase in the number of panthers killed by vehicles since 1999. In

neither case, however, was supporting evidence provided that would be necessary to conclude that these increases reflected population trends.

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, scrapes, 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, Volusia) north of the Caloosahatchee 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 in over 30 years (Belden and McBride 2005).

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 three 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. Three additional panthers were killed by vehicles from July 1, 2006, through November 30, 2006 (FWC, unpublished data), bringing the total to 99 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 six 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 six months old was determined by following the fates of 55 radio-collared dependent-aged kittens, including 17 introgressed panthers from 1985 - 2004. Only 1 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 ac (51,800 ha) for resident adult males and 48,000 ac (19,425 ha) for resident adult females; transient males had a home range of 153,599 ac (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 ac (65,009 ha) and females had a mean home range of 97,920 ac (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 ac (6,216 – 118,880 ha), averaging 89,600 ac (36,260 ha) for 20 resident adult males and 44,160 ac (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 ac (11,759 ha) for females ($n = 11$) and 62,528 ac (25,304 ha) for males ($n = 11$) (Lotz et al. 2005). The average home range was 35,089 ac (14,200 ha) for resident females ($n = 6$) and 137,143 ac (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 ft. 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 (*Dasyurus 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 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). Other environmental contaminants found in panthers include polychlorinated biphenyls (Arochlor 1260) and organochlorines (p, p'-DDE) (Dunbar 1995, Land et al. 2004). Elevated levels of p, p'- DDE were also detected in fat from that panther. The role of mercury and 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).

Habitat Characteristics and 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 ac (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 mi² (40,469-60,703 km²) 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 mi² (404,687-607,031 km²). This latter acreage corresponds to 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).

The Service created the Multi-species/Ecosystem Recovery Implementation Team (MERIT) to assist with implementation of the MSRP after it was signed in 1999. The Florida Panther Subteam of MERIT developed a landscape-level strategy for the conservation of the panther population in south Florida which was not finalized. Many of the Panther Subteam members refined the methodology, further analyzed the data, and better defined the results of this landscape-level strategy into a spatial model (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 10). 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 ac (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 (OSSF) and Wildlife Management Area (WMA), 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 ac (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 ac (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 ac (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 ac (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 ac (12,919 ha) value (Kautz et al. 2006) and the higher number is based on the 27,181 ac (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 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 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 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 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 the smallest class of forest patches (*i.e.*, 9-26 ac [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 7 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 ac (85 ha) in pine forest, 1/299 ac (121 ha) in swamps, 1/1,280 ac (518 ha) in prairie, 1/250 ac (101 ha) in marshes, and 1/111 ac (45 ha) in hammocks. Schortemeyer et al. (1991) estimated deer densities at 1/49-247 ac (20-100 ha) in three management units of BCNP based on track counts and aerial surveys. Labisky et al. (1995) reported 1/49 ac (20 ha) in southeastern BCNP. Using track counts alone, McCown (1994) estimated 1/183-225 ac (74-91 ha) on the FPNWR and 1/133-200 ac (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 americanum*) (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 and 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 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 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 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 mi² (113 km²) 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 12 and Table 2), 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 12:

1. In 1947, ENP was established with 1,507,834 ac (610,201 ha) and in 1989 was expanded with the addition of 104,320 ac (42,217 ha).
2. In 1974, Congress approved the purchase and formation of BCNP, protecting 570,238 ac (230,768 ha), later 145,919 ac (59052 ha) were added.
3. In 1974, the State of Florida began acquiring land for the FSPSP, which encompasses over 80,000 ac (32,375 ha). Efforts are underway to acquire about 16,640 ac (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 ac (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 inholdings.
5. In 1989, FPNWR was established and now protects 26,240 ac (10,619 ha).
6. In 1989, the Corkscrew Regional Ecosystem Watershed Land and Water Trust, a public and private partnership, was established and to date has coordinated the purchase of 42 26,880 ac (10,878 ha).
7. In 1996, the South Florida WMD, purchased the 32,000 ac (12,950 ha) OSSF.
8. In 2002 Spirit of the Wild WMA, consisting of over 7,040 ac (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 ac (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 ac (141,673 ha) in south Florida. Of these, 115,840 ac (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 ac (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, Panther Glades). North of the Caloosahatchee River, Fisheating Creek Conservation Easement, 41,600 ac (16,835 ha) in Glades County is a private holding used by dispersing male panthers. Also, 73,235 ac of the 90,845 ac Babcock Ranch were purchased in 2006 by the State of Florida and Lee County for conservation and agriculture. An additional 2,000 ac 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 and 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 13). There are four underpasses suitable for panther use currently existing, and two additional underpasses presently proposed by the Florida Department of Transportation (FDOT) along State Road 29 (SR 29) (Department of the Army Public Notice SAJ-2004-778) (Figure 13). Several additional panther and wildlife crossings are proposed along roadways in rural Lee and Collier Counties (Shindle et al. 2001). In addition, Collier County, in cooperation with the National Wildlife Federation and the Florida Wildlife Federation, is coordinating a study of the segment of CR 846 east of Immokalee and the section of Oil Well Road where the road crosses Camp Kies Strand by Dr. Reed Noss and Dr. Daniel Smith to determine the optimum location for wildlife crossing construction (WilsonMiller 2005). An additional crossing of Camp Kies Strand on CR 846 west of Immokalee is also being evaluated. However, vehicular trauma still occurs on outlying rural roads and the FWC is conducting a study to determine the impacts of vehicular collisions to panthers and studying ways to minimize panther vehicle collisions (Swanson et al. 2006).

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. FDOT has also identified the location of and constructed wildlife crossings on SR 29. Proposed crossings A and B (Figure 13) will be 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.

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 3). The minimum expected result of these projects is impacts to 76,919 ac and the preservation of 15,479 ac of panther habitat. Of the 76,919 ac of impacts, 38,932 ac are due to agricultural conversion and 37,982 ac to development and mining. Portions (10,370 ac) of the largest agricultural conversion project, the 28,700 ac 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 CERP. 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 February, 2007, the Service concluded consultations on 58 projects affecting 17,169 ac with preservation of 18,334 ac (Table 3). Following our refugia design assessment approach, the projects affected 7,287 ac in the Primary Zone, 5,911 ac in the Secondary Zone, and 3,965 ac in the Other Zone. Compensation provided included 15,118 ac in the Primary Zone, 652 ac in the Dispersal Zone, 2 ac in the Secondary Zone, and 1,410 ac 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 74,505 PHUs, with a corresponding PHU preservation and enhancement complement of 143,133 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.

Similar to residential, commercial, and industrial development projects, individual CERP projects may have an adverse direct effect on the Florida panther through: (1) the permanent loss and fragmentation of habitat used by the panther; (2) the permanent loss and fragmentation of habitat that supports panther prey; (3) the loss of available habitat for foraging, breeding, and dispersing

panthers; and (4) a reduction in the geographic distribution of habitat for the species. 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 in the project vicinity due to human activities; (3) the reduction in panther prey; (4) the reduction in value of habitat used by the panther adjacent to the project due to habitat fragmentation; and (5) a potential increase in intraspecific aggression between panthers (and an increase in mortality of subadult male panthers) due to reduction of the geographic distribution of habitat for the panther.

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.

In conclusion, the Service believes the model runs show lands in the Primary Zone are important to the survival and recovery of the Florida panther and 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 ac (12,919 ha) per panther is 2,551,851 ac (1,032,720 ha) for 80 panthers or 3,189,813 ac (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 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 7) 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 and 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 and 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 ac (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 10), 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 10), 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 10). 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 ac (918,895 ha); the Secondary Zone covers 812,104 ac (328,654 ha); and the Dispersal Zone covers 27,883 ac (11,284 ha); providing a total of 3,110,578 ac (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 ac (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 ac (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 ac (12,919 ha) value (Kautz et al. 2006) and the higher number is based on the 27,181 ac (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 approximately 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 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 ac per panther determined 2,873,070 ac 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 ac 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 ac (1,258,833 ha) (Kautz et al. 2006). Currently, 2,073,865 ac of Primary Zone equivalent lands are preserved (Table 4), so 799,205 additional ac 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 the panther core lands (Figure 10), 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 ac), referred to as the “Other” Zone, are added to the lands in Kautz et al.’s (2006) panther core lands (Figure 10) and represent the lands within the Service’s 2000 consultation area boundary south of the Caloosahatchee River as shown in Figure 7. These lands (core lands and other zone lands) together are referred to by the Service as the core area. 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 5). 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 ac. 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 ac). Multiply this acreage (655,996 ac) by 0.33 to determine the ac of Primary Zone equivalent lands the Other Zone can provide (655,996 times 0.33 equals 216,479 ac of Primary Zone equivalent lands) (Table 5). Using this assessment, the 503,481 ac of Secondary Zone lands equate to 347,402 ac 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 ac (actual acreage is 4,376,444 ac [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 5). Currently 2,073,865 ac of Primary Zone equivalent lands (actual acreage is 2,578,152 ac) of non-urban lands are preserved. The remaining non-urban at-risk private lands are estimated at 1,202,698 ac of Primary Zone equivalent lands (actual acreage is 1,798,295 ac). To meet the protected and managed lands goal for a population of 90 panthers, an additional 799,205 ac 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 ac) by the result of the acres of at-risk habitat in the Primary Zone (610,935 ac) times the value of the Primary Zone (1); plus the at-risk acres in the Dispersal Zone (27,883 ac) times the value of the Dispersal Zone (1); plus the at-risk acres in the Secondary Zone (503,481 ac) times the value of the Secondary Zone (0.69); plus the at-risk acres in the Other Zone (655,996 ac) times the value of the Other Zone (0.33); minus the at-risk acres of habitat to be protected (799,205 ac). 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 per year; 14,820 ac per 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 ac 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, on an individual basis, single-family residential developments by individual lot owners on lots no larger than 2.0 ha (5.0 ac) 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 about another 12,950 ac over a 5-year period (2,590 ac 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 approach 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 7 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 ac of pine flatwoods with 10 percent exotics would be treated in our habitat assessment methodology as 90 ac of pine flatwoods and 10 ac of exotics. Adding another 100 ac of cypress swamp with 10 percent exotics would change our site from 90 ac of pine flatwoods and 10 ac of exotics to 90 ac of pine flatwoods, 90 ac of cypress swamp, and 20 ac 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 ac of pine flatwoods and 10 ac 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 ac of pine flatwoods x 9 [the habitat suitability value for pine flatwoods] = 810 PHUs) + (10 ac 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.

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE - Audubon's Crested Caracara

The caracara is a member of the Class Aves, Order Falconiformes, Family Falconidae. It was originally described by John James Audubon (1834), who discovered the caracara on November 21, 1831, and published an account under the name *Polyborus vulgaris*. John Cassin renamed it in 1865 to *Polyborus audubonii*. In 1999, Dove and Banks definitively renamed the species *Caracara cheriway* and eliminated all subspecies classifications. Dove and Banks (1999) conducted a taxonomic analysis of museum specimens of caracaras based on plumage and morphological characteristics and concluded that there are three caracara species with no subspecific groupings. They refer to the North American caracara as *Caracara cheriway*, and this name was subsequently accepted by the American Ornithologists' Union. The list of threatened and endangered animals (50 CFR 17.11) continues to refer to the old scientific name *Polyborus plancus audubonii*, but this species is referred to in the remainder of this document as the caracara. It is a resident, diurnal, and non-migratory species that occurs in Florida as well as the southwestern United States and Central America. Florida's population of the caracara is found in the prairie area of the south-central region of the State. Only the Florida population, which is isolated from other populations of the species in the southwestern United States and Central America, is listed under the Act.

Species Description

The caracara is a large raptor with a crest, naked face, heavy bill, elongated neck, and unusually long legs. It is about 50 to 64 centimeters (cm) long and has a wingspan of 120 cm. The adult is dark brownish black on the crown, wings, back, and lower abdomen. The lower part of the head, throat, upper abdomen, and under tail coverts are white, the breast and upper back are whitish, heavily barred with black. The tail is white with narrow, dark crossbars and a broad, dark terminal band. Prominent white patches are visible near the tips of the wings in flight. The large, white patches in the primaries and the white tail, broadly tipped with black, are both very conspicuous in flight and can be recognized at a long distance (Bent 1961).

Juveniles have a similar color pattern but are brownish and buffy, with the breast and upper back streaked instead of barred. Subadults resemble adults but are more brownish in color. Adults have yellow-orange facial skin and yellow legs. Facial skin of juveniles is pinkish in color, and the legs are gray (Layne 1978). Full adult plumage is obtained sometime after 3 years of age (Morrison 1997). There is no evidence of sexual dimorphism, the sexes being similar in color and size; however, gender can be determined surgically or through genetic analysis (Morrison and Maltbie 1999).

A caracara's feet and flight behavior are also notable. Their feet are clearly those of a raptor; however, their talons are flatter, enabling caracaras to run and walk more easily than other raptors. Caracaras are terrestrial and often forage by walking for extended periods on the ground (Morrison and Humphrey 2001). Bent (1938) noted the caracara's flight pattern resembles that of a northern harrier (*Circus cyaneus*), but caracaras fly faster and more gracefully. Caracaras

are strong fliers and may reach speeds of 40 mph. They have also been observed soaring in large circles at great heights (Howell 1932).

Critical Habitat Description

Critical Habitat has not been designated for this species.

Life History

Caracaras are resident, diurnal, and non-migratory. Adult caracaras may be found in their home range year-round. Home ranges average approximately 3,000 ac (approximately 1,200 ha), corresponding to a radius of 1.2 to 1.5 miles (2 to 2.5 kilometers) surrounding the nest site (Morrison and Humphrey 2001). Foraging typically occurs throughout the home range during nesting and non-nesting seasons.

The Florida caracara population historically inhabited native dry or wet prairie areas containing scattered cabbage palms, their preferred nesting tree. Scattered saw palmetto, and low-growing oaks (*Quercus minima*, *Q. pumila*), and cypress also occur within these native communities. Over the last century, many of the native prairie vegetation communities in central and south Florida have been converted to agricultural land uses, and frequently replaced by improved and unimproved pasture dominated by short-stature, non-native, sod-forming grasses. Morrison and Humphrey (2001) hypothesize that the vegetation structure of open grasslands (short-stature vegetation, scattered shrub cover, and nest trees) may be preferred by the caracara, due to its tendency to walk on the ground during foraging activities. The short vegetation stature and relatively simple vegetation structure may directly facilitate foraging by caracaras and provide less cover for predators. Consequently, caracaras appear to benefit from management actions such as prescribed burning that maintain habitat in a low stature and structurally simple condition. These activities reduce vegetation cover and may facilitate the observation and capture of prey. Within agricultural lands, regular mowing, burning, and high-density grazing may maintain low vegetative structure, an important habitat characteristic of the caracara's nest stand area (Morrison and Humphrey 2001). Regular prescribed burning maintains habitat in a favorable condition in native dry prairies. These field observations are consistent with the home range compositional analyses that indicate non-random selection of improved and semi-improved pasture land use.

Morrison and Humphrey (2001) characterized caracara distribution, reproductive activity, and land use patterns within a 21,000 km² area in south-central Florida. Comparisons of caracara home ranges to randomly selected areas and available habitat within the study area revealed caracara home ranges contained higher proportions of improved pasture and lower proportions of forest, woodland, oak scrub, and marsh. Home range size was inversely related to the proportion of improved pasture within the home range. In addition, breeding-area occupancy rate, breeding rates, and nesting success were consistently higher on private ranch lands during the study. Although it is unclear exactly which management activities best promote habitat utilization by caracaras, the mowing, burning, and grazing activities associated with improved pastures serve to maintain the short vegetation structure they appear to favor. The scattered cabbage palms that

are often present within improved pastures to serve as shade for cattle provide nesting substrate for caracaras.

Additional investigations into habitat suitability for caracara (Morrison *et al.* 2006) indicate that maintaining heterogeneity which includes specific land cover types as well as small (less than 1 hectare or 2.47 ac) of freshwater wetlands, is critical in maintaining suitable habitat for the crested caracara in Florida. The proportion of six vegetation and land cover types (*i.e.*, cabbage palm-live oak hammock, grassland, improved pasture, unimproved pasture, hardwood hammocks and forest, and cypress/pine/cabbage palm) and 2 types of water (*i.e.*, lentic and lotic) were determined to be the most important criteria for predicting habitat suitability for caracara. Most known nest locations (72.9 percent) in the study were present on improved pasture although that habitat type only comprised 12.5 percent of the entire study area. Caracara appear to be exploiting pastures, ditches, and impounded wetlands that have replaced the historic land cover as shown by the high occurrence of improved and unimproved pastures and lotic waters in caracara home ranges (Morrison *et al.* 2006).

Caracaras are highly opportunistic in their feeding habits, eating carrion and capturing live prey. Their diets include insects and other invertebrates, fish, snakes, turtles, birds, and mammals (Layne 1978). Live prey also include rabbits, young opossums (*Didelphis marsupialis*), rats (*Rattus* spp.), mice, squirrels, frogs, lizards, young alligators, crabs, crayfish, fish, young birds, cattle egrets (*Bubulcus ibis*), beetles, grasshoppers, maggots, and worms (Bent 1961; Layne *et al.* 1977; Morrison 2001). Scavenging at urban dumps has also been observed (Morrison 2001). More recent information from Morrison (2005) indicates that wetland-dependent prey items comprise about 64 percent of the total diet. Mammals make up about 31 percent of the diet, with the majority of this being carrion.

The birds also closely follow mowers in pastures and tractors plowing fields, in order to capitalize on prey that may be exposed. Agricultural drainage ditches, cattle ponds, roadside ditches and other shallow water features also provide good foraging conditions for caracaras (Morrison 2001). Within native habitats, caracaras regularly scavenge in recently burned areas, and forage along the margins of wetlands within dry prairie communities.

These raptors hunt on the wing, from perches, and on the ground (Service 1989). They will also regularly patrol sections of highway in search of carrion (Palmer 1988). They may be seen feeding on road kills with vultures. However, caracaras are dominant over vultures and may occasionally chase the larger vultures from the road kill (Howell 1932).

Although adult caracaras are generally territorial and primarily occupy home ranges, large groups of individual caracaras are occasionally encountered (Layne 1978). Oberholser (1974) attributes this to the birds' carrion-feeding habit, although Morrison (2005) has noted that juvenile caracaras are nomadic. Caracaras are capable of moving long distances. Between the time when young birds leave the natal territory, and when subadults establish a territory, each individual may traverse a large portion of the species' range in Florida. Adults will also occasionally leave their territory and travel great distances, primarily outside of the breeding season. The caracara's movement capability and nomadic character during subadult years may

be the cause of occasional observations of caracaras far outside their breeding range. Caracaras have been observed in the Florida Keys and into the panhandle of Florida (Bay County), as well as in other states, though some of these may have been escaped individuals (Layne 1996). There appears to be no migration or genetic exchange between the Florida population and other populations of the northern caracara.

Routine observation and radio-telemetry monitoring suggest there are several “gathering areas” in south-central Florida that may be important to caracaras during the first 3 years after leaving their natal territory, before first breeding (Morrison 2001). Relatively large numbers of caracaras (up to 50) have been observed along the Kissimmee River north of SR 98; south of Old Eagle Island Road in northern Okeechobee County; south of SR 70, west of Fort Pierce; and south of SR 70 in Highlands County, and on the Buck Island Ranch, for example. These gathering areas are regularly but not continually used by subadult and non-breeding caracaras and generally consist of large expanses of improved pasture; however, the particular habitat values of these areas have not yet been evaluated.

Morrison (1999) reported that breeding pairs of caracaras seem to be monogamous, highly territorial, and exhibit fidelity to both their mate and the site. The age at first breeding has been documented as 3 years (Nemeth and Morrison 2002).

Details of breeding behavior in the caracara have been documented by Morrison (1998, 1999). The initiation of breeding is marked by several behavioral changes, including the pair perching together near the nesting site, preening and allopreening, and sharing food. Caracaras are one of the first of Florida’s raptors to begin nesting. Although breeding activity can occur from September through June, the primary breeding season is considered to be November through April. Nest initiation and egg-laying peak from December through February.

Caracaras construct new nests each nesting season, often in the same tree as the previous year. Both males and females participate in nest building. Nests are well concealed and most often found in the tops of cabbage palms (Morrison and Humphrey 2001) although nests have been found in live oaks (*Q. virginiana*), cypress (first record, Morrison et al. 1997), Australian pine (*Casuarina* spp.), saw palmetto, and black gum (*Nyssa sylvatica*). Caracaras usually construct their nests 4 to 18 m above the ground; their nests primarily consist of haphazardly woven vines trampled to form a depression (Bent 1938, Sprunt 1954, Humphrey and Morrison 1996). Caracaras vigorously defend their nesting territory during the breeding season (Morrison 2001).

Clutch size is two or three eggs, but most often two. Incubation lasts for about 31 to 33 days (Morrison 1999) and is shared by both sexes. Ordinarily only one brood is raised in a season, but around 10 percent of the population (annually) may raise a second brood. The young fledge at about 7 to 8 weeks of age, and post-fledgling dependency lasts approximately 8 weeks.

Population Dynamics

The great majority of caracara breeding territories occur on private lands in Florida, primarily within the ranchlands of central Florida. This fact makes monitoring the population and

determining territory occupancy and nesting effort or success very difficult. Consequently, estimates of the caracara population in Florida have been based on counts of caracaras along roadsides (Heinzman 1970; Layne 1995). These roadside counts also have the potential be strongly affected by the presence of non-territorial juvenile and sub-adult birds during the period when they are nomadic. Because the occurrence and density of caracaras is not evenly distributed within the region they occupy (due to congregation and nomadic individuals), these roadside surveys are probably unreliable for estimating the overall population.

Status and Distribution

The caracara's perceived decline, as described in historic literature, is attributed primarily to habitat loss (Layne 1996). This perceived decline and the geographic isolation of the Florida population eventually resulted in the caracara's listing as threatened in 1987 (52 FR 25232). In particular, the caracara was listed as threatened because its primary habitat, dry prairie, had been greatly eliminated or modified for agriculture and residential development. It was also listed because existing regulatory mechanisms did not adequately prevent the destruction or modification of the caracara's habitat, which is mainly located on private land.

Morrison and Humphrey (2001) stated that no data are available on historic abundance, habitat use, or nest distribution by caracaras in Florida. The size of Florida's caracara population remains in question. Accurate counts become difficult because of limited access to areas of suitable habitat and because of the bird's behavior and limited detectability (Humphrey and Morrison 1997). Heinzman (1970) published the results of a 4-year road survey (1967-1970), which suggested fewer than 100 individual caracaras at 58 localities remained in Florida. Stevenson (1976) concurred with this estimate in 1974. Layne (1995) monitored caracara distribution and population status in Florida from 1972 to 1989. Based on roadside surveys, he estimated that the adult portion of the population was stable with a minimum of about 300 birds in 150 territories. The immature portion of the population was estimated to be between 100 and 200 individuals, bringing the total statewide population to between 400 and 500 birds. However, given continued landscape change in areas where caracaras have been known to occur, and the fact that not all the probable breeding range has been adequately surveyed for breeding pairs, estimating this population's size remains difficult.

In addition to presumed population declines related to habitat loss, direct human-caused mortality may also be a factor to be considered in the recovery of the species. In the past, large numbers of caracaras were killed in vulture traps (Service 1989). Individuals may also be caught in leg-hold traps used to control mammalian predators (Morrison 1996). Road mortalities are a significant cause of caracara decline. Morrison (2003) identifies highway mortalities as a major cause of juvenile mortalities with young birds especially vulnerable within the first 6 months after fledging.

The Florida population of caracaras is isolated and habitat-specific. Therefore, it may be susceptible to environmental catastrophes and potentially reduced reproductive rates because of demographic accidents such as skewed sex ratios or disproportionate age-related mortality. Low numbers may also reduce the genetic viability through loss of heterozygosity, thereby increasing

vulnerability to environmental stresses. The location of many of the occupied territories on private land, and the inaccessibility of these territories to surveyors, makes it difficult to census the caracara and detect changes in its population size and distribution. This difficulty increases the possibility of not detecting a population decline that could result in extinction.

The major threat to this population remains habitat loss. Large areas of native prairie and pasture lands in south-central Florida have been converted to citrus operations, tree farms, other forms of agriculture, and real estate development and this loss has accelerated in the past few decades (Morrison and Humphrey 2001). However, historical conversion of forested habitats to pasture has not been adequately documented as partially offsetting losses to caracara habitat, so a full accounting of historic habitat changes is lacking. The current threat of habitat loss persists as changes in land use continue. Florida's burgeoning human population has also increased the number of motor vehicles and the need for roads. The increase in traffic as well as the caracara's predisposition for feeding on road-killed animals has probably increased the number of caracaras killed or injured as a result of vehicle strikes.

Cattle ranching and extensive pastures appear to be compatible with caracara survival. Inadequate information is available to assess current caracara use of native wet and dry prairie communities, but these communities are likely the primary communities that caracaras occupied in the historic Florida landscape. The number of territories occurring in improved or unimproved pasture can be expected to increase if sufficiently large overgrown pastures are reclaimed and new pastures or restored native prairies are created from other agricultural land uses. The conversion of pasture to citrus (Cox et al. 1994), sugarcane, and residential development is also cause for concern. Recognizing the conservation value of cattle ranches and enlisting landowner cooperation in the preservation and management of these lands are critical elements in recovery of the caracara.

Lack of habitat management is also a potential threat to caracaras in some areas, and can result in habitat degradation to the point where it is no longer suitable for occupancy. In particular, encroachment of woody shrubs and trees into open dry prairies, pastures and similar habitats will result in some reduction in habitat suitability. Complete clearing of large areas that includes removal of cabbage palms and other trees may also reduce the suitability of habitat, but generally only when very large areas are completely cleared.

While there is inadequate evidence available to conclude that the caracara population in Florida has declined significantly, loss of habitat is threatening remaining caracara territories at an increasing rate. The limited distribution of caracaras and a lack of opportunities for expansion of the distribution make this species vulnerable to reductions in habitat quality and other increasing threats within its range.

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE – Eastern Indigo Snake

Species description

The eastern indigo snake is the largest non-venomous snake in North America, obtaining lengths of up to 8.5 ft (2.6 meters) (Moler 1992). Its color is uniformly lustrous-black, dorsally and ventrally, except for a red or cream-colored suffusion of the chin, throat, and sometimes the cheeks. Its scales are large and smooth (the central 3 to 5 scale rows are lightly keeled in adult males) in 17 scale rows at mid-body. Its anal plate is undivided. In the Keys, adult eastern indigo snakes seem to have less red on their faces or throats compared to most mainland specimens (Lazell 1989). Several researchers have informally suggested that Lower Keys eastern indigo snakes may differ from mainland snakes in ways other than color.

Critical habitat description

Critical habitat has not been designated for this species.

Life history

In northern Florida, eastern indigo snakes breed between November and April, with females depositing 4 to 12 eggs during May or June (Moler 1992). Young hatch in approximately 3 months and there is no evidence of parental care. Limited information on the reproductive cycle in south-central Florida suggests that the breeding and egg-laying season may be extended. In this region, breeding extends from June to January; laying occurs from April to July; and hatching occurs during mid-summer to early fall (Layne and Steiner 1996). Eastern indigo snakes in captivity take 3 to 4 years to reach sexual maturity (Speake et al. 1987). Female eastern indigo snakes can store sperm and delay fertilization of eggs. There is a single record of a captive eastern indigo snake laying five eggs (at least one of which was fertile) after being isolated for more than 4 years (Carson 1945). However, there have been several recent reports of parthenogenetic reproduction by virginal snakes. Hence, sperm storage may not have been involved in Carson's (1945) example (Moler 1998). There is no information on the eastern indigo snake lifespan in the wild, although one captive individual lived 25 years, 11 months (Shaw 1959).

Eastern indigo snakes are active and spend a great deal of time foraging for food and mates. They are one of the few truly diurnal snake species, meaning that they are active during the day and rest at night. The eastern indigo snake is a generalized predator and will eat any vertebrate small enough to be overpowered. They do not kill their prey by constriction, but swallow their prey alive. Food items include fish, frogs, toads, snakes (venomous, as well as non-venomous), lizards, turtles, turtle eggs, small alligators, birds, and small mammals (Keegan 1944; Babis 1949; Kochman 1978; Steiner et al. 1983).

Population dynamics

Eastern indigo snakes require a mosaic of habitats. A study in southern Georgia found that interspersion of tortoise-inhabited sandhills and wetlands improve habitat quality for the eastern indigo snake (Landers and Speake 1980). Eastern indigo snakes require sheltered retreats from winter cold and desiccating conditions, and often use burrows of the gopher tortoise (*Gopherus polyphemus*) when available (Speake et al. 1978; Layne and Steiner 1996). In habitats lacking gopher tortoises, eastern indigo snakes may take shelter in hollowed root channels, hollow logs, or the burrows of rodents, armadillos, or land crabs (Lawler 1977; Moler 1985a; Layne and Steiner 1996). In the milder climates of central and southern Florida, eastern indigo snakes exist in a more stable thermal environment, where availability of thermal refugia may not be as critical to snake survival. Over most of its range in Florida, the eastern indigo snake frequents diverse habitats such as pine flatwoods, scrubby flatwoods, floodplain edges, sand ridges, dry glades, tropical hammocks, edges of freshwater marshes, muckland fields, coastal dunes, and xeric sandhill communities (Service 1999). Eastern indigos also use agricultural lands and various types of wetlands, with higher population concentrations occurring in the sandhill and pineland regions of northern and central Florida. Observations over the last 50 years made by maintenance workers in citrus groves in east-central Florida indicate that eastern indigo snakes are occasionally observed on the ground in the tree rows and more frequently near the canals, roads, and wet ditches (Zeigler 2006). In extreme south Florida (*i.e.*, the Everglades and Florida Keys), eastern indigo snakes are found in tropical hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats (Steiner et al. 1983). It is thought that they prefer hammocks and pine forests since most observations occur there and use of these areas is disproportionate compared to the relatively small total area of these habitats (Steiner et al. 1983).

Eastern indigo snakes range over large areas and into various habitats throughout the year, with most activity occurring in the summer and fall (Smith 1987; Moler 1985a). In Georgia, the average range of the eastern indigo snake is 12 ac during the winter (December through April), 106 ac during late spring through early summer (May through July), and 241 ac during late summer and fall (August through November) (Speake et al. 1978). Adult males have larger home ranges than adult females and juveniles; their ranges average 554 ac, reducing to 390 ac in the summer (Moler 1985b). In contrast, a gravid female may use from 3.5 to 106 ac (Smith 1987). In Florida, home ranges for females and males range from 5 to 371 ac and 4 to 805 ac, respectively (Smith 2003). At the Archbold Biological Station (ABS), average home range size for females was determined to be 47 ac and overlapping male home ranges to be 185 ac (Layne and Steiner 1996).

Status and distribution

The eastern indigo snake was listed as threatened on January 31, 1978 (43 FR 4028), due to population declines caused by habitat loss, over-collecting for the domestic and international pet trade, and mortality caused by rattlesnake collectors who gas gopher tortoise burrows to collect snakes.

The eastern indigo snake ranges from the southeastern United States to northern Argentina (Conant and Collins 1998). This species has eight recognized subspecies, two of which occur in the United States: the eastern indigo and the Texas indigo (*D. c. erebennus*). In the United States, the eastern indigo snake historically occurred throughout Florida and in the coastal plain of Georgia and has been recorded in Alabama and Mississippi (Diemer and Speake 1983; Moler 1985b). It may have occurred in southern South Carolina, but its occurrence there cannot be confirmed. Georgia and Florida currently support the remaining endemic populations of the eastern indigo snake (Lawler 1977). The eastern indigo occurs throughout most of Florida and is absent only from the Dry Tortugas and Marquesas, Keys and regions of north Florida where cold temperatures and deeper clay soils exist (Cox and Kautz 2000).

Effective law enforcement has reduced pressure on the species from the pet trade. However, because of its relatively large home range, the eastern indigo snake is especially vulnerable to habitat loss, degradation, and fragmentation (Lawler 1977; Moler 1985a). The primary threat to the eastern indigo snake is habitat loss due to development and fragmentation. In the interface areas between urban and native habitats, residential housing is also a threat because it increases the likelihood of snakes being killed by property owners and domestic pets. Extensive tracts of undeveloped land are important for maintaining eastern indigo snakes. In citrus groves, eastern indigo snake mortality occurs from vehicular traffic and management techniques such as pesticide usage, lawn mowers, and heavy equipment usage (Zeigler 2006). Within the last 5 years, since the spread of citrus canker, Zeigler (2006) reported seeing at least 12 dead eastern indigo snakes that were killed by heavy equipment operators in the act of clearing infected trees.

Seven confirmed observations of eastern indigo snakes occurred on the A-1 Reservoir in Palm Beach County, an Acceler8 component of the EAA Storage Reservoir Project (EAA Project) under the CERP. The seven observations included a snake accidentally killed during reservoir construction on October 10, 2006.

Tasks identified in the recovery plan for this species include: habitat management through controlled burning, testing experimental miniature radio transmitters for tracking juveniles, maintenance of a captive breeding colony at Auburn University, recapture of formerly released eastern indigo snakes to confirm survival in the wild, educational lectures and field trips, and efforts to obtain landowner cooperation in conservation efforts (Service 1999).

To protect and manage this species for recovery, large expanses of land must be protected. Management of these lands must be directed towards maintaining and enhancing the diversity of plant and animal assemblages within these properties. Where these goals are achieved, eastern indigo snakes will directly benefit because of improved habitat conditions. Land managers are encouraged to utilize fire as a tool to maintain biodiversity in fire-dependent ecosystems.

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 11). 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, 3-collared panthers, 2-uncollared females, and 2-uncollared males had home ranges in or home ranges that overlapped or were immediately adjacent to the same survey unit as the C-43 West Storage Reservoir project. In addition, 8 other panthers that used this same survey unit previously died during this time period (FWC 2003). This unit, designated as Unit 7, includes the OSSF and WMA and adjacent private lands.

Within the 25-mile radius action area, based on telemetry data as of June 2006, at least 13 living radio-collared panthers have overlapping home ranges. These panthers are FP 48 (female), FP 62 (male), FP 65 (male), FP 66 (female), FP 75 (female), FP 81 (male), FP 83 (female), FP 84 (male), FP 110 (female), FP 131 (male), FP 137 (male), FP 139 (male), and FP 143 (male). In addition, McBride (2003) notes previous use of the action area by other panthers prior to their mortality. The nearest telemetry point to the site of a panther still alive as of this document was FP 65 (male), recorded about 0.04 miles to the north of the access road

parcel. During 1999, FP 74 (male) was documented twice within the reservoir footprint along the Townsend Canal and four times within 0.5 miles of the project footprint on adjacent private property to the southeast (Figure 14); however, he died of a vehicle collision in September of that same year. FP 28 (male) was documented along the perimeter of the reservoir footprint in the southeast corner and died in September 1992 due to intraspecific aggression.

Historically, there have been a total of five radio-collared male and female panthers (FP 28, FP 65, FP 74, FP 137, and TX 101) recorded within 5 miles of the project site on 28 occasions based on telemetry data from May 1989 through June 2006 (Figure 15). This translates to an average of 1.65 occurrences per year or one occurrence every 7 to 8 months. Panther 28 was documented 1 time in 1989 and died in 1992 from intraspecific aggression. Panther 65 was documented 14 times in 1998 and is alive with a home range on private property in Hendry County north of BCNP. Panther 74 was documented 9 times in 1999 and died in September 1999 from a vehicle collision. Panther 137 was documented 1 times in 2005 and is alive with a home range in OWMA. Texas puma 101 was documented 3 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 March 2005, and no radio-collared panthers have been recorded within the project site. 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 33 projects and informally consulted on 1 project 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). These projects have impacted or are expected to impact about 33,062 ac of panther habitat. These projects have also incorporated a total of 22,967 ac 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 (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 the 33 Federal actions requiring formal consultation, that individually and cumulatively these projects do not jeopardize the survival and recovery of the Florida panther.

From July 2000 through September 2006, the Service also engaged in informal consultation for projects under 5 ac with the Corps for about 757 projects affecting about 764.1 ac in Collier County (primarily Northern Golden Gate Estates) and about 202.8 ac 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 16, 2004, and August 8, 2005, issued non-jurisdictional wetland determinations (isolated wetlands) for 10 projects totaling 3,779 ac in Collier County and for 10 projects totaling 276 ac in Lee County. 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 42 documented panther-vehicle collisions within the 25-mile action area (see Table 8 and Figure 16). The panther-vehicle collision closest to the project site (K 128 [male]) occurred in 2004, on CR 832, about 10.6 miles southeast of the site. Three other panthers, UCFP 29 (male), UCFP 90 (female), and UCFP 91 (male) were killed about 0.7, 0.1, and 1.3 miles from the K 128 mortality, respectively, on the same road. UCFP 29 was an adult killed during 1996 and UCFP 90 and UCFP 91 were both kittens (4 to 6 months old) killed during 2007. Two additional panther-vehicle collisions have already occurred in the action area in 2007. One occurred 23.5 miles southwest of the project on Interstate-75 0.5 miles north of Corkscrew Road; and one occurred 19.5 miles southwest of the project on Corkscrew Road near, Alico Road.

Activities within the action area have also benefited panthers. The issuance of Corps and State of Florida Environmental Resource Permits has preserved 22,967 ac of high quality panther habitat for permitted impacts to 33,062 ac 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 other Federal, State, and County resource agencies. Table 9 provides a summary of State acquisitions within the last 8 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: A protected species survey of the entire C-43 West Storage Reservoir project was initially conducted by SEA from June 2004 to August 2004 utilizing meandering pedestrian and vehicular (including all-terrain vehicles) transects and stationary observation points. Pre-construction surveys of the Test Cell project site were conducted June 27, 2005, and species specific surveys were conducted for nesting caracara February through May, 2006. Surveys for white-tailed deer and feral hog (*Sus scrofa*) tracks were conducted on seven occasions during September and October 2006 (Table 10). Based on five of the seven track surveys conducted, SEA calculated a deer density of one deer per 1,093 ac to one deer per 2,623 ac, and a feral hog density of one hog per 54 ac to one hog per 62 ac. If all seven survey events are used, deer density estimates increase to one deer per 165 ac to one deer per 70 ac, and a feral hog density of one hog per 50 ac to one hog per 58 ac. However, two of the surveys conducted in September yielded unusually high deer track counts when compared to the other surveys, possibly due to increased human activity in the groves such as pesticide application, irrigation maintenance, etc. Thus, the latter density estimates may not be realistic. According to the BA, Bobby Murray, the long-term operations manager for one of the onsite citrus operations, *i.e.*, Berry Groves, estimated the deer population to be no more than one deer per 525 ac. Evidence of armadillo, eastern cottontail (*Sylvilagus floridanus*), bobcat and raccoon was observed during the surveys. Other small mammals also constituting panther prey may utilize the site.

Based on the track surveys (Tyson 1952), deer densities on exotic-infested private lands in Lee County have averaged one deer per 591 ac (Turrell 2001) to one deer per 534 ac (Passarella Associates, Incorporated 2004). In comparison, deer densities on wildlife management areas average one deer per 165 ac to one deer per 250 ac (Steelman et al. 1999). Density estimates from deer tracks, however, should be viewed with caution. Track estimates are most appropriately used as long-term indicators (McCown 1991) and several factors can influence counts including weather, food abundance, population density, season, and availability of water (O'Connell et al. 1999).

Deer are known to forage in citrus groves on both the fruit trees and the associated vegetation communities. Citrus groves and other agricultural areas often produce quality bucks. In Hendry, Glades and Collier counties, a relatively high number of fish and wildlife species (*i.e.*, 203 species) were documented utilizing citrus groves and their associated cover types (*i.e.*, grove beds, agricultural reservoirs, impacted wetlands, canals, and ditches) (Mazzotti et al. 1992 and 1993). The majority of those species, however, were observed in natural wetlands now functioning as agricultural reservoirs or wet detention areas (Mazzotti et al. 1992 and 1993). Wildlife use of grove beds as habitat was similar to other disturbed habitats in south Florida in that most species commonly found in grove beds were habitat generalists and able to thrive in human-altered habitats (Mazzotti et al. 1992 and 1993). Nonetheless, mammals that commonly utilized citrus groves included deer, feral hog, raccoon, armadillo, Virginia opossum (*Didelphis virginiana*), marsh rabbit (*Sylvilagus palustris*), eastern cottontail, gray fox (*Urocyon cinereoargenteus*), bobcat, Florida black bear (*Ursus americanus floridanus*), several rodents, and other small mammals (Mazzotti et al. 1992 and 1993).

The Service believes the habitats on the property provide marginal quality foraging for prey species, which directly affects value of the habitat to panthers, and specifically, the frequency and duration of use of the property by panthers. As discussed previously, white-tailed deer densities and other prey species are influenced by the quality of the foraging habitat present in an area. 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. The C-43 West Storage Reservoir project area is dominated by citrus trees with an understory of mixed grasses, sedges and forbs. Less than two percent of the site consists of wetland vegetation communities, many of which were dominated by or contained minimal invasive exotic or nuisance vegetation such as Brazilian pepper and primrose willow.

Deer are ruminants with small stomach capacities and are selective for high quality forage to meet their nutritional needs. To meet these high quality forage needs, deer selectively move through the mosaic of habitat types taking advantage of the seasonal forage that provide the most benefit to the deer. The historical vegetation community within the project area was characterized as a mosaic of mesic and wetland habitats that provided seasonal patterns of plant growth. The past conversion of native habitats to citrus groves has resulted in an overall reduction of palatable plant species that provide high quality foraging needs for resident deer populations, hog, and other prey species. Although deer densities at the proposed compensation areas (*i.e.*, Band 1/Acceler8 Project areas) were not determined, they contain diverse habitats

with a variety of plant species that yield quality forage to panther prey species, especially resident deer populations, and many include exotic control, removal, or partial removal as a project feature.

Habitat Quality/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 10,602-acre C-43 West Storage Reservoir project site (minus the 267-acre Test Cell project) and the compensation provided by the Band 1/Acceler8 Projects as a group.

Table 11 illustrates the PHU calculations for the C-43 West Storage Reservoir project with impacts to 144 ac of land in the Primary Zone, 5,236 ac of land in the Secondary Zone, and 4,955 ac in the Other Zone with compensation provided through implementation of the Band 1/Acceler8 Projects combined, including the purchase and restoration of approximately 59,294 ac in the Primary Zone and 41,772 ac in the Other Zone (Figure 17). Table 11 shows the 10,335-acre impact area to presently support 19,438 PHUs with a net loss of 18,773 PHUs. The net loss (*i.e.*, 18,773 PHUs) is multiplied by 2.5 to provide the base ratio compensation need, which is 46,933 PHUs.

Since the overall purpose of the CERP is to restore the Everglades ecosystem and species assemblages, the CERP and Acceler8 implementation is expected to provide large-scale, long-term benefits to the ecosystem and listed species, though individual actions may result in smaller-scale or short-term adverse effects to one or more listed species. Band1/Acceler8 projects which fall within the core panther area (Figure 8) were treated collectively as if they were a single project and the methodology described above was used to assess the effects of these collective District projects on Florida panthers (Table 12 and 13). Calculations for Band1/Acceler8 Projects habitat impacts are estimates based on current project information and will be updated as individual Band 1/Acceler8 Projects plans are further developed. Appendix A includes individual project habitat impacts.

The compensation provided by Band 1/Acceler8 Projects collectively exceeds 548,000 PHUs. Consequently, the Service believes the habitat values lost by the proposed C-43 West Storage Reservoir project will be offset by the resultant preservation and compensation actions from implementation of the Band 1/Acceler8 Projects combined. The lands proposed for development are in the northern fringe of the panther's range and panther habitat value has been diminished by previous conversion to citrus groves. Lands proposed for preservation will be in the core area currently used by the panther, the majority will be within the Primary Zone and adjacent to other natural lands, and will be 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:

Though the C-43 West Storage Reservoir project will result in a net loss in number of acres of habitat available to the panther, the combined beneficial effects of the Band 1/Acceler8 Projects on the habitat quality provided to the Florida panther through restoration and preservation will be superior to that of the areas to be impacted, and the habitat will be protected in perpetuity. The Band 1/Acceler8 Projects will result in a net gain in the number of acres of habitat used by the panther that will be superior in quality to that of the area to be impacted by the C-43 West Storage Reservoir project. The compensation provided by the Band 1/Acceler8 Projects is primarily (*i.e.*, 59 percent) located in the Primary Zone and contains habitat valuable for breeding, foraging, and dispersal by the Florida panther. The restoration and preservation of the habitats as a result of implementation of the combined Band 1/Acceler8 project will increase the overall quality of the habitats to panthers and should result in increased use by panthers.

ENVIRONMENTAL BASELINE – Audubon’s Crested Caracara

Status of the Species within the Action Area

As discussed previously, caracaras are nonmigratory with a home range averaging 3,000 ac (1,200 hectare) in size and represented by an area with a radius of approximately 1.2 miles or 2 kms (Morrison 1997a). Adult caracaras typically forage throughout their home range during both the nesting and non-nesting seasons, and have different levels of tolerance and foraging needs that vary considerably throughout the year. Nesting caracaras are susceptible to disturbances that alter the existing levels or patterns of activity present around the nest tree. Observations of nesting caracaras by Morrison (2001) note that the birds will generally flush from the nest during incubation or early nestling stages if the source of the disturbance is within 300 meters (985 ft) from the nest tree.

For purposes of assessing levels of adverse project effects to nesting caracaras, two zones are recognized by the Service as being critical for conservation and recovery of the species. These are the primary zone and the secondary zone. The primary zone radius is the 300 meter (985 ft) flushing distance from the nest. The secondary zone radius is the 2,000-meter foraging territory in which the nest is located. Restrictions in the secondary zone are necessary to minimize disturbances that might compromise the integrity of the primary zone as well as to protect key areas outside of the primary zone. The Service acknowledges that caracara home ranges are not necessarily spherical; however, it demonstrates for the reader the spatial relationship of a typical caracara territory to the project’s size and location.

Caracara surveys were conducted in accordance with Service guidelines (Service 2002) during February through May of 2006 by SEA. Suitable caracara habitat within 300 meters and 2,000 meters of the project boundary were identified using 2004 aerial imagery and 2000 Florida Land Use, Cover and Forms Classification System (FLUCCS) Geographic Information System (GIS) data. However, permission to access the private property south and southeast of the C-43 West Reservoir project was not granted until the last survey event and was limited to approximately 1,000 ft of the property line.

Two caracara nest locations (1 confirmed and 1 potential) were identified in the project vicinity during species specific surveys conducted February through May of 2006. One confirmed nest was located in a group of cabbage palms along the southern edge of SR 80, approximately 4,750 ft north of the project boundary (Figure 18). No portion of the C-43 West Reservoir project area falls within the primary protection zone (*i.e.*, 300-meter radius) of that nest tree. However, the 110-acre access road parcel and 264 ac of the reservoir footprint fall within the secondary protection zone (*i.e.* 2,000-meter radius of the nest tree), resulting in a loss of 374 ac of habitat available to those caracaras for foraging.

A potential second nest location was identified during the 2006 surveys in a privately-owned, unimproved pasture property approximately 1,065 ft southeast of the project boundary. Two adults and two juvenile caracaras were observed along the project boundary and within the adjacent property. Activities observed included caracaras flying to and from the project area and adjacent property, and caracaras perching, preening, and foraging along the perimeter of the project and within the adjacent property. One adult was observed carrying prey and feeding juveniles on the ground. SEA was not permitted beyond 1,000 ft of the project boundary to confirm the nest location.

Nestlings fledge the nest at about 7 to 8 weeks although they are incapable of sustained flight and remain dependent on the adults for food. They remain close to the nest site perched in low-lying vegetation or lying on the ground within about 1,600 ft (500 meters) and the adults continue to feed the young for up to 8 weeks or more. Young typically do not venture far away from the nest until about 3 months after fledgling. Therefore, SEA tentatively identified a live oak tree as the potential nest tree based on this information and repeated observations of the adults and young in or near that tree. During a May 15, 2007, site visit, Service staff and the Superintendent for the private property owner and their environmental consultant positively identified the location of the nest tree approximately 80 ft from the potential nest tree identified by SEA. Approximately 1.3 ac of the C-43 West Reservoir project area falls within the primary protection zone and 1,100 ac of the project site falls within the secondary protection zone of this second confirmed nest (Figure 18).

Additionally, District staff observed six caracaras scavenging in the Test Cell Project area during and initial site preparation (*i.e.*, clearing and grubbing) and construction activities. Such activities may provide good foraging conditions for caracaras as they can take advantage of exposed and injured prey.

Factors Affecting Species Environment within the Action Area

Caracara were historically associated with grassland and wetland habitats in Florida. The draining of wetlands and the conversion of prairie habitat to residential and agricultural land uses have negatively impacted the caracara throughout its range. In contrast, the conversion of forested areas to pastureland has seemed to benefit caracaras. According to predevelopment vegetation maps of developed for the Southwest Florida Feasibility Study (Corps 2005), the C-43 West Reservoir project site was historically comprised primarily of mesic and hydric flatwoods,

with lesser amounts of wet prairie and freshwater marsh. While pine flatwoods are valuable ecological communities and are becoming increasingly rare in South Florida, they generally are not suitable for caracaras. Although wet prairie and freshwater marsh may provide a substantial amount of wetland-based forage for caracaras, those habitat types were not historically abundant on the project site. The conversion of the project site to a citrus operation containing citrus groves and impacted wetlands that function as agricultural reservoirs or wet detention areas, may have enhanced the habitat for caracaras. Habitat suitability models developed by Morrison et al. (2006) ranked 13 vegetation cover classes for importance to crested caracaras in south-central Florida, including the C-43 West Reservoir project area, using compositional analysis of 28 caracara home ranges compared to the overall study area. Citrus was ranked 7 on a scale of 0 to 10 and was deemed of medium preference to caracara (Table 14). Only 4 other cover classes ranked higher (*i.e.*, improved pasture, freshwater marsh, grassland, and mixed upland hardwoods). Pinelands or flatwoods were ranked as a 2 and were deemed of low preference to caracara.

This is not to say that the current condition for this species as a whole is better today than it was historically. As a result of ongoing, land use changes, caracaras appear to be exploiting pastures, ditches, and impounded wetlands that have replaced the historic land cover. The level of agricultural development throughout the caracara's range has dramatically impaired or eliminated their native habitat and has substituted it with pastureland that is not self-sustaining. Southwest Florida has had the fastest growing citrus acreage in the state and growth in citrus acreage is usually on land that was formerly converted to pastureland (Corps 2005). Future land use projections for Hendry and Glades counties indicate continued conversion of pasturelands in the project vicinity to citrus operations and an increase in urban and rural development. The recent escalation in residential real estate prices in Florida has resulted in the sale and subdivision of large parcels of pastureland and citrus farms. This is a concern both within the action area and on private lands throughout the species range.

Continued residential development may further impact caracara territories by displacement of caracaras or their prey, or changes in habitat use patterns. Construction of single-family homes on 10 or 20 ac of ranchlands is an increasing threat to caracaras, and many of these will not require a Federal permit. The result is fragmentation of large tracts of pastures that caracaras have occupied. Quantifying the combined effects of these small, incremental reductions in caracara habitat suitability, and the potential effects of these small projects on caracara nesting is difficult, but some impacts have occurred and should be expected in the future. For example, habitat suitability modeling results indicate that some caracaras may nest in less suitable areas that contain suitable nesting trees (*i.e.*, small clumps of or scattered cabbage palms) and that have suitable foraging habitat nearby (Morrison et al. 2006). The two nest locations in the project vicinity may be evidence of this as both nests are located in cabbage palms within or adjacent to small tracts of pasture. The pasture directly north of SR 80 contains 61.7 ac (25.0 hectares) and the fallow agricultural field south of the nest tree contains 83.4 ac (33.7 hectares) and both are completely surrounded by citrus groves or rural development. The nest tree in the southeast corner is located within 67.1 ac (27.3 hectares) of pasture surrounded by citrus, cypress swamp, and pine flatwoods.

Past and ongoing Federal actions affecting the caracara within the action area that may cause additional impacts to the species include the 267-acre Test Cell project previously described and SR80 improvement and widening projects. The Service informally consulted on the Test Cell project in a letter dated November 30, 2005. No crested caracara nests or suitable nesting habitat occurred within the proposed test cell project area, and no construction activities or habitat loss would occur within the primary or secondary protection zones of known caracara nest sites or unknown nest sites in available nesting habitat that had not been surveyed. Based on this information, the Service concurred with the Corps determination that the Test Cell Project “may affect, but is not likely to adversely affect” the crested caracara. During initial site preparation and construction activities, District staff observed six caracaras scavenging in the Test Cell Project area. Such activities may provide good foraging conditions for caracaras as they can take advantage of exposed and injured prey. No birds were injured or killed as a result of project activities.

As noted earlier, one nest is located in the southern right-of-way of SR 80. SR80 is a 132-mile (211 km) route linking United States Highway (US) 1 in West Palm Beach and US 41 in Fort Myers and is an important east-west travel route. Due to high traffic volume, the Florida Department of Transportation has begun construction on a limited-access highway from Interstate 95 to US 441 in Palm Beach County, and a controlled-access highway from US 441 to Interstate 75 east of Fort Myers. Most of the main stretch of controlled-access highway has been completed from Loxahatchee to the northbound US 27 split-off west of Clewiston, as well as the stretch that crosses the action area extending from Interstate 75 to Labelle. Work is currently underway to make drainage improvements to the edge of the roadway from east of the Lee and Hendry County line to west of Grandma’s Grove RV Park on SR 80. The Service has already consulted on the effects of those projects on listed species through the DA permitting process.

ENVIRONMENTAL BASELINE – Eastern Indigo Snake

Status of the species within the action area

Although the eastern indigo snake is documented throughout the project area, we have little information on the distribution and abundance of the eastern indigo snake in the action area. Indigo snakes are known to occur in the Caloosahatchee River basin in low densities and are known to occur along the banks of larger ditches and canals in citrus groves, particularly if burrows (*e.g.*, tortoise, armadillo, small mammal, and land crab), debris piles, or other shelter are in close proximity. The most intensive study of wildlife use of citrus groves in the action area was conducted by Mazzotti et al. (1993). That study area included 600,000 ha (1,482,632 ac) in southwest Florida; encompassing the region known as the Immokalee Rise which includes the C-43 West Storage Reservoir project area. Citrus groves, including grove beds, canals, impacted wetlands, and reservoirs, had a relatively high species richness (203 species) however the majority of species (159) were observed in agricultural reservoirs. One hundred six species were observed in grove beds of various ages. Following a scheme developed by Duever et al. (1986), habitat importance values for 380 taxa were assigned to different land cover types in the Immokalee Rise Citrus Development Study. Citrus grove habitat utilization for the indigo snake was assigned an index of 2 (commonly used). Roads and ditches are the most likely places to

observe eastern indigo snakes, but most sitings in natural habitat occur in pine flatwoods, hammocks, and edges of ecotones where prey is abundant. Animal burrows (especially armadillo) in the canal and ditch banks present in this project likely provide refugia for the eastern indigo snake. The Corps and the Service have assumed that eastern indigo snakes occupy the site, and are more prevalent where habitat and prey items are more plentiful.

Past and ongoing Federal actions affecting the eastern indigo snake within the action area include the construction, operation, and monitoring of a 267-acre Test Cell project to evaluate the on-site seepage potential and effectiveness of seepage control measures, the suitability of on-site materials for embankment construction and slope protection, and the effects of water residence time and seepage on water quality. That project included two 500-foot by 500-foot test cells with offset seepage canals, a borrow area, settling ponds, and staging areas and was authorized under DA Permit number 2005-6598 (IP-TKW) issued December 6, 2005. Impacted jurisdictional areas included 1.9 ac of excavated open-water, 2.6 ac of wet prairie, and 24.5 ac of tertiary, agricultural drainage canals. Fifteen armadillo burrows were identified within the 267-acre project area that may provide shelter for indigo snakes. Project-related construction activities were determined to have potential to destroy shelter and refugia sites and cause individuals to leave the area, abandon den sites, and miss foraging and mating opportunities. According to the site plan, the Test Cell Project would primarily impact the smaller, tertiary canals with little or no impact to the larger, secondary and primary canal banks that indigo snakes prefer, so it was deemed unlikely that eastern indigo snakes would occur within the Test Cell project footprint.

The Service informally consulted on the Test Cell project in a letter dated November 30, 2005. The Service's Standard Indigo Snake Protection Conditions were implemented during construction to minimize potential adverse effects to indigo snakes (Service 2002). Those measures include: 1) providing indigo snake educational materials to construction employees prior to project initiation; 2) if a live indigo snake is found, construction activities will cease until the snake has left the project area on its' own accord and the location of sightings will be reported to the Service; and, 3) if a dead indigo snake is found, the snake will be frozen as soon as possible and the Service will be contacted immediately for further instructions. Based on this information, the Service concurred with the Corps determination that the Test Cell Project "may affect, but is not likely to adversely affect" the eastern indigo snake.

Factors affecting species environment within the action area

The project action area is within one of the fastest growing areas in the country (<http://www.census.gov/Press-Release/www/releases/archives/population/009865.html>; Zwick and Carr 2006). Development includes both residential and agricultural demands that initially targeted coastal and upland areas that include pinelands and coastal hammocks. More recent development has impacted vast areas of wetlands, particularly short-hydroperiod wetlands such as wet prairie, hydric flatwoods, or isolated ponds (Corps 1997, Corps 2005, Service 2000). Degradation and fragmentation of habitat has reduced availability of both refugia and prey for this species. At a landscape level, the C-43 project is surrounded by a matrix of agricultural, forested, and wetland land covers with pockets of urban land use. Citrus groves, row crops and

improved pasture with scattered cypress and mixed wetland hardwoods flank the project to the north, east, and south. The area to the north of the project site also contains some low-density residential areas. Forested uplands (parceled into low-density residential lots in various stages of development) include pine flatwoods, longleaf pine-xeric oak, sand pine, and xeric oak are adjacent and west of the project. Urban areas are present to the southwest and northeast of the project area with small parcels along the Caloosahatchee River. Regions to the northwest and southeast of the project area are generally undeveloped. Intensive agriculture in the study area occurs mainly as citrus, with some row crops, sod farms, plant nurseries, and sugar cane. These non-native areas are generally less desirable habitats for fish and wildlife. They exhibit habitat uniformity and are subject to disturbance from humans, machinery, and pesticide usage. Still, some wildlife is usually present in these areas as either residents or transients from native habitats.

The project footprint is currently an active citrus grove. Natural and biological features and land use within the C-43 West Reservoir project area were initially reviewed using the 2000 FLUCCS GIS data. Citrus grove covers approximately 90 percent of the project site. The citrus grove land use classification includes acreage covered by citrus trees, grove maintenance roads, and small berms, brush piles, and other small features related to citrus grove operations. Water comprises 8.9 percent of the site and includes extensive agricultural canals and ditches, classified as streams and waterways, and excavated ponds, classified as reservoirs less than 10 ac in size. Wetland comprises 1.1 percent of the site and includes mixed wetland hardwoods, willow and elderberry, exotic wetland hardwoods, cypress, wetland shrub, and freshwater marsh.

The 10,602-acre site includes 1,061.3 ac of jurisdictional wetlands and waters of the United States, including 934.6 ac of man-made agricultural ditches and canals used for irrigation and drainage conveyance and 126.7 ac of natural wetlands. Natural wetlands in agricultural areas typically suffer from altered hydrology, typically exhibiting shorter hydroperiods, although some intermittent flooding may occur in areas of low relief. These conditions lead to the loss of habitat for breeding amphibians (Moler and Franz 1987). Agricultural ditches may be permanently flooded, providing habitat for non-native fish. The effect of the availability of non-native prey species, particularly fish and small mammals, is unknown (Mazzotti 1993).

With the exception of the area previously cleared for the Test Cell project, the citrus grove is actively managed. The current irrigation practice in the grove is accomplished through micro irrigation supported by adjacent seepage ditches. Pesticide usage is typical for this type of crop and includes a copper-based fungicidal spray twice a year. However, no copper has been applied to the project area for approximately 3 years. Canal banks and tree rows are regularly mowed. Maintenance vehicles regularly travel on the roads in the grove, providing opportunities for vehicle mortality.

EFFECTS OF THE ACTION – Florida Panther

This section analyzes the direct and indirect effects of the project 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 and 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. Intraspecific aggression, though habitat based, could also result in mortality.

This project site contains marginal quality panther habitat (see discussion under Wildlife Assessment) and is located within the northern periphery of the geographic range of the Florida panther's breeding population in south Florida. The timing of construction for this project, relative to sensitive periods of the panther's lifecycle, is unknown. Panthers have the potential to be found on and adjacent to the proposed construction footprint year-round. The project will be constructed in three disruptive events, and result in permanent loss and alteration of the existing ground cover on the project site. Project construction will be undertaken in phases over several years. The initial land clearing will commence July 2007 and proceed through March 2008, the first phase of construction will commence October 2007 and proceed through April 2008, and the final construction phase will commence February 2008 and proceed through December 2011. The disturbance associated with the project will be permanent and result in a loss of habitat currently available to the panther.

Analyses for Effects of the Action

The 10,602-acre C-43 West Storage Reservoir project site is on the extreme northern edge of the Florida panther Primary and Secondary Zones as designated by Kautz et al. (2006), and is located inside the Panther Focus Area as defined by the Service. The site currently provides habitat of mostly low quality for the Florida panther (see discussion under Wildlife Assessment). The project site is located on the northern fringe of occupied habitat, is encompassed by primarily by agricultural development (*i.e.*, citrus groves), and is located near but not within known dispersal corridors (FWC 2006b) between larger publicly owned managed lands. The project will result in the conversion of 10,335 ac of marginal quality panther habitat on-site primarily into open-water reservoir.

Compensation for the loss of 10,335 ac of panther habitat will be through the protection and restoration of 100,492 ac off-site through implementation of Band 1/Acceler8 Projects included in CERP. Fifty-nine percent of the lands preserved are in the Primary Zone (Kautz et al. 2006)

of the panther core lands (Figure 7) and the remaining ac are located in the Other Zone. These “core area” lands include the majority of home ranges of the current population of the Florida panther (see definition of core panther area in Effects of the Action - Primary Equivalent Lands). The total compensation will provide over 548,000 PHUs, primarily in areas with a relatively higher level of documented panther usage (telemetry data) to minimize the impact of the net loss of 18,773 PHUs in an area bordered by agricultural development (*i.e.*, citrus groves) and exhibiting limited documented panther usage (telemetry data).

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 about 10,335 ac of habitat suitable for foraging and dispersal by the Florida panther. The project lands are located inside and along northern edge of the Florida panther Primary and Secondary Zones. The site offers a limited prey base and is surrounded by existing agricultural development (*i.e.*, citrus groves), or proposed residential development and agricultural activities. The land will be converted to an open-water reservoir. 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 habitat use 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 agricultural and rural development and roadways and is at the extreme north edge of occupied habitat south of the Caloosahatchee River. 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 be appreciable as a result of project implementation.

Permanent Loss and Fragmentation of Habitat that Supports Panther Prey: Prey surveys documented use of the C-43 West Storage Reservoir project site by two primary panther prey species, white-tailed deer and feral hogs. However, the site consists primarily of citrus groves and disturbed wetlands with minimal invasion by exotics, which provide poor foraging value to these and other prey species. The project will result in the loss of about 10,335 ac of habitat available for use by panther prey species. The project site is bounded by SR 80 and existing agricultural and rural development to the north, agricultural activity to the south, the Townsend Canal to the west, and existing agricultural and rural development and SR 29 to the east. Although the native habitats have been degraded through conversion to agriculture and associated hydrological alterations, 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 agricultural and rural development and roadways and is at the northern edge of the core area of occupied habitat south of the Caloosahatchee River. 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 to be appreciable.

Road Way Improvements: No expansion of surrounding roads will occur as part of the C-43 West Storage Reservoir project. Some improvements may be necessary to enhance the existing agricultural access roads to meet public health and safety standards for ingress and egress of vehicles to the project site for construction, maintenance, and future recreational access. Therefore, road improvements are not expected to impact the Florida panther.

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 conversion to agriculture and the distance from the more commonly used core lands of the panther. The project site is bounded by SR 80 and existing agricultural and rural development to the north, agricultural activity to the south, the Townsend Canal to the west, and existing agricultural and rural development and SR 29 to the east. Three deceased collared panthers (FP 28, FP 74, and TX 101) have been documented within 5 miles of the project area. One deceased collared male (FP 74) was tracked within the project area along the Townsend canal and four times within 0.5 miles of the southeastern project boundary during 1999. Two living panthers, FP 65 (male) and FP 137 (male) have been documented within 5 miles of the project on numerous occasions in 1998 and 2005, respectively. Since the habitat quality of the site is generally poor, as it is primarily citrus groves with impacted wetlands 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 10,335 ac of agricultural land along the northern edge of the Panther Focus

Area south of the Caloosahatchee River. This loss represents only 0.53 percent of the 1,962,294 ac of available non-urban private lands in south Florida in the core area of the Florida panther (Table 5). The Service believes the habitat values lost by the project will be minimized by the preservation and restoration actions of the Band 1/Acceler8 projects combined. The project lands proposed are primarily citrus groves and disturbed wetlands with minimal invasion by exotics on the northern fringe of the occupied range of the Florida panther and are encompassed by agriculture, rural development, and existing roads. The lands proposed for compensation through implementation of the Band 1/Acceler8 projects 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, it is likely that all land clearing and construction associated with the project will commence during July 2007, and will be completed by December 2011. 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 impact of the habitat lost as a result of the development will be minimized by the preservation and restoration actions of the Band 1/Acceler8 projects combined. The applicant's proposed preservation acreage is estimated at 100,492 ac. The lands proposed for development are primarily citrus groves and disturbed wetlands at least partially invaded by exotic vegetation, are on the fringe of the currently occupied range of the Florida panther, are adjacent to agricultural and rural development, and are adjacent to SR 80. The lands proposed for preservation 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. All access and staging areas are to be located within the project footprint. Future maintenance and monitoring activities are expected to result in minimal impact to the surrounding environment. Therefore, only negligible impacts are expected to result from interrelated or interdependent actions as a result of the project.

Indirect Effects

Indirect effects are those effects that are caused by or will result from the proposed action and are later in time, but are still 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 and 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 for 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 increased vehicular traffic in the project vicinity during construction and operation. Vehicular mortality and injury data (Table 8, Figure 16) provided by the FWC indicate collisions with motor vehicles have been increasing since 2000 in the 25-mile radius project action area. In 2003 and 2006, there were six documented panther-vehicle collisions per year within the project action area (Table 8). These 2 years represent the most panthers killed by vehicles in single years in the action area. However, this number may be surpassed this year (2007), as 4 panthers have already been killed by vehicle collisions during the first 5 months. Four panthers were killed per year in 2000 and 2002. All of the 42 documented collisions within the action area have occurred more than 10 miles away from the project site, and 37 (88 percent) occurred more than 15 miles from the project site.

Major travel routes in the vicinity of the project site (Figure 1) include SR80 to the north, and SR29 to the east. SR80 is a four-lane divided highway and is already a heavily traveled east-west transportation route. SR29 is a two-lane rural highway. Construction traffic will come from SR80 and then use the existing agricultural roads in the 110-acre access road parcel to travel to and from the project area. Construction is proposed to take place in phases through December 2011. Once construction is completed, additional vehicular traffic will operate in the area as a result of project monitoring, operations, and maintenance. Projected impacts to future traffic are related to maintenance vehicles and possible recreational access to the reservoir site. Considering this information and distances from the project site to documented collisions, it is unlikely the traffic generated by this project will significantly increase the risk of roadway mortality to panthers.

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 habitat on the project site consists primarily of citrus groves and disturbed wetlands with minimal invasion by exotics, which provide low quality habitat to the Florida panther and 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 and human interactions and prey disturbance.

Habitat Fragmentation: Considering our discussion of fragmentation under Direct Effects, the project site is located on the northern fringe of occupied habitat, is adjacent to existing agricultural and rural 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 northern fringe of the Panther Focus Area south of the Caloosahatchee River. 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. 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. Therefore, we do not believe that panther prey species or Florida panthers utilize the property on a frequent basis. However, the reduction in the geographic range of habitat for dispersal or escape cover may contribute to a potential increased risk of death or injury 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 C-43 West Storage Reservoir 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 10,335 ac of potential panther habitat according to the most current home range estimates of the Florida panther (Lotz et al. 2005). This represents 35.6 percent of a female panther's average home range (29,059 ac) and 16.5 percent of a male panther's average home range (62,542 ac). 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 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 northern fringe of occupied habitat, is adjacent to agricultural and rural development, and is not located within known dispersal corridors (FWC 2006b) between larger publicly owned managed lands. Therefore, appreciable fragmentation of panther habitat is not expected to result from project implementation.

EFFECTS OF THE ACTION – Audubon’s Crested Caracara

This section includes an analysis of the direct and indirect effects of the proposed action on the caracara, including beneficial effects, interrelated and interdependent actions, and species response to the proposed action. To determine whether the proposed action would likely jeopardize the continued existence of this species, we focused on the expected consequences of the proposed action on the potential for future caracara nesting and habitat use.

Factors to be Considered

Caracaras have been documented to nest immediately adjacent to the C-43 West Reservoir project area and are known to forage within and adjacent to the project area. Thus, the action will take place when this species is likely to be present and nesting in the area. Construction will be conducted in phases commencing during July 2007 and extending through April 2011. The operation and maintenance of the project is anticipated to last at least 40 years. Potential direct and indirect impacts to caracaras may occur as a result of the initial destruction and degradation of existing habitat; dredging, earthmoving, and other activities associated with construction of the reservoir (including associated pump stations and water control structures), seepage canal, access roads, and recreational facilities; modifications to existing canals; and operation and maintenance of the project. Project-related activities may cause caracaras to leave the immediate vicinity, abandon nest sites, abandon territories, abandon active nests during the egg laying or brood-rearing stages, and possibly miss foraging, mating, and brood-rearing opportunities. Displaced adults may incur a higher risk of mortality because of either intraspecific aggression by caracaras defending territories into which displaced caracaras attempt to move, predation, or other sources of mortality such as vehicle collisions or other trauma associated with scouting unfamiliar areas. Potential direct impacts to the caracara or its habitat include direct injury or mortality from (1) all construction-related activities, (2) vehicular traffic, and (3) loss of available habitat for foraging, breeding and dispersing birds. Potential indirect impacts include injury or mortality from future operation and maintenance associated with the reservoir, including (1) vehicular traffic, mowing, and pesticide usage; (2) fluctuations in prey density in the reservoir and associated infrastructure as water levels fluctuate and potentially become dry; and (3) impacts from copper contamination of benthic fauna in the reservoir.

Analyses for Effects of the Action

Direct Effects

Direct effects are those effects that are caused by the proposed action. The direct effects evaluated by the Service include direct injury or mortality and loss or degradation of available

habitat for foraging and breeding. The direct effects that this project may have on caracaras within the action area are discussed below.

Injury and Mortality: Our data indicate that caracaras utilize the area in and around the C-43 West Storage Reservoir project for nesting and foraging. It is difficult to determine the number of caracaras that would be directly injured, disturbed, or killed by the project as it depends on the proximity of project-related activities to the nest trees and the timing of those activities in relation to the occurrence of caracara nesting and fledging. Accidental adult injury or mortality as a direct result of project-related activities would be unlikely since older birds are more wary and likely more experienced than juveniles. However, during winter months when caracara nesting is more prevalent, eggs and small chicks may perish from overexposure if adults are frequently flushed from nest trees or avoid the nest for extended periods (Morrison 1998). Additionally, fledgling and juvenile caracaras spend more time on the ground and do not venture far from the nest tree. Therefore, they are at risk of injury or death from heavy equipment operations, vehicular traffic, and mowers, particularly if such activities occur within the primary and secondary zones during the nesting season. Morrison (2005) identified vehicular traffic as a specific cause of mortality to juvenile caracaras feeding on carrion.

The best way to minimize the risk of this type of injury is to avoid the primary and secondary zones surrounding the nest tree during the nesting season. None of the proposed project activities would occur within the primary zone of the northern nest, and only one acre of the primary zone surrounding the southeastern nest overlaps the project footprint. That one acre is separated from the rest of the primary zone by agricultural roads and a canal that demarcate the boundary between the proposed project and the adjacent private property. Therefore, it is unlikely that recently fledged young incapable of sustained flight would utilize that acre. Juveniles, however, may venture farther from the nest and be present in the project area during construction, particularly in the secondary zones, and therefore may be at risk of direct injury or mortality. Proposed project activities in that area include initial clearing, grubbing and stripping, and construction of a portion of Dam Segment O including the adjacent portion of the seepage canal and associated littoral zones.

Avoidance of the secondary zone surrounding each nest is not entirely possible due to the scale of the proposed project and the methodology required for construction of the reservoir embankments. All or portions of Dam Segments E, F, G, M, N, O, and P, including the adjacent portions of the seepage canal and associated water control structures, will be constructed within the secondary zones of one of the two nests. The full embankment will be best constructed as the project progresses to allow for placement of the upstream soil-cement and establishment of grass on the downstream slope of the embankment. This also includes constructing the internal drain system, borrow, and fill placement as the embankment is built. The embankment construction is a critical element of the project and the quality of this work is key to the District's dam safety program.

Large equipment, such as bulldozers with rakes and pans, will be utilized for embankment construction. This equipment works in a linear fashion around the site borrowing soil and then placing the borrow material on the embankment in six inch lifts. The techniques and sequencing

used are important to insure the necessary quality of the work. The available 6 month work periods outside of the caracara nesting season (*i.e.*, May through October) in the secondary zone represent 1 month of the dry season and 5 months of the rainy season. Thus the majority of the reservoir embankment within the secondary zone can only be constructed during the rainy season which increases the uncertainties of the work. Not only will the construction of the earthen portion of the embankment be impacted by the enforcement of the secondary zone during the Caracara nesting season, the placement of the soil cement, of which the production rate and quality is greatly effected by rainy conditions, will have to also be scheduled for the rainy season. The periods for the construction of all Project elements within the secondary zone is insufficient to meet the requirements of the Project and will require modifying the construction sequence and techniques with an approach that is more difficult and possibly raising questions of embankment integrity.

Accordingly, the Service anticipates that disturbance would occur through project activities in the primary or secondary zone that force caracaras to leave foraging or perching sites in the immediate vicinity, to nest in new locations either within or outside the existing territories, abandon active nests during the egg laying or brood-rearing stages, or possibly miss foraging, mating, and brood-rearing opportunities each year over the five-year construction schedule. If breeding or nesting opportunities are missed or abandoned, this could represent a loss of recruitment to the population from two nesting pairs for 5 years. Additionally, displaced adults may incur a higher risk of mortality because of intraspecific aggression by caracaras defending territories into which displaced caracaras attempt to move, predation, or other sources of mortality such as vehicle collisions or other trauma associated with scouting unfamiliar areas.

Loss of Habitat:

Although, no known nest trees or other cabbage palms suitable for nesting will be removed as part of the C-43 West Reservoir project, a total 1,474 ac of potential foraging habitat consisting primarily of citrus groves and impacted wetlands in the secondary zones of two known nest locations, will be converted to reservoir, embankment, or seepage canal. Thus, if we assume a worst-case scenario, the entire 1,474 ac will be habitat lost as a result of the proposed project. This loss of habitat may result in territory shift, intraspecific aggression, or territory abandonment.

It is possible that caracaras may forage in the interior of the reservoir when it is dry, along the exterior reservoir embankments, and along the seepage canal after construction. Caracaras are not expected to forage on the interior of the reservoir embankments as they will be lined with concrete and no vegetation that may support prey is expected to become established. In this scenario, slightly less than 1,474 ac of habitat would be lost. However, we are uncertain how caracaras will react to a change in land use over a substantial percentage of their territory. Morrison (2005) stated that natural wetlands larger than 25 ac (10 hectares) are not as likely to be included in caracara territories as wetlands less than 25 ac. Morrison et al. (2006) found that that 90 percent of 28 caracara home ranges contained 50 to 150 hectares of freshwater marsh (excluding sawgrass- and cattail-dominated marshes). However, 90 percent of those freshwater marshes were less than 1 hectare in size with approximately 50 percent less than or equal to

0.1 hectares in size. Thus, we do not expect caracaras to forage substantially in the reservoir when one or both cells are completely drawn down.

Indirect Effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The indirect impacts evaluated by the Service include: (1) post-construction maintenance of the roads, embankments, seepage canal, boat ramps, pump stations, and other water control structures; (2) future recreational activities such as picnicking, boating, fishing, hiking, or horseback riding; and (3) chemical contamination. The indirect effects that the proposed action may have on caracaras within the action area are discussed below.

Operation and Maintenance: Routine operation and maintenance may result in temporary and insignificant disturbance to the crested caracara. Once construction is completed, additional vehicular traffic will access and operate in the area as a result of project monitoring, operations, and maintenance which may include mowing of embankments or heavy equipment operation. Adult caracaras nesting in the project vicinity are already acclimated to human presence, and vehicular traffic and heavy equipment operations associated with routine agricultural activities.

Caracara may forage on prey items that could become established on the embankments and littoral zones of the seepage canals. The Service anticipates that vehicular activity or heavy equipment operation associated with maintenance may disturb, injure, or kill individual caracara fledglings or juveniles that may be foraging onsite, since they do not venture far from nest the tree following fledging and are inexperienced.

Recreation: Recreational activities may result in temporary and insignificant disturbance to caracaras. Detailed information on future recreational activities in the project area is not available at this time. However, recreational activities could reasonably include picnicking, boating, fishing, and hiking or horseback riding on the service road along the crown of the reservoir embankments. Future recreational access and facilities (*i.e.*, picnic tables, restrooms, etc.) will most likely be located in the 110-acre access road parcel which occurs within the secondary zone of the nest on SR80. Those adults are already acclimated to routine vehicular traffic along SR80 as well as vehicles traveling to and from the project area as a result of agricultural activities. Additionally, the proposed access route for the reservoir is currently the access route to and from and the location of the existing facilities for the citrus operation (*i.e.*, Berry Groves-LaBelle Congen). The adult caracaras nesting on SR80 are already acclimated to human presence, vehicular traffic, and heavy equipment use associated with routine agricultural activities, including fruit harvesting and ditch maintenance. Likewise, the caracaras nesting to the southeast of the project area are also acclimated to limited human presence, and vehicular traffic and heavy equipment operations associated with routine agricultural activities.

Contaminants:

An environmental site assessment for chemical contamination was performed by the District in 1999 for the entire C-43 West Reservoir project area.

Copper: Soil sampling has identified seven grids (*i.e.*, grids 56, 58, 124, 125, 134, 135, and 143) in the Berry Labelle – Congen Groves (Tracts GX-100-017 & GX-100-018) portion of the site that will require remediation due to copper contamination. The Service recommended remediation for the entirety of Grids 124, 125, 134, 135, and 143 (250 ac) and for the portions of Grids 56 and 58 that will be within the footprint of the proposed reservoir. The Service concurred in a letter dated September 14, 2006, that removing contamination from the seven grids would remove the risk of direct impacts to Service trust resources. Approximately one foot of soil will be excavated from areas to be remediated and the soil will be utilized within the reservoir embankments, burying the soils such that surface water will not contact the copper-contaminated soil. However, the Service noted that the remaining copper concentration in some areas of the property may be high enough to adversely impact benthic organisms.

We anticipate that remediated soils placed in the embankments will not adversely affect caracaras or their prey. The adverse effect of crested caracara consumption of contaminated prey associated with benthic organisms is not known, but is considered to be low given the periodicity and duration of expected draw down events.

Other contaminants: The 600-ac Bryan Paul Citrus Grove (Tract GX-100-009) will be remediated for chlordane contamination by removal of the top two feet of soil in the 20-acre area and utilizing that soil within the reservoir embankments. The 2,025-acre Bob Paul Citrus Grove (Tract GX-100-015) may be remediated for organochlorine pesticides in two 50-acre grids upon further investigation to delineate contamination. The 2,399-acre Winthrop Property (Tract GX-100-005) will be remediated for metals, petroleum hydrocarbons, and pesticides detected around maintenance areas by removal of contaminated soils. The 954-acre Griffin Property (Tract GX-100-001) will be remediated for metals and polycyclic aromatic hydrocarbons in burn areas, chemical barns, and fertilizer mix and load areas by removal of contaminated soils. Given proper remediation, the anticipated risk to crested caracara from other contaminants is considered low.

Beneficial Effects

The loss of caracara foraging habitat when the project is built may be offset, in part, by potential foraging along the external embankments and the seepage canal. The project would have approximately 16.3 miles of external embankments, 2.8 miles of internal embankment, 14.7 miles of perimeter canal, and 109 ac of littoral zones. Interior portions of the reservoir and the interior dam embankments are anticipated to be a harder material (soil cement or concrete) and therefore, would not provide the necessary herbaceous plant cover needed by caracara prey. The width of the side slopes of the external embankments would be 114 ft. The width of the toe between the bottom of the external embankment and the perimeter canal is 90 ft. For the perimeter reservoir embankments and toe, a total of 403.05 ac (204 ft of the perimeter

embankment x 86,064 ft [16.3 miles]) of potential caracara foraging habitat would be created. The top of the embankment was also considered caracara foraging habitat and provides 27.66 ac (14-foot crest of the perimeter embankment x 86,064 ft [16.3 mi]). The total potential caracara habitat created by this project was estimated to be 430.71 ac (403.05 + 27.66) of foraging habitat. The number of birds that may forage on this habitat depends on the number of intersecting territories. Two known territories intersect the C-43 West Reservoir project area. Thus, up to 4 adults and 4 juveniles (two per nest) might forage in the project area. However, these estimates are speculative given that large wetlands (greater than 1 hectare) or large areas of open water are generally not included in caracara territories and large reservoirs have not yet been operated within known territories of the caracara in south Florida. Therefore, we recommend monitoring to determine caracara usage at this site following construction.

Additionally, the proposed project may benefit caracara during the initial stages of construction by exposing prey for foraging birds. However, this benefit may be offset by the increased risk of injury and mortality to young, inexperienced caracara.

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. All access and staging areas are to be located within the project footprint. Future maintenance and monitoring activities are expected to result in minimal impact to the surrounding environment. Therefore, only negligible impacts are expected to result from interrelated or interdependent actions as a result of the project.

Species' Response to the Proposed Action

Construction, operation, and maintenance of the project can result in actions that may kill or injure individual caracaras, and destroy or degrade occupied and potential nesting and foraging habitat. Due to their large territories (about 3,000 ac) and generally wary reaction to human activity, the risk of direct mortality of adult caracaras is not anticipated. Sub-adult caracaras, especially fledglings, are more at risk since they spend more time on the ground. As a result, the likelihood of mortality or injury increases through predation and vehicular collisions. Any clearing, burning, earthmoving, construction, operation, and maintenance activities may also adversely affect caracaras by disrupting parental care of the nest and chicks, and causing them to leave the area and possibly abandon territories, and miss foraging opportunities. The consequences of disrupting parental care of the nest (*e.g.*, reduced egg incubation or chick protection and feeding) may lead to egg or nestling mortality in a variety of forms, such as exposure, starvation, falling from the nest, or predation. Individual caracaras that leave the area may be more vulnerable to predation and intraspecific aggression.

The Service anticipates that 1,474 ac of caracara foraging habitat consisting primarily of citrus groves and impacted wetlands, would be directly impacted by the proposed project and converted to an above-ground reservoir with an average depth of 20 ft. This habitat conversion

may lead to indirect effects on an unknown amount of additional acreage outside of the project area via caracara territory shifts, shrinkage, or abandonment.

To determine the species' response to the action, we first assumed that the two known nesting pairs would continue to nest either in the same nest tree or one located nearby and may shift their foraging territory as a result of the proposed project and related activities. The pair nesting along SR 80 will likely continue to nest in the same location. The availability of cabbage palms is limited to the highway right-of-way near the current nest tree. The 61.7 ac pasture adjacent to west-bound lane (north) of SR 80 does not contain any cabbage palms which may explain why the pair chose to nest along the south side of the highway. However, if a typical territory is 3,000 ac and is assumed to be circular, the loss of 374 ac (or 12.4 percent of their territory) in the secondary zone consisting primarily of citrus groves and impacted wetlands would not force the pair to abandon their nest tree or territory. They may slightly shift their territory to avoid the project area during and post-construction.

We also do not believe that the pair nesting on private property southeast of the project area will abandon their territory unless the habitat converted to reservoir has critical resources (*e.g.*, better forage) and the remainder of the territory is marginal or sub-marginal habitat. That pair may be able to find another suitable nest tree slightly further away from the reservoir footprint. The current nest tree is located within 67.1 ac of pasture that will not be impacted by the proposed project and that contains several cabbage palms. However, if a typical territory is 3,000 ac and is assumed to be circular, that pair will lose approximately 37 percent (1,101 ac) of its territory. Although this is a significant loss of habitat, aerial photography indicates that additional suitable foraging habitat (*i.e.*, pasture, fallow farm fields, and active citrus groves) is currently available within and adjacent to the remaining portion of their territory (1,899 ac) on privately owned land and the birds would be forced to shift their foraging territory. This prediction is based on limited caracara data and the assumption that this area is not already occupied by other caracaras.

Each nesting pair of caracaras may produce two to three offspring per year. The Service anticipates that the proposed construction activities may cause adults to abandon nest attempts or otherwise disrupt parental care of a nest or chicks, resulting in the loss of two to six juvenile caracaras per year. We also anticipate that the likelihood of reduced reproductive success is greater for the pair nesting on private property southeast of the project area due to greater loss of habitat within their potential territory and the close proximity of construction activities. Increased human presence and noise disturbance from associated equipment operation would occur on the periphery of the primary zone established to protect the nest site from disturbance during the nesting season

If both nesting pairs are successful, there could be up to 10 caracaras (4 adults and 2 to 6 offspring) using the C-43 West Reservoir footprint for at least part of the year. We believe that some caracaras may use the reservoir embankments and the seepage canal following construction if there are sufficient prey items. These individual caracaras may be temporarily displaced while foraging by on-going maintenance, operational, and recreational activities. However, the impact may be beneficial (*e.g.*, mowing may expose prey) or negligible.

EFFECTS OF THE ACTION - Eastern Indigo Snake

Factors to be Considered

Eastern indigo snakes have been documented in the project action area. Because eastern indigo snakes use a variety of habitats, and have very large home ranges, they may occur throughout the project site and adjacent citrus groves and natural areas. This action will take place when this species is likely to be present in the area. The duration of the tree clearing and construction will be from July 12, 2007 to March 30, 2008. Pre-loading of embankments will occur from October 11, 2007 to April 30, 2008. Reservoir and pump station construction will occur from February 14, 2008 to December of 2011. The operation and maintenance of the project is anticipated to last approximately 50 years. Potential impacts to eastern indigo snakes may occur due to citrus tree removal and burning, habitat destruction and degradation, earthmoving, construction of the reservoir and operation and maintenance of the project. The action may also cause eastern indigo snakes to leave the area, abandon den sites, and possibly miss foraging and mating opportunities. Individual eastern indigo snakes fleeing the area may be more vulnerable to road mortality, predation or intraspecific aggression. Potential direct impacts to the eastern indigo snake or its habitat include mortality from (1) all construction activities including tree removal, burning, and contaminant remediation, (2) vehicular traffic, and (3) initial rehydration; and injury or disruption of normal behaviors from the loss of available habitat for foraging, breeding, and dispersing. Potential indirect impacts include mortality from future operation and maintenance associated with the C-43 West Reservoir project that may result in mortality or injury from (1) vehicular traffic, mowing, and pesticide usage; and injury from (2) fluctuations in prey density in the reservoir and associated infrastructure as water levels fluctuate and potentially become dry.

The eastern indigo snake is difficult to detect and quantify for the following reasons: (1) it has a wide-ranging distribution; (2) it has a patchy distribution within suitable habitat; (3) it has limited detectability due to use of burrows or holes for shelter, (4) there is likely unoccupied suitable habitat; (5) juveniles have limited detectability due to their affinity for thick vegetation, and (6) they may use cryptic sheltering areas that may be temporarily established during construction (e.g., brush piles, equipment stockpiles, and dirt mounds). The lack of practical methods to survey, in conjunction with wide-ranging activity and use of a variety of habitat types makes it difficult to determine the exact number of eastern indigo snakes that will be affected.

Analyses for effects of the action

Direct effects

Direct effects are those effects that are caused by the proposed action. The direct impacts evaluated by the Service include direct injury and mortality from construction (including initial hydration) and roadkill, loss of habitat for foraging, breeding, and dispersing, and disturbance related to the initial hydration of the reservoir. The direct effects that this project may have on eastern indigo snakes within the action area are discussed below. For purposes of this analysis,

the 267-acre Test Cell project site has been subtracted from the project effects analysis, and the total impact is estimated to be 10,264 ac.

Injury and mortality: It is difficult to determine the percentage of eastern indigo snakes that would be directly injured or killed by the project. However, due to the nature of the proposed construction (*i.e.*, complete disturbance of the site by tree removal, debris piling and burning, canal plugging or dredging, embankment construction, soil transport for contaminant remediation, and initial hydration), and the known death of an indigo snake on a similar reservoir construction project the Service estimates that the majority of the eastern indigo snakes present at the time of the action could be adversely affected by the project.

On October 10, 2006, an eastern indigo snake was killed while excavation of a sediment mound was occurring in the A-1 Reservoir footprint. The site of mortality was a sediment mound approximately 10-15 ft high and 20-25 ft in diameter along the far side of a canal levee road, adjacent to fallow sugarcane fields. The sediment had been excavated from a canal and deposited along the far side of the levee road approximately one to two weeks earlier, was now dry, and was subsequently being moved to an adjacent area. The equipment operator had been trained to identify eastern indigo snakes and to stop activity if any were observed. The operator did not see the snake on the mound. As the sediment was being deposited, the operator observed an eastern indigo snake falling from the sediment. Similar deaths of snakes have occurred in development of urban sites in Lee (Florida Gulf Coast University) and Collier counties, including the action area. Snakes typically seek refuge in burn or debris pile sites during construction (Dryden personal communication 2007).

It is not easy to estimate the density of eastern indigo snakes at the C-43 West Reservoir using existing data. However, a 26-year study conducted by Layne and Steiner (1996) at Archbold Biological Station (ABS) estimated a population density of 2.6 eastern indigo snakes (1.9 males, 0.7 females) per 247 ac (100 ha). ABS is approximately 30 miles northeast of the project area and contains better snake habitat (*i.e.*, the study area was comprised of 60 percent xeric pine and oak uplands, and 40 percent pine flatwoods, bayheads, swale, and seasonal ponds). Eastern indigo snakes have been observed at ABS in all natural and man-altered habitats with no obvious habitat preferences (Layne and Steiner 1996). The ratio of adult males to adult females at ABS was estimated to be approximately 4:1. The juvenile sex ratio was closer to 1:1. These estimates were consistent with other studies of captive eastern indigo snakes and museum specimens (Moulis 1976, Smith 1941, Duellman and Schwartz 1958).

The C-43 West Reservoir project site likely contains or intersects many eastern indigo snake home ranges. Based on population density estimates at ABS, one could estimate that as many as 108 adult eastern indigo snakes may be present within the C-43 West Reservoir project site (10,264 ac/247 ac x 2.6 snakes = 108 snakes). However, due to the differences in habitat between ABS and the project site, we anticipate that the density of eastern indigo snakes at the C-43 West Reservoir project site would be lower than that at ABS. Regular mowing, vehicular traffic, and pesticide usage on the project site are also likely to have decreased the suitability of the habitat for eastern indigo snakes and their prey. We have made an estimate that the quality

of the eastern indigo snake habitat at the project site is half that of ABS. In that case, then there could be up to 54 adult eastern indigo snakes within the C-43 West Reservoir project site.

Major travel routes in the vicinity of the project site (Figure 1) include SR80 to the north and SR29 to the east. SR80 is a four-lane divided highway and is already a heavily traveled east-west transportation route. SR29 is a two-lane rural highway. Construction traffic will come from SR80 and then use the existing agricultural roads in the 110-acre access road parcel to travel to and from the project area. Construction is proposed to take place in phases through December 2011, exposing eastern indigo snakes to changes or additions in vehicle traffic on the site over a period of approximately four and one-half years.

Loss of habitat: In general, citrus groves are not optimal eastern indigo snake habitat (Bolt 2006, Mazzotti et al. 1993). Some citrus growers maintain a higher herbaceous vegetative structure along canals, roads, and wet ditches as well as in between the rows of trees. Islands of more natural areas (hydric hammocks, cypress, and other wetlands) may also be present, either in or at the periphery of the groves. Groves interspersed or adjacent to natural habitat would have more prey items for eastern indigo snakes and also provide more cover than a grove that is more intensively managed (Zeigler 2006). Factors which influence species richness in citrus groves in the Immokalee Rise region in addition to grove age were size, interspersion of other important habitats, sampling effort, proximity to large natural areas, visibility of wildlife in groves of different ages and effects of workers on wildlife (especially snakes) (Mazzotti et al. 1993). In the Immokalee Rise Citrus Study, grove beds, agricultural reservoirs, impacted wetlands, canals and ditches in citrus groves provided habitat for prey species such as small mammals, birds, toads, frogs, fish, lizards, turtles, alligators, other snakes, and non-native species such as house mice (*Mus musculus*), black rats (*Rattus rattus*), and Norway rats (*Rattus norvegicus*). For this project, we are assuming that the entire remaining 10,264-acre grove is potential habitat for the eastern indigo snake even though the areas around the wet ditches and canals are likely to have better snake habitat and prey than the interior portions. Therefore, the Service considers the entire 10,264 ac to be habitat lost as a result of construction.

Initial Hydration: The initial flooding of the reservoir has the potential to inundate indigo snakes and their burrows. Indigo snakes may seek temporary refuge in air pockets in burrows. Slow initial flooding may allow some indigo snakes to vacate the reservoir, although some snakes may drown if trapped in air pockets and eggs may be destroyed by water.

Indirect effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The indirect impacts evaluated by the Service include injury and mortality associated with: 1) post-construction traffic increases from vehicles accessing the area for project monitoring, operations, maintenance or possible recreational access; (2) post-construction maintenance of the roads, levees, pump stations, and reservoir (including vegetation management methods such as mowing, herbicide application, and physical removal; reduced foraging opportunities associated with fluctuations in the prey populations from reservoir, canal or ditch drawdown or flooding; and 3) possible drowning or loss of individuals or nests

associated with rehydration; and harassment associated with rehydration of the reservoir. The indirect effects that the proposed action may have on eastern indigo snakes within the action area are discussed below.

Injury and Mortality: Once construction is completed, additional vehicular traffic will access and operate in the area as a result of project monitoring, operations, maintenance, and recreation. Some portion of the crown of the embankments will also be accessible for recreation access. Considering this information, it is likely that a small amount of mortality will occur as a result of additional vehicles accessing the site.

The Service anticipates that a small number of eastern indigo snakes may occupy the project area during operation and maintenance for the life of the project. Given the elevation of the project site levees and the number of prey items that could become established in and around the reservoir during drydown; these snakes may be at risk from the operation of maintenance vehicles and equipment, although the precise impacts are difficult to measure.

Mowing of embankments, vehicular activity, or heavy equipment operation associated with maintenance has the potential to crush or injure individual eastern indigo snakes and eggs, and destroy or degrade potential habitat. In general, the District uses the following guidelines for mowing levees:

1. Mowing occurs approximately 4 times per year.
2. Mowing occurs when vegetative height reaches 8 to 10 inches.
3. Mowers are set at 6 inches height.
4. Mowing occurs slightly beyond the toe of the slope if water levels allow.
5. No wildlife is to be harmed in the mowing of any levees.

Loss of Prey: Following the establishment of vegetation on the reservoir embankments (within six months after completion), prey items may colonize the reservoir embankments. Additionally, depending on the operation of the project and available water, the reservoir may occasionally dry out in low-precipitation years. It is not clear whether an eastern indigo snake prey base could become established within the reservoir. The interior slopes will be lined with a soil-cement mixture but the floor would remain as a natural substrate. Exposed substrate could attract, expose, or trap prey for the eastern indigo snake. Rehydration of the reservoir could result in loss of prey items. However, due to the large volume of water stored in the reservoir, complete drydown is anticipated to occur infrequently and this potential effect should be re-evaluated as more data becomes available regarding inundation frequency. Pesticide application may occur as part of project maintenance or accommodation of recreational activities. Prey (insects and some amphibians and reptiles) may be vulnerable to pesticide application and may be lost as a result of these activities.

Rehydration of the reservoir: Because the interior of the perimeter embankment and the sides of the interior dam will be concrete, snake access to a drying reservoir may be limited. If access to the reservoir floor occurs in the event that portions of the reservoir become dry, and in the event a prey base becomes established, eastern indigo snakes may be attracted to the reservoir

floor and cold potentially be vulnerable to inundation upon rehydration. Eastern indigo snakes may drown or have to move off the site to find a suitable substitute. Due to the volume of water stored in the reservoir, complete drydown is anticipated to occur infrequently. However, this effect should be re-evaluated as more data becomes available regarding inundation frequency.

Contaminants:

Copper: Soil sampling has identified seven grids (*i.e.*, grids 56, 58, 124, 125, 134, 135, and 143) in the Berry Labelle – Congen Groves (Tracts GX-100-017 & GX-100-018) portion of the site that will require remediation due to copper contamination. The Service recommended remediation for the entirety of Grids 124, 125, 134, 135, and 143 (250 ac) and for the portions of Grids 56 and 58 that will be within the footprint of the proposed reservoir. The Service concurred in a letter dated September 14, 2006, that removing contamination from the seven grids would remove the risk of direct impacts to Service trust resources. Approximately one foot of soil will be excavated from areas to be remediated and the soil will be utilized within the reservoir embankments, burying the soils such that surface water will not contact the copper-contaminated soil. However, the Service noted that the remaining copper concentration in some areas of the property may be high enough to adversely impact benthic organisms.

We anticipate that remediated soils placed in the embankments will not adversely affect eastern indigo snakes. Copper does not significantly biomagnify in the food chain beyond benthic invertebrates. Since the majority of the potential prey of the indigo snake associated with periodic drawdown of the reservoir is not composed of benthic invertebrates, the Service does not anticipate any effect to the indigo snake (Frakes, personal communication 2007)

Other contaminants: The 600-acre Bryan Paul Citrus Grove (Tract GX-100-009) will be remediated for chlordane contamination by removal of the top two ft of soil in the 20-acre area and utilizing that soil within the reservoir embankments. The 2,025-acre Bob Paul Citrus Grove (Tract GX-100-015) may be remediated for organochlorine pesticides in two 50-acre grids upon further investigation to delineate contamination. The 2,399-acre Winthrop Property (Tract GX-100-005) will be remediated for metals, petroleum hydrocarbons, and pesticides detected around maintenance areas by removal of contaminated soils. The 954-acre Griffin Property (Tract GX-100-001) will be remediated for metals and polycyclic aromatic hydrocarbons in burn areas, chemical barns, and fertilizer mix and load areas by removal of contaminated soils. Given proper remediation, the anticipated risk from other contaminants is probably low.

Beneficial Effects

The management of the C-43 West Reservoir project site may result in minor potential benefits to the eastern indigo snake. The loss of eastern indigo snake habitat when the citrus grove is cleared may be minimally offset after vegetation on the external reservoir embankment has stabilized and prey items for the eastern indigo snake become available at sufficient densities (two to five years following construction). At that time, there should be habitat suitable for the eastern indigo snake on the external portion of the reservoir embankment. Interior portions of the reservoir and the interior dam embankments are anticipated to be a harder material (soil

cement or concrete) and therefore, would not provide the necessary herbaceous plant cover needed by eastern indigo snakes and their prey. The width of the side slopes of the external embankments would be 114 ft. The width of the toe between the bottom of the external embankment and the perimeter canal is 90 ft. For the perimeter reservoir embankments and toe, a total of 403.05 ac (204 ft of the perimeter embankment x 86,064 ft [16.3 mi]) of potential indigo snake habitat would be created. The top of the embankment was not considered eastern indigo snake habitat, even though snakes may be found there, due to the offsetting consequence of potential road mortality and lack of prey. The total potential eastern indigo snake habitat created by this project was estimated to be 403.05. Using the density data for ABS, if this acreage was in one block instead of linear it would support 4.24 eastern indigo snakes. However, since this habitat covers the perimeter of the site, eastern indigo snakes from outside the project area may occasionally use this habitat, assuming prey and cover are suitable and that the perimeter canal can occasionally be crossed. Therefore, it is difficult to estimate how many eastern indigo snakes will actually use the site following construction. Similarly, the extent to which prey items may become available as a result of reservoir drawdown is unknown.

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. The management of the C-43 West Reservoir project site is an interdependent action.

Species' response to the proposed action

Construction, operation, and maintenance of the project can result in actions that may kill or injure individual eastern indigo snakes and destroy nests, and destroy or degrade occupied and potential habitat and foraging areas. Due to their large home ranges and relative low density, risk of direct mortality would not normally be considered substantial. However, due to the large size of the project area, the likelihood of mortality or injury increases. Any clearing, burning, earthmoving, construction, operation, and maintenance activities may also adversely affect eastern indigo snakes by causing them to leave the area, and possibly miss foraging and mating opportunities. Individual eastern indigo snakes fleeing the area may be more vulnerable to predation and intraspecific aggression. The Service anticipates that the eastern indigo snake population at the C-43 West Reservoir project will not fully recover from the effects of the proposed action.

It is anticipated that all 10,264 ac of potential eastern indigo snake habitat within the citrus grove portion of the action area would be impacted by the proposed action. The number of individuals present at the time of the action is not known. The Service estimates that as many as 41 adult male and 13 adult female eastern indigo snakes may be present within the site. These estimates are based on population density estimates at ABS (Layne and Steiner 1996) and reduced based on inferior habitat quality in the groves. It is not known how many juvenile eastern indigo snakes may be present at the time of the action. Juvenile indigo snakes are more vulnerable

because they typically do not use underground refugia as adults do, preferring thick vegetation for cover (Speake et al. 1987).

We believe that some eastern indigo snakes may move to the reservoir embankments, interior dam embankments, and toe slopes between the reservoir embankments and the perimeter canal following construction and stabilization of the vegetation and establishment of prey items. Eastern indigo snakes may also access the reservoir if extended periods of drydown occur and prey items establish in the reservoir. Access to these prey items will likely be controlled by the ability of the snake to negotiate the concrete interior surface of the external embankment, water depth, and the extent of available forage habitat in ecotones between dry and wet areas. We cannot estimate the number or age of eastern indigo snakes that may move into either area. Individual eastern indigo snakes may also be affected by on-going maintenance and management activities.

CUMULATIVE EFFECTS – Florida Panther

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. Future Federal actions unrelated to the proposed action but located in the action area that would affect panthers are not considered in this section because they would require separate consultations pursuant to section 7 of the Act. 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 Developments of Regional Impact (DRI) Orders (2001 to 2006); (2) Collier and Lee County Planned Unit Developments (PUDs) (2001 to 2006); and (5) South Florida Water Management District's Environmental Resource Permits (2001 to 2006) (Figure 19). To evaluate these effects, the Service incorporated the 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 19,438 acres could be expected to be subject to development without Federal permit involvement through the Clean Water Act section

404 (Table 15). This level of development represents 66.9 percent of a female panther's average home range (29,059 ac) and 31 percent of a male panther's average home range (62,542 ac).

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 ac as of September 2004 (Figure 20). 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 ac as of August 2003. The breakdown of acres for August 2003 is: (1) wetlands, about 17,572 ac; (2) uplands, about 17,990 ac; and (3) water, about 210 ac. 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 ac of land were converted from vacant to developed with the breakdown as: (1) wetlands, about 696 ac; and (2) uplands, about 1,740 ac.

The evaluation process provided an estimate of 417 lots totaling 1,740 ac for Northern Golden Gate Estates. Therefore, using NWI mapping for the Northern Golden Gate Estates, a total of about 1,740 ac 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 ac) and 1.67 percent of a male panther's average home range (62,542 ac).

Vacant lands within the area of Lehigh Acres, also within the action area, totaled about 34,852 ac as of April 2003 (Figure 21). The breakdown of acres is: (1) wetlands, about 1,057 ac; (2) uplands, about 33,592 ac; and (3) water, about 202 ac. 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 ac of land was converted from vacant to occupied, during the 1-year period. The breakdown of converted acres is estimated as: (1) wetlands, 66 ac; (2) uplands, 375 ac; and (3) water, 0 ac. Therefore, using NWI mapping, about 375 ac 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 21,553 ac 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 74.2 percent of a female panther's average home range (29,059 ac) and 34.5 percent of a male panther's average home range (62,542 ac), 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 1.10 percent of the non-urban private lands at risk in the core area (1,962,294 ac) (Table 5). 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.

CUMULATIVE EFFECTS – Audubon’s Crested Caracara

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Conversion of land from pasture to more intensive agricultural or residential uses could be a cumulative effect on the species if no wetlands were impacted (or no Federal permit was required). The most significant threat to the caracara is habitat loss resulting from this type of land use conversion (Layne 1996, Humphrey and Morrison 1997). Our assumed post-construction shifts in caracara territories may ultimately result in nest or territory abandonment if these large tracts of privately owned pastures or other agricultural activities adjacent to the project site are converted to residential or other non-pasture or non-prairie land uses. Based on the information in Table 15, the likelihood of more intensive land use conversions on adjacent land without Federal permit involvement through the Clean Water Act section 404 is high.

As caracara are known to feed on road kills, road improvement and widening projects may benefit caracara by increasing traffic and consequently increasing the number of road kills. However, caracaras are often killed while feeding on carrion within and along roadways. Thus, increased traffic and increased road kills likely lead to increased mortality of caracaras, particularly juveniles.

CUMULATIVE EFFECTS – Eastern Indigo Snake

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Conversion of large tracts of natural and rural habitats to more intensive agricultural or residential uses could be a cumulative effect on the species if no wetlands were impacted (or no federal permit was required). The primary threat to the eastern indigo snake is habitat loss and fragmentation due to development (Lawler 1977; Moler 1985a). Additional habitat may be lost by non-federally reviewed actions such as single-family residential developments. Residential developments also increase risk of harm to indigo snakes in the interface areas between urban and native habitats because it increases the likelihood of snakes being killed by property

owners and domestic pets. Increased traffic associated with development may also lead to increased snake mortality.

SUMMARY OF EFFECTS – Florida Panther

Panther Usage: The timing of construction for this project, relative to sensitive periods of the panther's lifecycle, is unknown. However, 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 encompassed by agricultural (*i.e.*, citrus groves) and rural 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 2000 in the project action area. Although the risk to the panther from collisions with vehicles as a result of the C-43 West Reservoir project is difficult to quantify, the Service believes that the increase in traffic generated by the project is not likely to increase the risk of roadway mortality or injury to 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 10,335 ac of mostly low quality panther habitat within the Primary, Secondary, and Other Zones (see discussion under Wildlife Assessment). Habitat types are primarily citrus groves and disturbed wetlands. Wildlife utilization of the property shows limited foraging values 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 10,335 ac of panther habitat represents 0.53 percent of the 1,962,294 ac of available non-urban private lands in the core area. This small loss (0.53 percent) of non-urban private lands on the northern edge of the panther's occupied range will not negatively impact the Service's land conservation and preservation goals.

Compensation: The Band1/Acceler8 Projects will collectively provide for the preservation and restoration of approximately 100,492 ac in the panther core area, including 59,294 ac in the Primary Zone and 41,198 ac in the Other Zone. Preservation of 41,198 ac in the Other Zone is equivalent to preservation of 13,733 ac (*i.e.*, 41,198 ac times 1/3) in the Primary Zone. Thus, the combined Band1/Acceler8 project lands in the panther core area preserves 73,027 ac (*i.e.*, 59,294 + 13,733) of Primary Zone equivalent lands, which represents 9.4 percent of the 778,082 ac of Primary Zone equivalent lands in private ownership still needed for the panther population goal of 90 individuals. The functional value of the habitats to the panther will be maintained long-term through hydrological restoration and the removal of exotic vegetation.

Therefore, we believe the preservation and restoration of approximately 100,492 actual ac of habitat used by the panther in the panther core area will minimize the impact of the loss of this lower quality habitat and will further the Service's panther conservation goal.

Compensation provided by the combined Band1/Acceler8 projects benefit 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 northern edge of occupied habitat, is encompassed by agricultural (*i.e.*, citrus groves) and rural development, and is not located within known dispersal corridors to larger publicly owned managed lands important to the panther. Therefore, appreciable fragmentation of habitat used by the panther 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 escape cover may contribute to a potential increased risk of death or injury of panthers in the action area due to intraspecific aggression.

Cumulative Effects Analysis: In the cumulative effects analysis, the Service identified the potential loss of about 4,046 ac 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 (0.22 percent of the 1,962,294 ac) 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 negatively impact the Service's land conservation and preservation goals.

Conservation Land Acquisitions: The State and County land acquisition programs acquired about 17,092 ac of lands within the action area from 2000 to 2004 (Table 9), which represents 2.1 percent of the 799,205 ac 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.

SUMMARY OF EFFECTS – Audubon’s Crested Caracara

The Service anticipates approximately 1,474 ac of caracara habitat will be lost through conversion of citrus groves to an above-ground reservoir. The Service anticipates disturbance of adults would occur that could also result in potential injury or mortality to eggs, chicks, and fledglings over a minimum of 5 years.

The Service anticipates a potential beneficial effect of the project for caracaras. We anticipate that up to 430.71 ac of levee-based foraging habitat could be generated by the project within the existing two caracara territories. Additionally, initial site preparation and construction activities may provide good foraging conditions by exposing prey.

SUMMARY OF EFFECTS – Eastern Indigo Snake

The C-43 West Storage Reservoir project will affect the eastern indigo snake by the loss of habitat associated with conversion of 10,264 ac of primarily upland citrus grove to deep water reservoir, embankments, canals, ditches and roadways. Direct injury or mortality could occur from construction activity and vehicle operation, destruction of temporary refugia (vegetation and debris piles) and the initial hydration. Indigo snakes will lose most of the project prey base to the initial rehydration and will have to move off of the site, risking exposure to predation and intraspecific aggression. Post-construction management and maintenance activities will include mowing, pesticide application, equipment maintenance, and possible recreation opportunities for the public which may result in injury or mortality. Rehydration after drydown may result in mortality, loss of habitat and loss of prey. The potential habitat replacement associated with embankments within 2 to 5 years after construction is estimated to be only 403 ac of habitat.

CONCLUSION

Florida Panther

In conclusion, the Service has determined there will be no direct mortality or injury of the Florida panther resulting from this project. Indirect effects are 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 C-43 West Reservoir project. The adverse affects of project-generated traffic and intraspecific aggression potential, however, is not anticipated to appreciably diminish or preclude the survival and recovery 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 by 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. Taking all of the above into consideration, the Service believes the proposed construction and operation of the C-43 West Reservoir 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.

Audubon's Crested Caracara

After reviewing the current status of the caracara, 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 C-43 West Reservoir project, as proposed, is not likely to jeopardize the continued existence of the caracara. The Service reached this conclusion based on the determination that there will be no direct mortality or injury to adult caracara from the proposed project. However, the project-related changes in land cover and use primarily in the secondary zones of active nests as well as the increase in human presence and construction activities may contribute to indirect effects on the nest success of caracaras in the project vicinity. The Florida population of caracara is considered stable (Morrison 1996) and the potential short-term loss of reproductive success of two nesting pairs as a result of the project is not expected to appreciably affect the overall population of caracaras over time as caracaras are long-lived, maintain pair bonds for life, and exhibit strong nest site fidelity.

No critical habitat has been designated for the caracara; therefore, none will be affected.

Eastern Indigo Snake

After reviewing the current status of the eastern indigo snake, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, it is the Service's biological opinion that the C-43 West Storage Reservoir project, as proposed, is not likely to jeopardize the continued existence of the eastern indigo snake. Although we anticipate incidental take of eastern indigo snakes, the Service has determined that the loss of a large area of primarily upland citrus grove under active agricultural production will not reduce the distribution of indigo snakes in the action area or in southern Florida. The indigo snake has a broad distribution in a mosaic of habitats and is a generalist that forages on a variety of available prey. The eastern indigo snake has some ability to move away from situations which may result in direct injury and mortality (construction and hydration) and can access adjacent habitat if escape opportunities are made available. For this project, the presence of on-site observers, pre- and post education, speed restrictions, order of construction, and rate of reservoir fill should reduce the incidence of injury, mortality, and disturbance.

No critical habitat has been designated for the eastern indigo snake; 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 the District, 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 the District 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 the District, 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 consist of existing agricultural and rural developments that reduce their suitability for use by either resident or dispersing panthers. However, the Service does not anticipate construction of the project will result in the direct mortality or injury of any Florida panthers. The Service does however, anticipate indirect take of the panther in the form of harm and harassment because of potential increases in interspecific aggression within the 25-mile radius action area. This level of incidental take may be associated with the loss of 10,335 ac of panther habitat within the Primary, Secondary, and Other Zones (*i.e.*, 144, 5,236, and 4,955 ac, respectively).

Audubon's Crested Caracara

The Service anticipates that the proposed action will incidentally take the federally listed caracara, though the level of incidental take may be difficult to detect and quantify for the following reasons: (1) it has a wide-ranging distribution; (2) it has a protracted breeding season; (3) it would be difficult to find or identify dead or impaired individuals; and (4) there is a possibility for double brooding in a season, which may or may not occur in the same nest tree. The incidental take is expected to be in the form of harassment although take may also occur in the form of harm due to tree clearing, burning, construction, and operation and maintenance of the project. Caracaras will be permanently displaced from the project site in the open-water

portion of the reservoir cells. It is possible that these caracaras could utilize the reservoir embankments or seepage canal after construction.

The Service anticipates that up to two adult pairs of caracaras could be taken as a result of this proposed action. This incidental take for adult birds is expected to be in the form of harassment. No direct killing or injuring of adult caracaras is anticipated. Harassment of adults is limited to the flushing of adults off the nest, modification of their foraging and nesting behavior, and the possible displacement from their home territory to adjacent suitable lands due to a net loss of habitat quality for this species as a result of the action. The consequences of disrupted parental care of the nest (*e.g.*, reduced egg incubation, chick protection and feeding, or care of fledglings) may lead to egg, nestling, or fledgling mortality in a variety of forms, such as exposure, starvation, falling from the nest, or predation.

Therefore, the Service also anticipates that disturbance may cause the loss of productivity (eggs or young) associated with up to two caracara nest sites for up to five consecutive breeding seasons. The Service anticipates that up to six caracara eggs or young (a maximum of three per nest) could be incidentally taken per year during the construction of the project. This take would be in the form of harm.

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

Eastern Indigo Snake

Incidental take of the eastern indigo snake is difficult to detect and quantify for the following reasons: (1) it has a wide-ranging distribution; (2) it has a patchy distribution within suitable habitat; (3) it has limited detectability due to use of burrows or holes for shelter, (4) there is likely unoccupied suitable habitat; (5) juveniles have limited detectability due to their affinity for thick vegetation, and (6) they may use cryptic sheltering areas that may be temporarily established during construction (*e.g.*, brush piles, equipment stockpiles, and dirt mounds). The lack of practical methods to survey, in conjunction with wide-ranging activity and use of a variety of habitat types makes it difficult to determine the exact number of eastern indigo snakes that will be incidentally taken.

The Service anticipates that the direct permanent loss of approximately 10,264 ac of eastern indigo snake habitat will occur through conversion of citrus grove to reservoir and associated embankments, canals, and other infrastructure. Based on the reported density of eastern indigo snakes at ABS, and reducing that density by half based on the inferior habitat characteristics of the existing citrus grove, the Service anticipates up to 54 eastern indigo snakes will be taken incidental to the initial project construction and operations. The Service estimates that up to 25 percent of the eastern indigo snakes potentially impacted by the C-43 West Reservoir project site may be killed or injured by the initial construction activities. Above-ground refugia (burn, sediment, or debris piles) may be lost during clearing and construction. Additionally, individual eastern indigo snakes fleeing the area may be more vulnerable to roadkill, predation and

intraspecific aggression. The remaining 75 percent of the snakes would not be directly killed or injured but would be affected by the loss of habitat. These individuals could leave the area, abandon den sites, miss foraging and mating opportunities and experience lower productivity. The incidental take associated with construction activities and loss of the majority of the habitat on the site is in the form of harm and harassment.

Initial hydration and rehydration may drown indigo snakes or destroy nests. This incidental take is expected to be in the form of harm.

It is not expected that this species will be permanently extirpated from the project site; however, it is not known how many snakes may return to the site, reproduce on the site, or survive from juvenile or adult on the site. Reservoir embankments may provide limited habitat. Maintenance, operations, and recreational activities (including mowing, and vehicle and equipment operation) may kill or injure indigo snakes. This incidental take is primarily in the form of harm. Human disturbance, loss of prey from pesticide application, loss of prey from initial hydration or rehydration, and movement away from habitat as a result of rehydration may be the result of long-term project operation and management. This incidental take, which is difficult to quantify, is expected to be in the form of harassment.

The Service anticipates a potential beneficial but minor indirect effect of the project to be interrelated to the management of the reservoir. We anticipate that up to 403.05 ac of embankment-based eastern indigo snake habitat could be generated by the project within 2-5 years of project completion. Because this potential habitat is linear in shape, we estimated it as if it were all in one evenly-shaped block, providing potential benefits to four eastern indigo snakes.

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 adverse modification of their designated critical habitat. No critical habitat has been designated for the Florida panther, Audubon's crested caracara, or the eastern indigo snake; therefore, none will be affected.

REASONABLE AND PRUDENT MEASURES

Florida Panther

The Service believes the Corps and the District have developed a project that has conservation measures necessary and appropriate to minimize the effect of incidental take of the Florida panther. In summary, to compensate for impacts to 10,335 ac of habitat, the Corps and the District propose to enhance and preserve approximately 59,294 ac and 41,772 ac of habitat used by the panther within the Primary and Other Zones, respectively, to benefit the Florida panther and its prey.

Audubon's Crested Caracara

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the caracara. Disturbance and injury to caracaras should be minimized during construction activities. Education of personnel on the site will facilitate minimization of impacts and conservation of the species. The District staff will coordinate and report on their activities to the greatest extent practical to minimize potential adverse effects on natural resource compliance, management, and monitoring requirements; and post speed limit of 35 mph or slower.

Eastern Indigo Snake

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the eastern indigo snake. Disturbance and injury to eastern indigo snakes should be minimized during construction activities. Education of personnel on the site will facilitate minimization of impacts and conservation of the species. Initial and rehydration fill rates can be adjusted to minimize mortality of indigo snakes and reduce the loss of prey. The District staff will coordinate and report on their initial construction activities; initial reservoir fill and reservoir rehydration; and long-term maintenance, management, and recreational activities to minimize potential adverse effects on the eastern indigo snake.

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 and 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 the District, 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 the District 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 the District, 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)).

Florida Panther

Although we have not identified any specific Reasonable and Prudent Measures not incorporated in the project for Florida panthers, we are providing the following for clarification:

1. The Corps will include, as special conditions to the permit instrument, the conservation measures listed below and in the description of the proposed action that commits the applicant to purchase, preserve, and manage high quality habitat used by the panther, which is necessary and appropriate to minimize incidental take of panthers by the proposed action. Specifically, to compensate for the loss of 10,335 ac of habitat used by the panther, the District proposes to preserve and enhance 59,294 ac and 41,772 ac of Florida panther habitat in the Primary and Other Zones, respectively;
2. 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);
3. 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;
4. **Annual Report:** An annual report will be presented to the Corps and to the Service in order to comply with 50 CFR part 402.14(i)(3), which states "In order to monitor the impacts of incidental take, the Federal agency or any applicant must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement." The report will contain the following information:
 - a. The current status of the construction of the project as well as any construction phases or milestones that have been completed;
5. The Corps will provide a copy of the final as-builts to the Service within 1 year of construction completion. These as-builts will also include habitat types and acreages of all land cover types within the project footprint;
6. The Corps will provide documentation to the Service for completion of any proposed restoration and verification of the execution and terms of the conservation easement or deed, if applicable;
7. 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, FL; 33811-1299; 1-800-282-8002; and
8. 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.

Audubon's Crested Caracara

In order to be exempt from the prohibitions of section 9 of the Act, the Corps shall ensure that the District complies with the following terms and conditions which implement the reasonable and prudent measures described above and outline reporting and monitoring requirements. These terms and conditions are non-discretionary.

Caracara pairs proximate to the C-43 site will be monitored during land cover conversion and construction of reservoirs associated with this project. The goal of monitoring is to obtain detailed information on how a caracara breeding pair is affected by project-related disturbance and the changes in habitat availability within their territory. This will include the ability to evaluate changes in area use by caracaras, changes in location of nesting, nest success, fledging success, and adult and juvenile survival. The monitoring will be conducted starting as soon as possible before any clearing or grubbing occurs within the primary or secondary zones of a caracara nest and will continue until 1 year post-construction. The approved monitoring plan should include the following specific objectives:

1. Conduct additional annual surveys for caracara nests and territories in the proposed project area and within 1.5 miles of the project area boundary to evaluate effectiveness of surveys and to increase knowledge of caracara nest sites and densities within these areas. This will also provide information to allow evaluation of how any observed changes in habitat use may affect any other caracara territories in the vicinity in conjunction with data collected on radio-tagged birds. Surveys of suitable habitat within 1.5 miles of the project area may be conducted from roads or other public access points.
2. Capture and radio tag caracaras at the nest located on private property southeast of the proposed project footprint. Use satellite or standard VHF telemetry to monitor the adult caracaras' movements, habitat use, and survival over multiple years, both pre- and post-conversion. Monitoring of radio-tagged birds must be sufficient to document movements away from the territory if they occur.
3. Compare documented habitat use before and after project activities using the recently available habitat model and map (Morrison et al. 2006).
4. Monitor reproductive effort, nest success, fledging success, and adult and juvenile survival of all caracara nests within 3,000 meters of the proposed project.

The monitoring must be sufficiently rigorous to determine which of the following hypotheses about caracara responses to habitat conversion are exhibited by each caracara pair whose territory overlaps the project area:

- Caracara pairs may move to the nearest suitable habitat and establish a new nest site and territory. This suitable habitat may already be occupied by other caracaras, but if the habitat is suitable and sufficient in size, territory boundaries may shift and all pairs may be able to coexist and reproduce successfully.
- Caracara pairs may leave the project area and travel some distance to find another area of suitable habitat where they can establish a new nest site and territory. If they can find such new areas, they may be able to survive and reproduce successfully.
- Caracara pairs may attempt to establish new nest sites and territories either near or far from the development area but may be unsuccessful either because of territorial aggressiveness from resident pairs or because no other suitable habitat exists.
- In the absence of being able to establish a new territory and nesting site, the caracaras may become nomadic, traveling around south-central Florida, perhaps joining sub-adult flocks, or if not, simply surviving but being unable to establish anywhere and breed. In this case, these pairs' reproductive contribution to the overall population's persistence is lost.
- Displaced caracaras could die prematurely. As nomads, displaced adults may incur higher risk of mortality because of either a) being killed by caracaras defending territories into which displaced caracaras attempt to move, or b) through collision with vehicles or other trauma associated with scouting unfamiliar areas.
- The effects of the project do not result in any changes to the territory location and habitat use, and do not affect survival or productivity of the caracara pair at the site.

A monitoring proposal that details the methods which address the objectives described above should be submitted to the Service for review and approval at least 30 days prior to initiating caracara monitoring. The agency personnel or contractor who will be conducting the monitoring will also be responsible for obtaining a section 10(a)(1)(A) recovery permit that authorizes affects to caracaras that result from caracara trapping, transmitter attachment, nest monitoring and other associated activities.

Annual reports on the caracara monitoring project which include results form the monitoring to date, preliminary results of analyses, and complete data sets that result from the monitoring efforts shall be submitted to the Service. A final report shall also be prepared that provides results and final analyses after completion of all data collection and analyses.

Eastern Indigo Snake

In order to be exempt from the prohibitions of section 9 of the Act, the Corps shall ensure that the District complies with the following terms and conditions, which implement the reasonable and prudent measures described above and outline reporting and monitoring requirements. These terms and conditions are non-discretionary.

1. Minimize road and construction-related mortality:

- a. Precautions for the eastern indigo snake will be required to avoid injury to any individual animal. The Draft Standard Protection Measures for the Eastern Indigo Snake (Service 2002) will be incorporated into special conditions of the permit.
 - b. The District shall provide at least one qualified observer during ground clearing activities. The observer's qualifications will be provided to and approved by the Service's C-43 Project biologist (Fish and Wildlife Service, South Florida Ecological Services Office; J.N. "Ding" Darling National Wildlife Refuge, 1 Wildlife Drive, Sanibel, Florida 33957, (941) 472-1100 (ext. 231), 2 weeks prior to initiation of construction. The observer's sole function would be to visually evaluate the area to be cleared immediately prior to, and following vegetation removal, stockpiling, and burning and to record any eastern indigo snake activity. Only individuals who have been either authorized by a section 10(a)(1)(A) permit issued by the Service, or by the State of Florida through the FWC for such activities, are permitted to come in contact with an eastern indigo snake.
 - c. During initial removal of the citrus trees the canal banks will not be altered. The trees will be up-rooted, allowed to dry, and subsequently pushed into piles and burned. Brush piles would be located as far away from the ditches (snake habitat) as possible in order to keep snakes from recolonizing brush piles before they are burned. Removal of trees would proceed at a relatively slow pace, thus allowing eastern indigo snakes the opportunity to move away.
 - d. During tree clearing, the equipment operators will start work at the farthest point from ditches, canals, or other potential temporary refugia and work towards the ditches or canals so that the eastern indigo snake, if encountered, would be encouraged to move away from the disturbance and towards temporary refugia.
 - e. The District shall conduct a pre-construction wildlife education meeting with all workers and contractors that will be present on the site, including those conducting the initial remediation activities, using the standard Acceler8 preconstruction package, as well as conditions under which the Service should be notified with regard to eastern indigo snake concerns.
 - f. For avoidance and safety reasons, a speed limit of 35 mph will be posted for all vehicular traffic. Pre-construction education materials shall specify speed restrictions.
2. Minimize harm (habitat loss, mortality due to drowning) and harassment (disturbance, loss of prey) by:
 - a. Initial hydration of the reservoir will be at a maximum rate of 6 inches per day until the water depth is 6 inches above the highest surface elevation excluding existing embankments. The highest surface elevation is approximately 26.0 feet; thus the reservoir would be filled at a maximum rate of 6 inches per day until the water elevation

reaches 26.5 feet. Once the 26.5 foot depth is reached, the reservoir fill rate will not be restricted.

- b. The subsequent first rehydration of the reservoir after an extended drydown event will be at a rate of 1 foot per day until the water is 1 foot above the highest surface elevation excluding embankments or other man-made structures such as boat ramps. The highest surface elevation is approximately 26.0 feet; thus the reservoir would be filled at a maximum rate of 1 foot per day until the water elevation reaches 27 feet. Once the 27 foot depth is reached, the reservoir fill rate will not be restricted. An extended drydown event will be defined and included as a 404 permit condition.
- c. The Corps shall monitor indigo snake response during initial fill to determine the effect of hydration on indigo snakes. If necessary, snakes will be captured and released outside the reservoir. The Corps shall monitor indigo snakes during rehydration following the first extended drydown event to determine reservoir accessibility and use by indigo snakes and their prey during drydown events and the effect of rehydration on snakes if present. An extended drydown event will be defined prior to the 404 permit issuance and a detailed monitoring plan shall be submitted to the Service for review and approval at least 30 days prior to initial filling of the reservoir. The agency personnel or contractor who will be conducting the monitoring will also be responsible for obtaining a section 10(a)(1)(A) recovery permit that authorizes affects to indigo snakes as a result of trapping, transporting, and releasing them. If snake monitoring indicates that snakes are capable of escaping the reservoir without harm or that snakes do not use the reservoir bottom during extended drydown events, then restrictions on rehydration rates will be re-evaluated.
- d. The Corps shall conduct a pre-construction wildlife education meeting with all workers and contractors that will be present on the site, including those conducting the initial remediation activities, using the standard Acceler8 preconstruction package; as well as conditions under which the Service should be notified with regard to eastern indigo snake concerns.
- e. All vehicle and equipment operators will be notified for the life of the project, including all management and maintenance personnel, to avoid all snakes and burrows if at all possible. All on-site personnel will be educated to recognize the eastern indigo snake for the life of the project. If any snake is encountered, it will be avoided and allowed to leave the area on its own before vehicle or equipment use is resumed.
- f. Educational information on the eastern indigo snake will be posted at the educational kiosks on the site.

3. Monitoring and reporting requirements:

- a. Results of all observations associated with ground clearing activities (as required in Terms and Conditions 1.a.) shall be provided to the Service's C-43 Project biologist (Fish and Wildlife Service, South Florida Ecological Services Office; J.N. "Ding" Darling National Wildlife Refuge, 1 Wildlife Drive, Sanibel, Florida 33957, (941) 472-1100 (ext. 231), within 30 days following the activity.
 - b. Initial hydration shall be monitored to assure consistency with the Term and Condition 2 (a) and 2 (c). Results of observations associated with initial hydration including stage gauge levels, observations of indigo snakes or their prey, additional information identified in the monitoring plan, and recommendations to reduce effects to indigo snakes during rehydration shall be provided to the Service's C-43 Project biologist (Fish and Wildlife Service, South Florida Ecological Services Office; J.N. "Ding" Darling National Wildlife Refuge, 1 Wildlife Drive, Sanibel, Florida 33957, (941) 472-1100 (ext. 231) within 10 days following the activity.
 - c. Levee mower operators will scan the areas where vegetation has been cut immediately afterwards mowing and count and record the number of all species of dead or injured snakes observed with particular attention to identifying and counting any potential eastern indigo snakes.
 - d. The Corps shall provide the Service C-43 Project biologist (Fish and Wildlife Service, South Florida Ecological Services Office; J.N. Ding Darling National Wildlife Refuge, 1 Wildlife Drive, Sanibel, Florida 33957, (941) 472-1100 (ext. 231), a one-week advance notice on the schedule for ground clearing of citrus trees or other construction phases (pre-loading of embankments, perimeter canal construction, pump and infrastructure construction, and initial hydration) so that we may participate in on-site observational activities.
 - e. The Corps shall provide the Service C-43 Project biologist (Fish and Wildlife Service, South Florida Ecological Services Office; J.N. Ding Darling National Wildlife Refuge, 1 Wildlife Drive, Sanibel, Florida 33957, (941) 472-1100 (ext. 231), a two-day advance notice on the schedule to rehydrate the reservoir by pumping or weir operation after the first drydown event. This term and condition will be discontinued if rehydration events are determined to have no adverse effect on eastern indigo snakes as determined by monitoring and agreed to by the Service.
4. Disposition of dead or injured animals (salvage):

- a. Annually, a report of all snakes killed or injured by operation or maintenance of the C-43 West Reservoir project (as indicated in Terms and Conditions 1.h.) must be submitted to the Service's C-43 project biologist (Fish and Wildlife Service, J.N. "Ding" Darling National Wildlife Refuge, 1 Wildlife Drive, Sanibel, FL 33957, (941) 472-1100. This report should contain the location, dates, and times for any sightings of eastern indigo snakes and the disposition of all eastern indigo snakes found. A site map with

observation locations should also be included in this report. If no snakes are encountered, a report should be submitted indicating that fact.

- b. Upon locating a dead, injured, or sick federally listed species, initial notification must be made to referenced project biologist and the nearest Service Law Enforcement Office (Fish and Wildlife Service; Ed Lewis, Fort Myers, Florida (239) 561-8148. Secondary notification should be made to the FWC, South Region; 8535 Northlake Boulevard; West Palm Beach, Florida; 33412-3303; (561) 625-5122; 1-888-404-3922. If not specifically instructed by Service law enforcement to submit dead specimens, all dead specimens and snake sheds should be offered to the Florida Museum of Natural History, Gainesville, FL 32960. The museum should be contacted with regard to details for preservation and transport.

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. Dead eastern indigo snakes should be placed on ice and frozen as soon as possible. In conjunction with the care of sick or injured specimens 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. We recommend the following:

Audubon's Crested Caracara

1. Support scientific studies to determine the response of breeding caracaras to habitat restoration efforts (e.g., flooding of pasture, general construction activities) within their established territories. This information would be useful in predicting the effects of other restoration efforts in the CERP that are planned within the caracara's existing range, as well as in developing measures to reduce potentially adverse project effects on the caracara and assist in the recovery of this species.
2. Implement the procedures in *Recommended Management Practices and Survey Protocols for Audubon's Crested Caracara in Florida* (Morrison 2001) during project planning and construction, as appropriate. The implementation of these guidelines by land managers and Federal action agencies would help in the recovery of this species.
3. Monitor the long-term responses of caracaras to altered habitat conditions over broad areas. This would provide useful information in determining the potential effects of large-scale

projects, such as the CERP, agricultural conversion, and residential development on this species.

4. The Corps should continue to work with the Corps, Service, public land managers, and private landowners to identify other habitats that have the potential to be improved for caracaras. When potential habitat improvement sites are identified, the agencies will cooperate and jointly coordinate with the respective land management entities and landowners to improve these caracara habitats. Habitat improvement measures may include land management actions such as removal of exotic or nuisance species of vegetation, prescribed burning, and planting of native vegetation. The short-term goal of these habitat restoration measures would be to offset or compensate for any potential losses in caracara breeding pairs resulting from this and anticipated projects. A long-term goal of these measures would address the potential loss of caracara reproduction resulting from implementation of future phases of the CERP.
5. Following construction, maintain an on-site educational kiosk for the public on the listed species and other wildlife that may be observed in the project area.

Eastern Indigo Snake

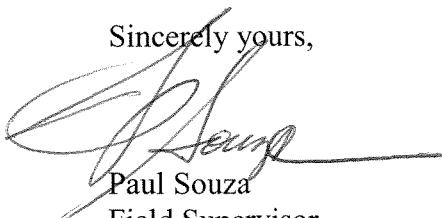
1. Following construction, maintain an educational kiosk for the public on the listed species and other wildlife that may be observed in the C-43 West Reservoir project.
2. If large snake skins are found, they should be collected, dried, and sent to the Service's C-43 Project biologist (Fish and Wildlife Service, J.N. "Ding" Darling National Wildlife Refuge, 1 Wildlife Drive, Sanibel, Florida 33957, (941) 472-1100 for positive identification and genetic studies. Information on the collection date and location should be included.
3. Cooperate with research-based efforts to provide for long-term ecological monitoring on eastern indigo snake prey densities and habitats in the project area.

REINITIATION NOTICE

This concludes formal consultation on the C-43 West Reservoir 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 Joyce Mazourek at 239-472-1100, extension 231.

Sincerely yours,



Paul Souza

Field Supervisor

South Florida Ecological Services Office

cc:

Corps, Jacksonville, Florida (Beth Marlowe, Susan Conner)

Corps, West Palm Beach, Florida (Tori White)

District, Fort Myers, Florida (Janet Starnes)

District, West Palm Beach (John Mitnik)

EPA, West Palm Beach, Florida (Richard Harvey)

FWC, Punta Gorda, Florida

FWC, Naples, Florida (Darrell Land)

FWC, Tallahassee, Florida (Ron Mezich)

Service, Atlanta, Georgia (Noreen Walsh) (electronic copy only)

Service, J.N. "Ding" Darling NWR, Sanibel, Florida (Robert Jess, Joyce Mazourek)

Service, Vero Beach, Florida (Chris Belden) (electronic copy only)

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Table 1. Wood Stork Foraging Habitat Assessment.

Uniform Mitigation Assessment Method				
Cover Type	Acres	Existing	With Project	Functional Value (+ or -)
Freshwater Marsh	6.9	0.5	0.27	(-) 1.6
Secondary	191.6	0.4	0.27	(-) 24.9
Tertiary	541.3	0.4	0.27	(-) 70.4
Tapegrass	4,130	0.33	0.60	(+) 446

Table 2. *Targeted and Acquired Acreage Totals of Conservation Lands in South Florida Directly Affecting the Panther within the Consultation 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 Reservations²			
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 2 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 3. Habitat preservation efforts resulting from formal and informal consultations with the Service for projects affecting Florida panther habitat from March 1984 to May 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
06/11/99	4-1-98-F-	199800622	STOF Water	Hendry	1,091	0	0	0

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)
	398		Conservation Plan					
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-F-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
01/30/02	4-1-98-F-372	199402492	Florida Rock	Lee	5,269	802	0	802
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	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
02/21/03	4-1-01-F-607	200001926	Mirasol	Collier	800	914	145	1,059
03/09/05	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-	2003-5331 2003-6965	Arborwood and Treeline Avenue	Lee	2,329	0	1,700	1,700

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)
	1-04-F-5982							
06/06/05	4-1-03-F-7855	2003-11156	Collier Regional Medical	Collier	44	0	64	64
06/14/04 03/21/05	4-1-04-F-5744	199603501	Terafina	Collier	437	210	261	471
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	Wentworth 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	2005-6176	Santa Barbara , 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
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

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)
06/05/06	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	326	326
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
10/26/06	41420-2006-I-0849	20055702	Marina Del Lago	Lee	49	0	36	36
10/27/06	41420-	20057180	Living Word Family	Collier	18	0	35	35

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)
	2006-I-0203		Church					
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
pending	41420-2006-F-0850	200312445	Airport Interstate Commerce Park	Lee	323	0	371	371
02/21/03 03/09/05 05/03/07	4-1-01-F-607	200001926	Mirasol	Collier	773	941	182	1,117
pending	4-1-04-F-6112	20021683	Alico Airpark (Haul Ventures)	Collier	241	75	414	489
				Totals	94,088	7,349	26,464	33,814

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. 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 ac are at risk in the other zone with about 80 percent with resource value

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. 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 8. Panther-Vehicle Collisions within the C-43 West Reservoir project Action Area as of June 2007.

YEAR	Distance From Project Center	Roadway	Sex	Panther	Result
1972	27.3	SR 25	M	UCFP28	Death
1983	21.2	US 27	M	UCFP09-(G83-22)	Death
1988	18.9	Near Daniels Road	M	FP28	Injury
1989	13.2	CR 850	M	UCFP18-(RK-850)	Death
1992	21.6	Alico Road	M	NONE	Injury
1993	18.9	Daniels Road	M	UCFP22	Death
1993	21.6	CR 846	M	FP50	Death
1994	26.2	County Line Road	M	UCFP23-(FP52'S)	Death
1995	20.7	CR 846	F	FP52	Death
1996	11.3	CR 832	M	UCFP29	Death
1997	21.7	CR 846	U	UCFP31	Death
1998	26.2	CR 846	F	UCFP25	Death
2000	25.4	CR 846	M	UCFP34	Death
2000	19.8	CR 846	M	UCFP35	Death
2000	24.6	CR 846	F	UCFP36	Death
2000	21.1	CR 846	F	UCFP37	Death
2001	25.7	CR 846	F	UCFP42	Death
2001	25.8	CR 846	M	UCFP43	Death
2002	24.7	3.4 miles North of Palmdale, Glades County	M	UCFP45	Death
2002	21.7	CR 846	F	UCFP48	Death
2002	20.2	CR 846	F	UCFP49 (K98)	Death
2002	24.7	CR 846	M	FP99	Death
2003	21.8	CR 846	M	UCFP50 (K33)	Death
2003	24.8 miles east	CR 833	M	UCFP52	Death
2003	26.7 miles southeast	SR 29	F	UCFP53	Death
2003	26.2 miles southeast	SR 29	M	UCFP54	Death
2003	21.8 miles south	CR 846	F	UCFP58	Death
2003	27.3 miles southeast	CR 833	F	UCFP61	Death
2004	25.6 miles southeast	SR 29	F	UCFP69	Death
2004	24.3 miles southeast	SR 29	F	UCFP70	Death
2004	10.6 miles southeast	CR 832	M	K128	Death
2005	24.4 miles southeast	SR 29	M	UCFP75	Death
2006	22.5 miles southeast	CR846	M	UCFP78	Death
2006	23.8 miles south	CR846	F	UCFP79	Death
2006	18.1 miles west	I-75 Lee County	M	UCFP81	Death
2006	18.2 miles east	CR 832	M	UCFP85	Death
2006	19.5 miles southwest	Corkscrew Road	M	UCFP87	Death
2006	24.6 miles southeast	County Line Road	M	UCFP89	Death
2007	10.7 miles southeast	CR 832	F	UCFP90	Death
2007	11.9 miles southeast	CR 832	M	UCFP91	Death
2007	23.5 miles southwest	I-75 Lee County	M	UCFP93	Death
2007	19.5 miles southwest	Corkscrew Road	F	UCFP97	Death

Table 9. County and State Acquisitions within the Action Area (Acres).

	State Acquisition
Year	Acres
1999	71297
2000	49086
2001	34774
2002	56324
2003	56110
Totals	17,092.43

Table 10. Results of Panther Prey Abundance Surveys Conducted Within the C-43 West Reservoir Project Area. Table excerpted from Appendix I, Final Biological Assessment for the C-43 West Storage Reservoir Project, Hendry County, Florida.

Table 1. Number of tracks per survey date for white-tailed deer and feral hog.

Transect	Species	Number of Tracks per Survey Date						Total (for the 5 analyzed days)
		9/15/2006	9/26/2006*	9/27/2006*	9/28/2006	9/29/2006	10/12/2006	
1	White-tailed Deer	1	1	9	0	0	1	0
	Feral Hog	7	10	1	7	9	0	4
2	White-tailed Deer	0	9	2	0	0	0	1
	Feral Hog	26	0	14	4	7	2	33
3	White-tailed Deer	0	8	0	0	0	0	0
	Feral Hog	15	0	22	4	1	0	22
4	White-tailed Deer	0	7	7	0	0	0	0
	Feral Hog	0	2	0	5	1	1	7
5	White-tailed Deer	0	1	17	0	0	0	0
	Feral Hog	5	2	6	0	4	1	12
Total		1	26	36	0	0	1	3
		53	14	46	20	22	4	130
t_1 (average # of tracks/mile)	White-tailed Deer	0.4	10.4	14	0	0	0.4	0.4
	Feral Hog	21.2	5.6	17.6	8	8.8	1.6	12.4

Notes:

1. Data from these two days were considered outliers and were not used in the population density estimate.
2. All transects are 0.5 miles in length, and consist of grove access/maintenance roads (dirt surface).
3. t_1 is derived from Tysch (1952) formula for population estimates $X_1 = t_1 / D$ where X_1 is the population density per square mile; t_1 is the number of tracks per mile, and D is the average daily range of deer.
4. sample calculation for deer using $D=1$ mile (as per Tysch, 1952): $X_1 = 0.24 \text{ tracks per mile} / 1 \text{ mile} = 0.24 \text{ deer}/\text{mi}^2$. Then $0.24 \text{ deer per mi}^2 \times 16.19 \text{ mi}^2 = 3.8 \text{ deer}$ in the project site.

Table 11a. Florida Panther Habitat Matrix – Primary Equivalent Panther Habitat Units for C-43 Test Cell Project

Test Cell Project Only	Habitat Values	Test Cell Project Development 267 acres				
		Functional Units Needed 388				
Land Cover Type		Pre		Post		
		Secondary Acres	Other Acres	Primary Equivalent PHUs	Secondary Acres	
Freshwater Marsh	9	0	2.6	8		
Citrus Groves	4	47.5	190.5	381		
Water	0	6.1	20.3	0	53.6	
					213.4	
Subtotal		53.6	213.4	388	53.6	
					213.4	
					0	

Table 11b. Florida Panther Habitat Matrix – Primary Equivalent Panther Habitat Units for C-43 West Reservoir Project.

C-43 West Storage Reservoir Project and Access Road Parcel (without Test Cell Project)		C-43 West Storage Reservoir Project and Access Road Parcel (without Test Cell Project) Development 10,335 acres							
		Functional Units Needed 46,933							
Land Cover Type	Habitat value	Pre				Post			
		Primary Acres	Secondary Acres	Other Acres	Primary Equivalent PHUs	Primary Acres	Secondary Acres	Other Acres	Primary Equivalent PHUs
Freshwater marsh	9	0	9	5	69	--	--	--	--
Cypress swamp	9	1	24	8	177	--	--	--	--
Grassland/pasture	7	1	0	0	7	15	89	62	665
Shrub swamp	5	3	57	10	222	--	--	--	--
Shrub and brush	5	0	4	3	18	--	--	--	--
Orchards/groves	4	128	4,702	4421	18,945	--	--	--	--
Water	0	11	440	456	0	129	5147	4783	0
Urban	0	0	0	52	0	0	0	110	0
Subtotal		144	5236	4955	19438	144	5236	4955	665

Table 12. Florida Panther Habitat Matrix –Primary Equivalent Panther Habitat Units by individual Band 1/Acceler8 Project –Development.

Band 1/ Acceler8 Project Name ¹	Land Cover Type	Habitat value	Project Development							
			Functional Units Needed							
			Pre				Post			
			Primary Acres	Secondary Acres	Other Acres	PHU	Primary Acres	Secondary Acres	Other Acres	PHU
C-43 West Storage Reservoir (*Includes Test Cell Project and Access Road Parcel)	Freshwater marsh	9	0	9	8	77	--	--	--	--
	Cypress swamp	9	1	24	8	177	--	--	--	--
	Grassland/pasture	7	1	0	0	7	15	89	62	665
	Shrub swamp	5	3	57	10	222	--	--	--	--
	Shrub and brush	5	0	4	3	18	--	--	--	--
	Orchards/groves	4	128	4,750	4612	19326	--	--	--	--
	Water	0	11	446	476	0	129	5201	4996	0
	Urban	0	0	0	52	0	0	0	110	0
	Subtotal		144	5290	5168	19826	144	5290	5168	665
EAA Reservoir	Hardwood forest	10	--	--	--	--	--	--	95	317
	Freshwater marsh	9	--	--	59.5	179	--	--	308	924
	Grassland/pasture	7	--	--	242.8	567	--	--	445	1,038
	Shrub swamp	5	--	--	165.44	276	--	--	--	--
	Shrub and brush	5	--	--	8.47	14	--	--	--	--
	STA	4.5	--	--	--	--	--	--	1,500	2,250
	Crop land	4	--	--	32,668	43,557	--	--	--	--
	Reservoir	1.5	--	--	11.51	6	--	--	--	--
	Water	0	--	--	468.83	0	--	--	31,392	0
	Urban	0	--	--	115.45	0	--	--	--	--
	Subtotal		0	0	33,740	44,598	0	0	33,740	4,529
C-111 Spreader	Freshwater marsh	9	2348	--	--	21132	225	--	--	2025
	Shrub swamp	5	1088	--	--	5440	--	--	--	0
	STA	4.5	--	--	--	0	3436	--	--	15462
	Water	0	225	--	--	0	--	--	--	0
	Subtotal		3,661	0	0	26,572	3,661	0	0	17,487
Projects Combined	Total		3,805	5,290	33,740	90,996	3,805	5,290	33,740	22,681

¹ All values are estimates and habitat impacts will be updated as individual Band 1/Acceler8 Projects plans are developed.

Table 13. Florida Panther Habitat Matrix Panther Habitat Units by Individual Band 1/Acceler8 Project – Compensation.

Band 1/ Acceler8 Project Name	Land Cover Type	Habitat Value	Band 1/Acceler8 Compensation						
			59,294 ac Primary Zone						
			Pre				Post		
			Primary Acres	Secondary Acres	Other Acres	PHU	Primary Acres	Secondary Acres	Other Acres
Picayune Strand Restoration Project	Freshwater marsh	9	702			6,318	14,720		132,480
	Bottomland hardwood	9	44,046			396,414	18,388		165,492
	Hardwood swamp	9	1,818			16,362	10,433		93,897
	Cypress swamp	9	744			6,696	13,739		123,651
	Exotic plants	3	11,829			35,487	0		0
	Water	0	155			0	2,014		0
	Total		59,294	0	0	461,277	59,294	0	515,520

All values are estimates and habitat impacts will be updated as individual Band 1/Acceler8 Project plans are developed.

Table 14*. Thirteen vegetation cover classes ranked for importance to crested caracaras in south-central Florida. Ranks were obtained using compositional analysis of 28 caracara home ranges compared to the overall study area. Cover classes were derived from the original 43 classes in the Florida Vegetation and Land Cover layer (FWC 2003). General preference ranks were assigned subjectively, based on field observations of caracaras in the region.

Vegetation cover class	More detailed preference rank ¹	General Preference Rank
Improved pasture	10	High
Freshwater marsh	9	High
Grassland	9	High
Mixed upland hardwoods	8	High
Citrus	7	Medium
Agriculture	6	Medium
Shrub swamp	5	Medium
Bare soil	3	Low
Shrub and brushland	3	Low
Pinelands	2	Low
Urban	1	Low
Scrub	1	Low
Wetland forest	0	Not used
All other habitats	0	Not used

* Table adapted from Morrison et al. 2006

¹ From results of compositional analysis

Table 15. C-43 West Reservoir Project Panther Consultation Area Project List.

Less than 5 percent Wetland Acres	Total Acres	Wetland Acres	Percent Wetland Acres	District ERP	PUD
Project Name					
FPL CORKSCREW ROAD SUBSTATION	0.12	0.00	0.00	2001	
HICKEY CREEK MITIGATION PARK	0.23	0.00	0.00	2001	
JOHNSON PROPERTY L308A DT	0.25	0.00	0.00	2001	
EL RIO GRANDE MOBILE HOME PARK	18.12	0.00	0.00	2002	
PALMETTO RIDGE HIGH SCHOOL	151.16	0.00	0.00	2002	
SR-78 ROADSIDE DITCH RELOCATION	5.82	0.00	0.00	2002	
STONEYBROOK AT GATEWAY	25.04	0.00	0.00	2002	
GATEWAY BOULEVARD EXTENSION AT STONEYBROOK OF GATEWAY	0.23	0.00	0.00	2003	
HARRIS MORAN RESEARCH FACILITY	7.63	0.00	0.00	2003	
HEACOCK	6.09	0.00	0.00	2003	
LEE COUNTY GUN RANGE	9.59	0.00	0.00	2003	
VILLAGE WALK - BONITA SPRINGS	631.33	0.00	0.00	2003	
AIRPORT TERMINAL AND AUTO TRANSPORT SERVICES	1.39	0.00	0.00	2004	
CAMP JERNEE	14.24	0.00	0.00	2004	
CYPRESS LEGENDS NO DEWATERING CONDITION REMOVAL	21.45	0.00	0.00	2004	
GUNNERY ROAD FROM SR 82 TO LEE BOULEVARD	32.01	0.00	0.00	2004	
SR 78 S OF NICODEMOUS SLOUGH TO BRIDGE NUMBER 050056	82.46	0.00	0.00	2004	
THE SHOPS AT VERANDAH	0.23	0.00	0.00	2004	
TRANSPORTATION EAST FACILITY - PARKING LOT AND BLDG ADDITION	20.69	0.00	0.00	2004	
ALICO LAKES VILLAGE	31.71	0.00	0.00	2005	
CORKSCREW ROAD CURVES IMPROVEMENTS	0.29	0.00	0.00	2005	
DOGWOOD COMMERCIAL PLAZA	2.85	0.00	0.00	2005	
DQ GRILL AND CHILL AT SHERWOOD	1.20	0.00	0.00	2005	
E.M.S. COMPOUND	9.44	0.00	0.00	2005	
FIFTH THIRD BANK - FT MYERS	1.19	0.00	0.00	2005	
GOFF COMMUNICATIONS TELECOMMUNICATION TOWER/THORP RD	0.23	0.00	0.00	2005	
MOBIL SERVICE STATION RAS NO 81285	1.39	0.00	0.00	2005	
OAKS AND HAMMOCK AT VERANDAH	13.43	0.00	0.00	2005	
ORANGE BLOSSOM RANCH	522.43	0.00	0.00	2005	
ORANGE BLOSSOM RANCH PHASE A	428.13	0.00	0.00	2005	
OWENS PARKING LOT	1.03	0.00	0.00	2005	
BIGGERSTAFF 2	1.29	0.00	0.00	2006	
FAIRWAY COVE AT VERANDAH	20.63	0.00	0.00	2006	
WORTHINGTON WAREHOUSE CONDOMINIUMS	14.25	0.00	0.00	2006	
AIRPORT CROSSINGS	80.85	0.00	0.00		2002
AIRPORT TECHNOLOGY CENTER IPP	94.00	0.00	0.00		2002
JETWAY TRADEPORT MPD	37.14	0.00	0.00		2002
JETWAY TRADEPORT MPD	0.92	0.00	0.00		2002
JETWAY TRADEPORT MPD	0.99	0.00	0.00		2002
SOUTHWEST FLORIDA ROCK	177.54	0.00	0.00		2002
WORTHINGTON VILLAGE @ SR82 RPD/CPD	338.13	0.00	0.00		2002
AIRPORT SOUTH INTERCHANGE CPD	31.65	0.02	0.00		2002
IMMOKALEE ROAD 6-LANE WIDENING	85.26	0.00	0.00		2004
BAYSHORE FARMS 1	113.32	0.02	0.01		2004
QUAIL CREEK DRAINAGE IMPROVEMENTS	2.39	0.01	0.44		2001
COTTONWOOD BEND AT VERANDAH	20.52	0.11	0.52		2004
SR 82 GROVES LLP PKA (IMMOKALEE FARM)	917.33	8.39	0.91		2002
NICK SINGLETARY FARMS INC	234.88	4.77	2.03		2002
GLADES RESORT	85.79	1.79	2.08		2005
COLONIAL BLVD BICYCLE PATHS	30.41	0.64	2.10		2001
HOME DEPOT - FORT MYERS	15.12	0.36	2.39		2004
CROOKS RANCH	2748.49	76.64	2.79		2004
EVERGLADES ECOTOUR LODGE	68.45	2.04	2.98		2005
HILL GRADE FARM CENTER PIVOTS	9948.07	314.30	3.16		2002
APEX CENTER	95.35	3.10	3.25		2004
TALAVERA ESTATES	34.48	1.19	3.46		2005
AVE MARIA PHASE 2	965.58	34.96	3.62		2006

Less than 5 percent Wetland Acres						
Project Name		Total Acres	Wetland Acres	Percent Wetland Acres	District ERP	PUD
DOUBLE BOTTOM CENTER (C.C.E. DISTRIBUTION CENTER)		20.22	0.78	3.88	2003	
GATEWAY UTILITY SITE - MAINTENANCE BUILDING		46.24	1.84	3.97	2005	
AIRPORT SEWER DISTRICT GATEWAY WWTP EXPANSION - 2 MGD		44.31	1.84	4.15	2006	
SCHOENBRUN FARMS GROVE 2		537.12	23.34	4.35	2001	
PORTICO		585.82	26.03	4.44	2005	
		19,437.94				

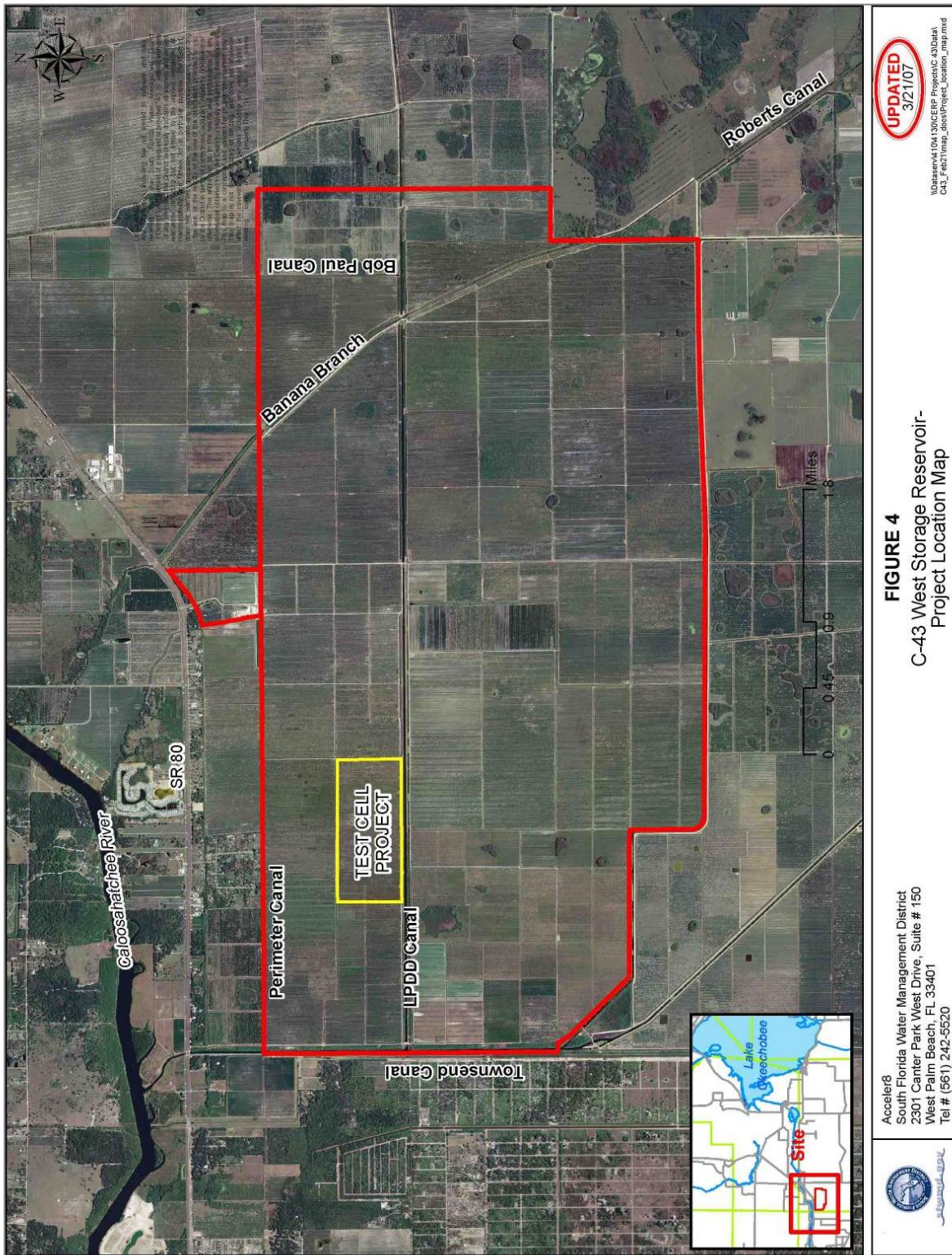


Figure 1. C-43 West Storage Reservoir Project, Access Road Parcel, and Test Cell Project location.

C-43 West Storage Reservoir: Phase III Environmental Site Assessments

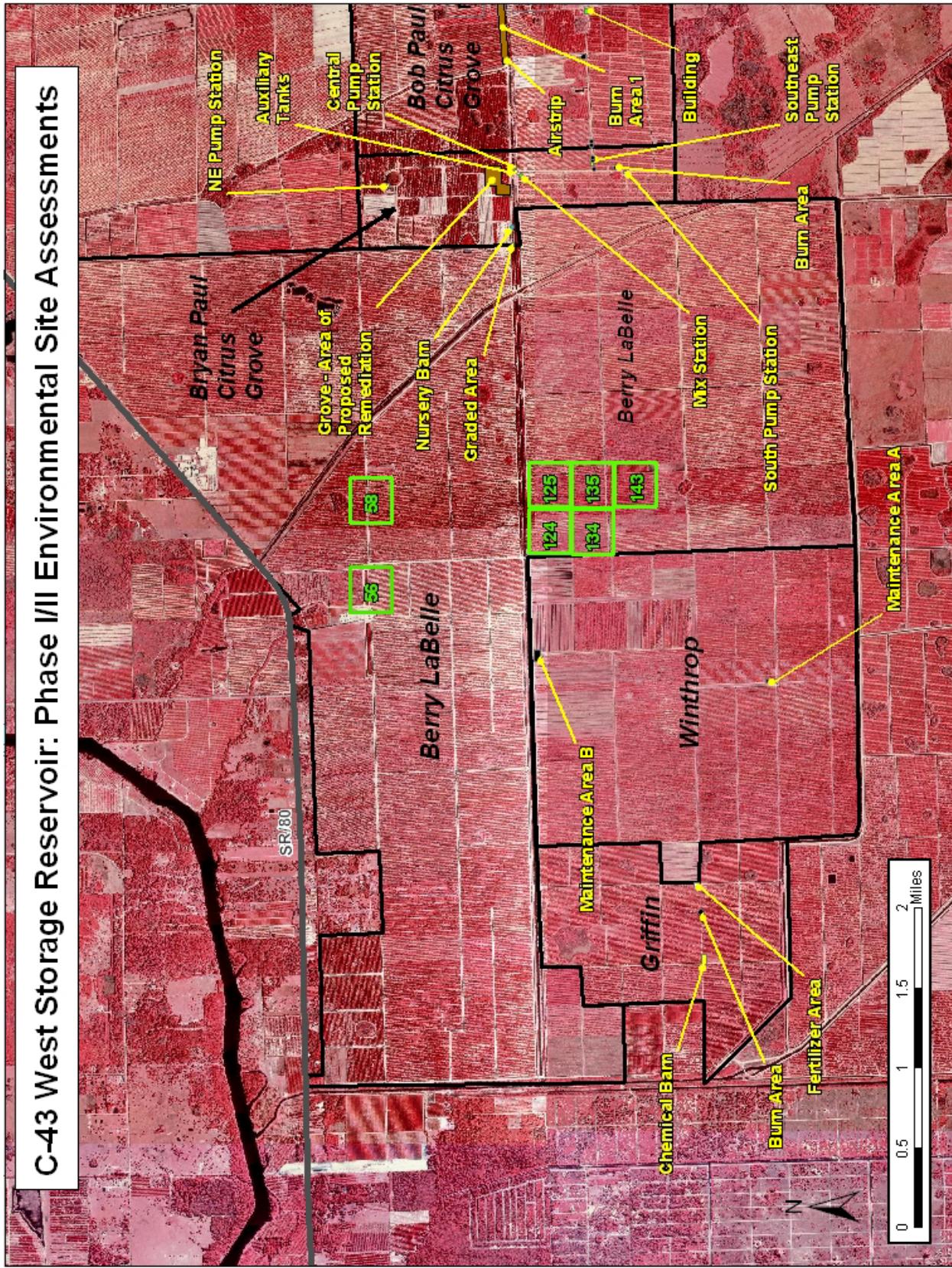


Figure 2. C-43 Basin Storage Reservoir: Phase I and II Environmental Assessments.

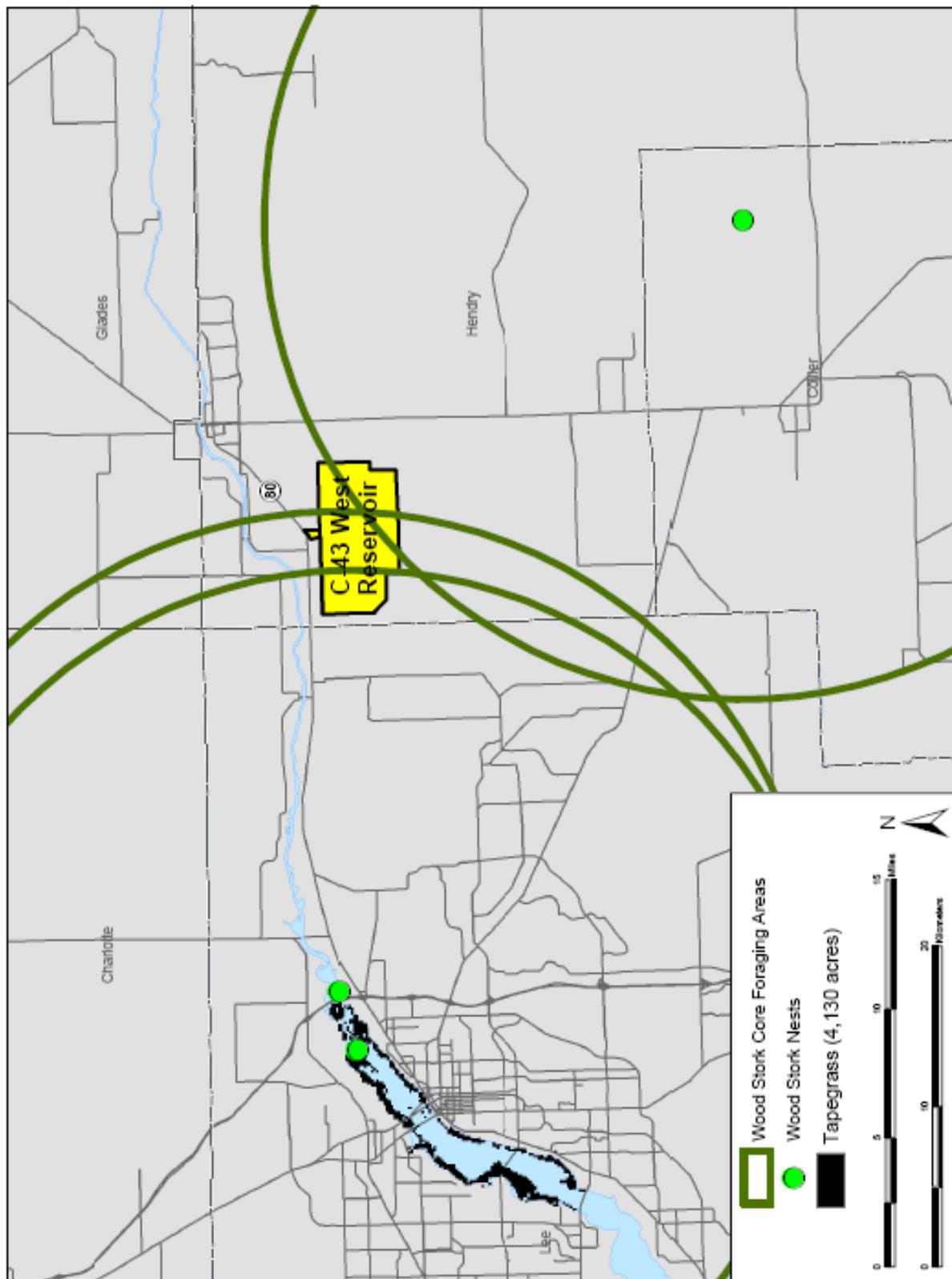


Figure 3. Location of Wood Stork Rookeries and Associated Core Foraging Areas in Relation to the C-43 Basin Storage Reservoir Project Area and Tapegrass Beds in the Upper Caloosahatchee Estuary.

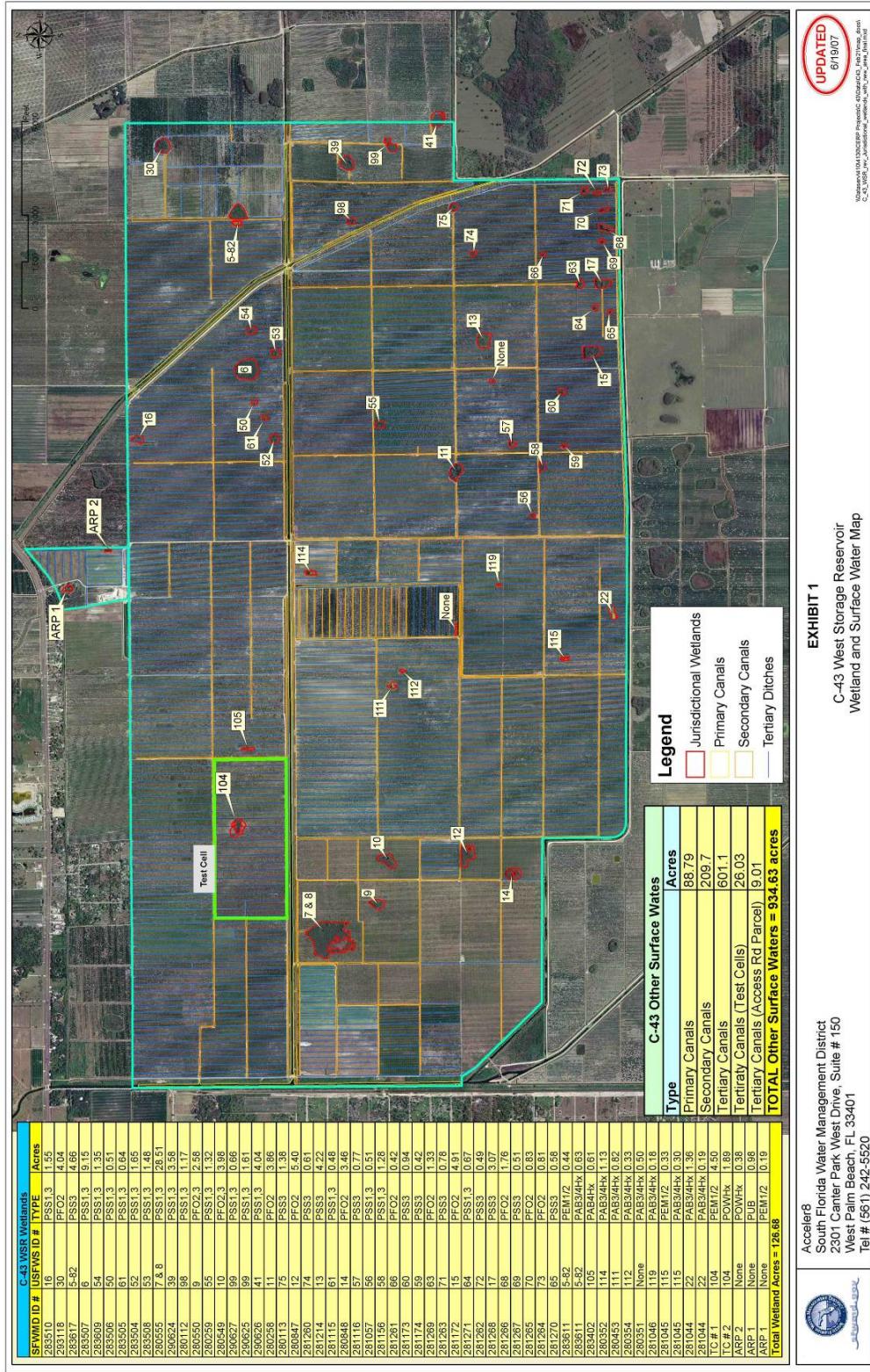


Figure 4. C-43 Basin Storage Reservoir: Jurisdictional Wetlands and Surface Waters of the United States.

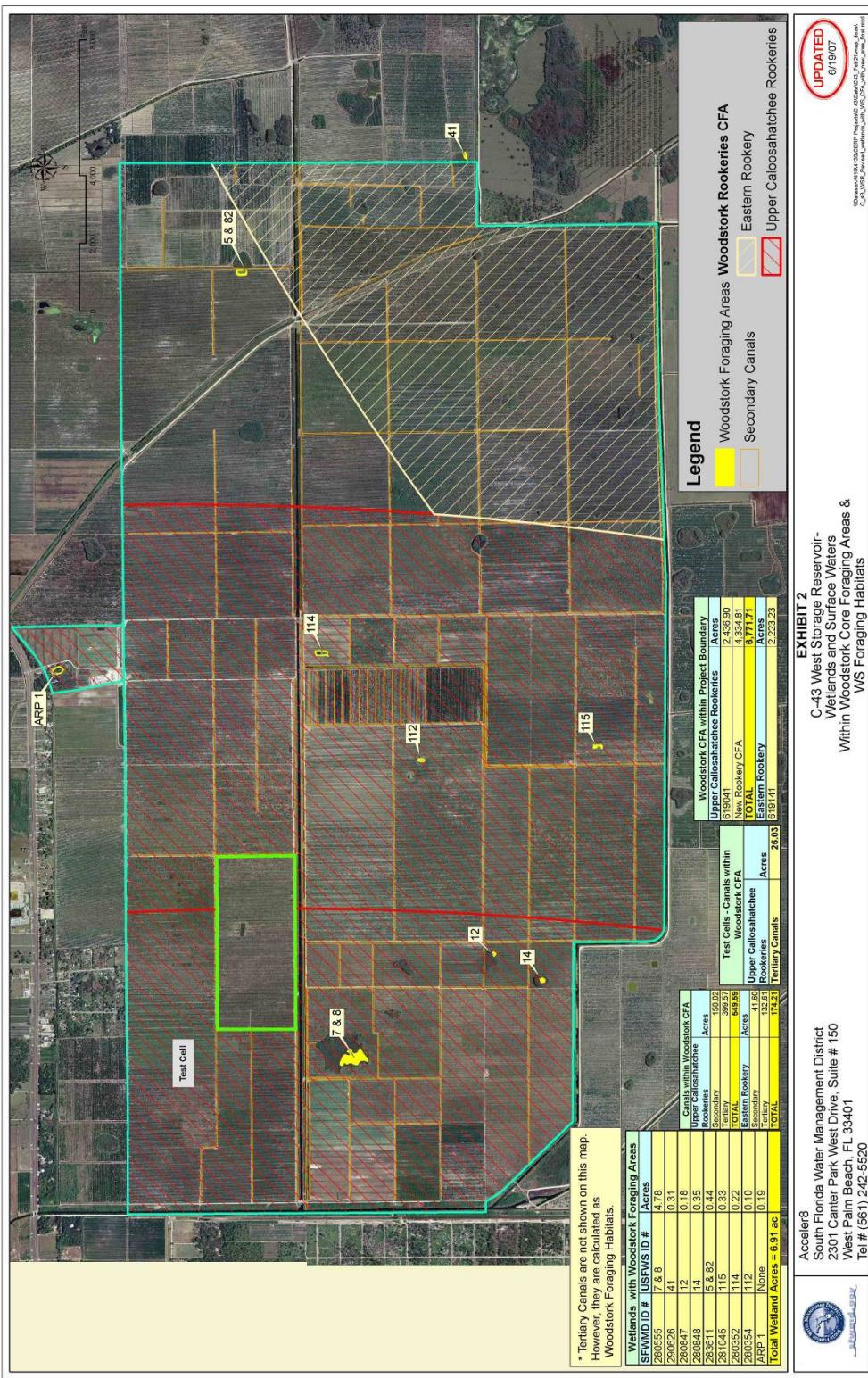
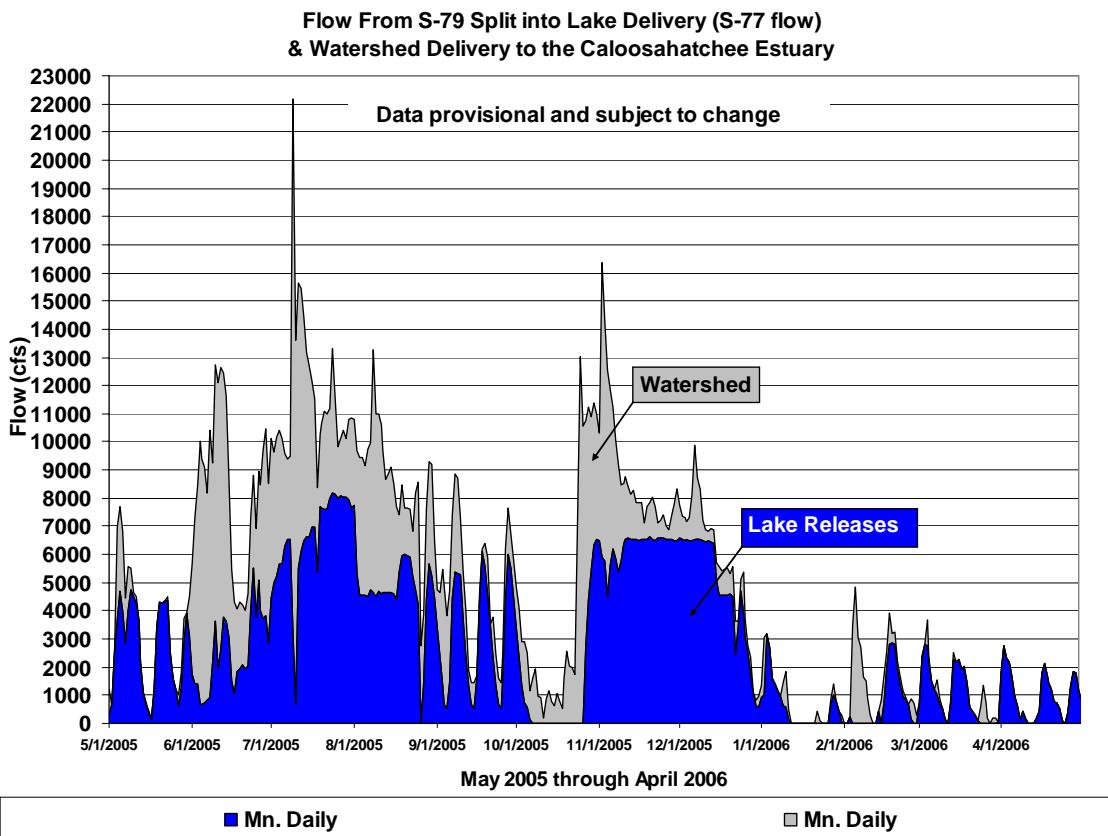


Figure 5. Potential Wood Stork Foraging Areas within the C-43 Basin Storage Reservoir Project Area.



Note: The portion of the discharge accounted for by Lake Okeechobee releases is shown in blue.

Figure 6. Total discharge into the Caloosahatchee Estuary from Lake Okeechobee and the Caloosahatchee Watershed at S-79.

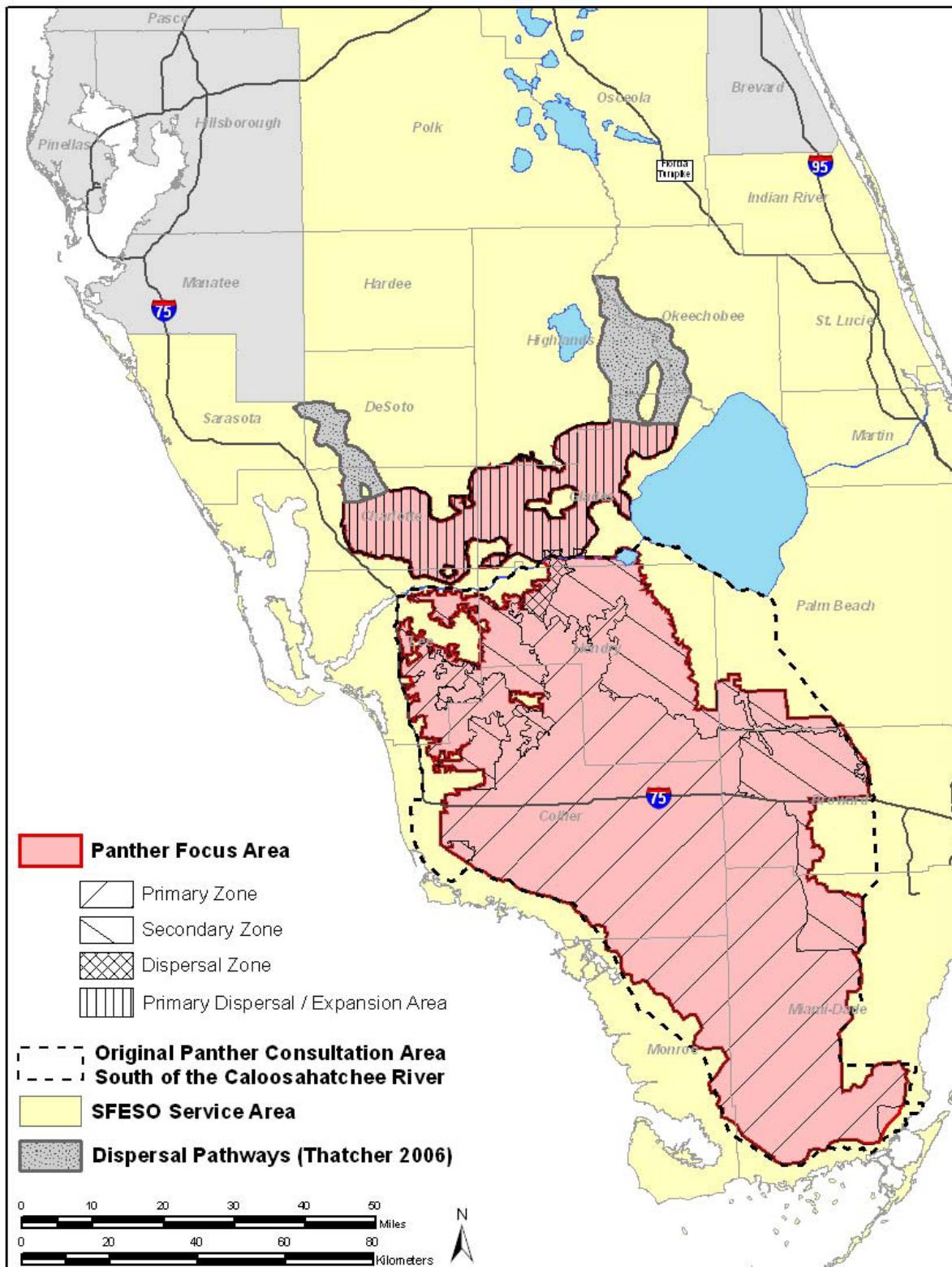


Figure 7. Florida Panther Focus Area.

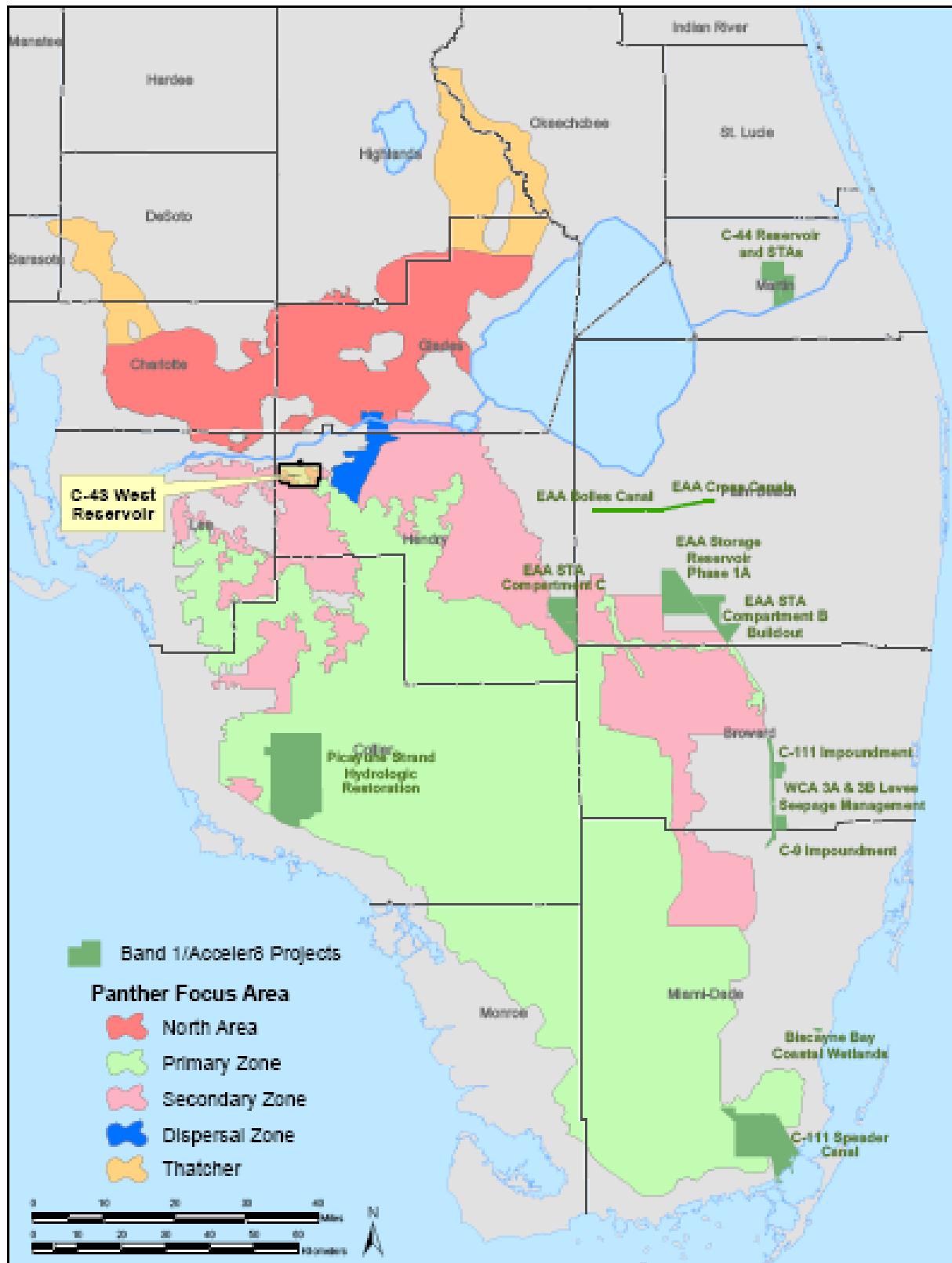


Figure 8. C-43 West Reservoir Project and other Acceler8 Projects in Relation to Florida Panther Focus Area and Primary, Secondary, and other Panther Zones.

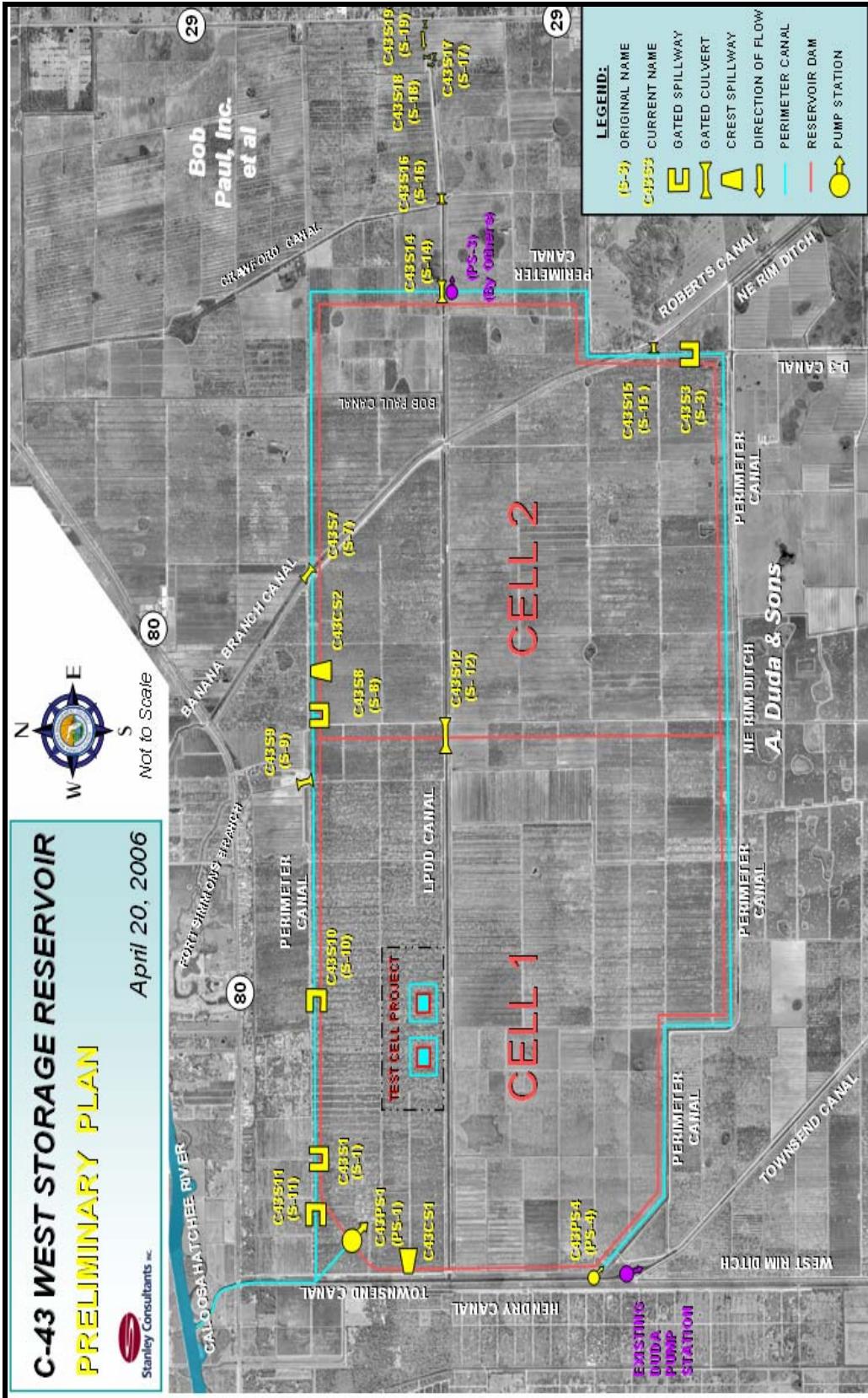


Figure 9. C-43 West Reservoir Project Site Plan.

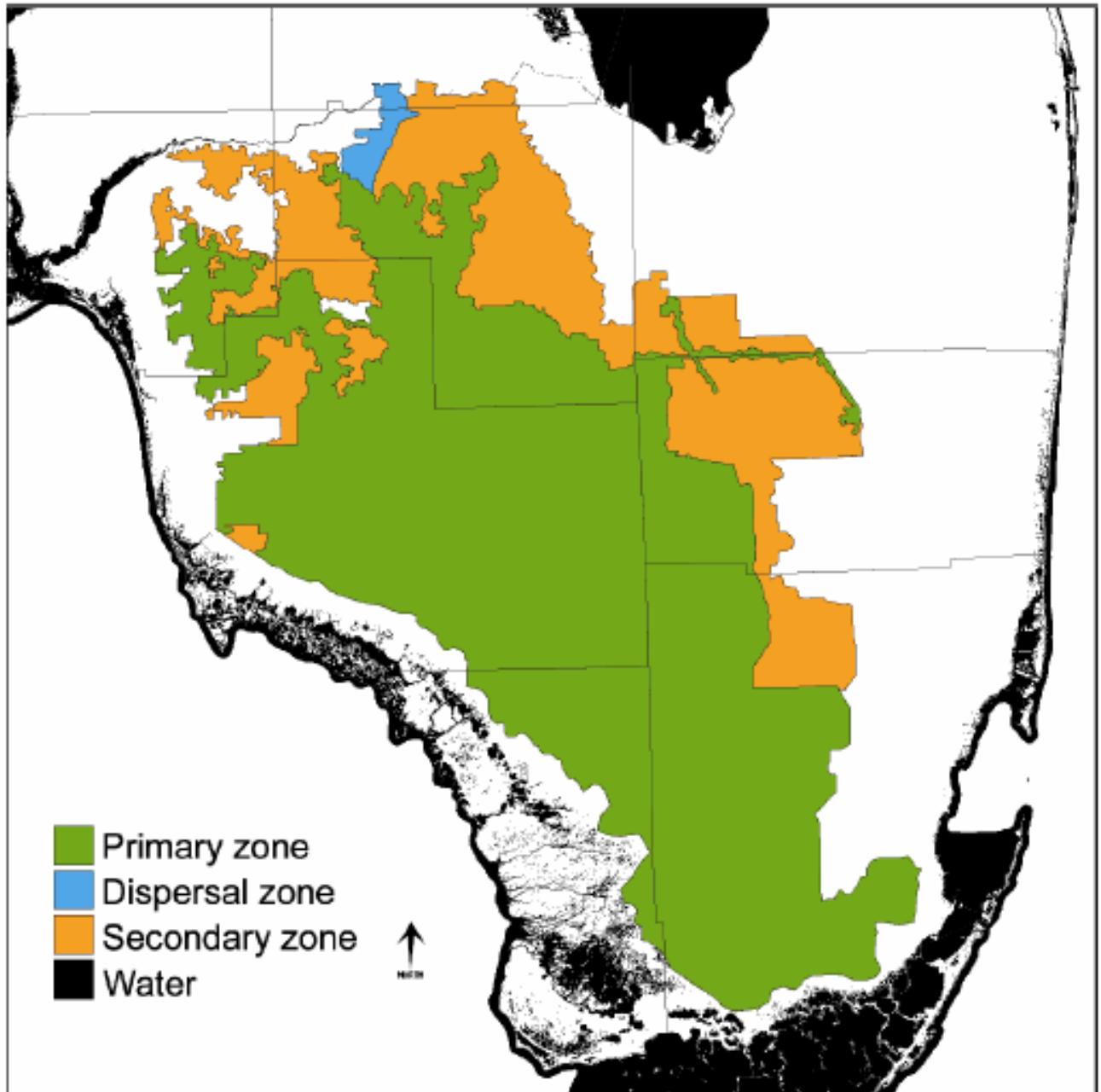


Figure 10. Florida Panther Zones (Kautz et al. 2006).

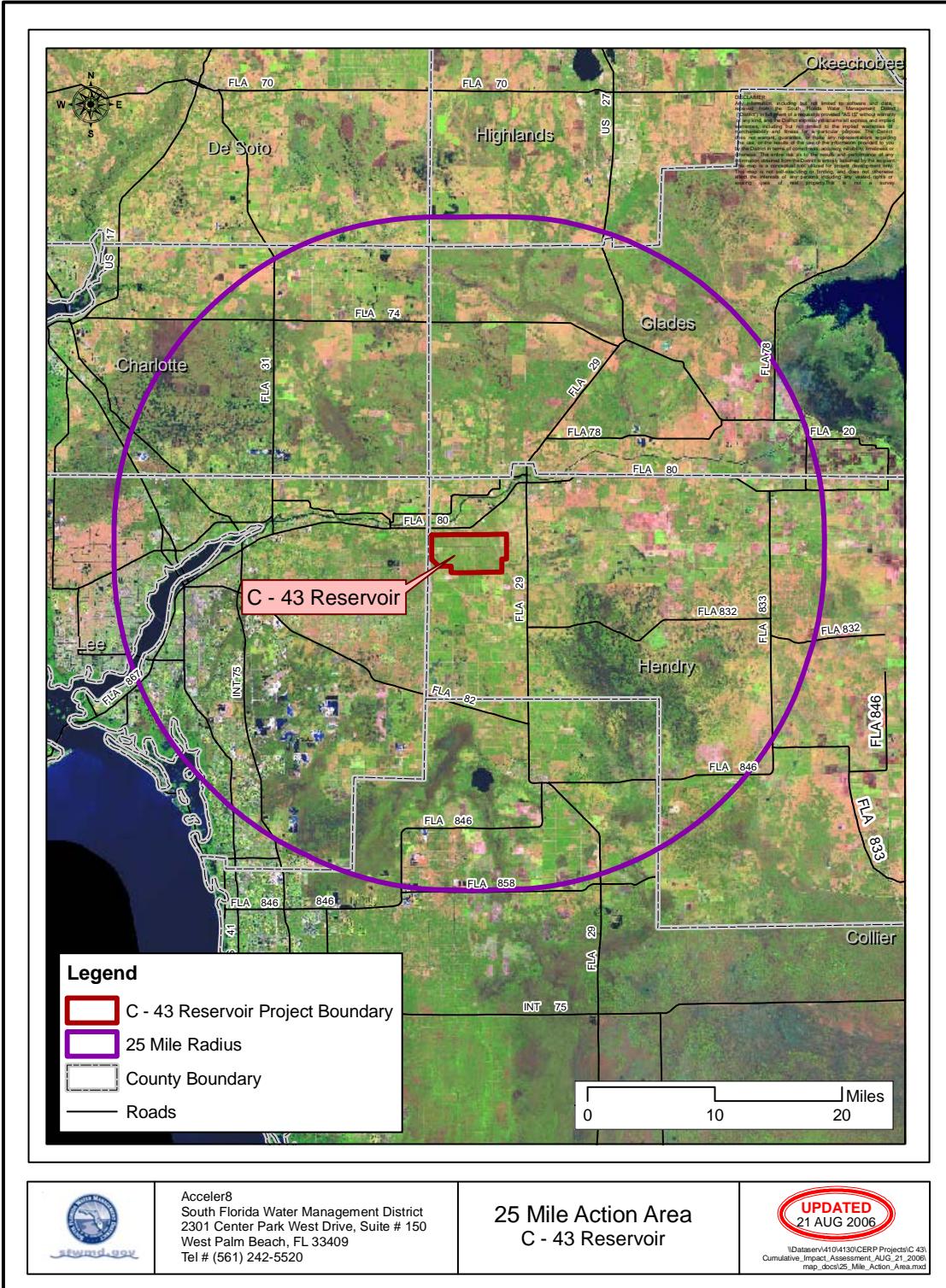


Figure 11. The 25-Mile Florida panther Action area for C-43 West Reservoir Project Area.

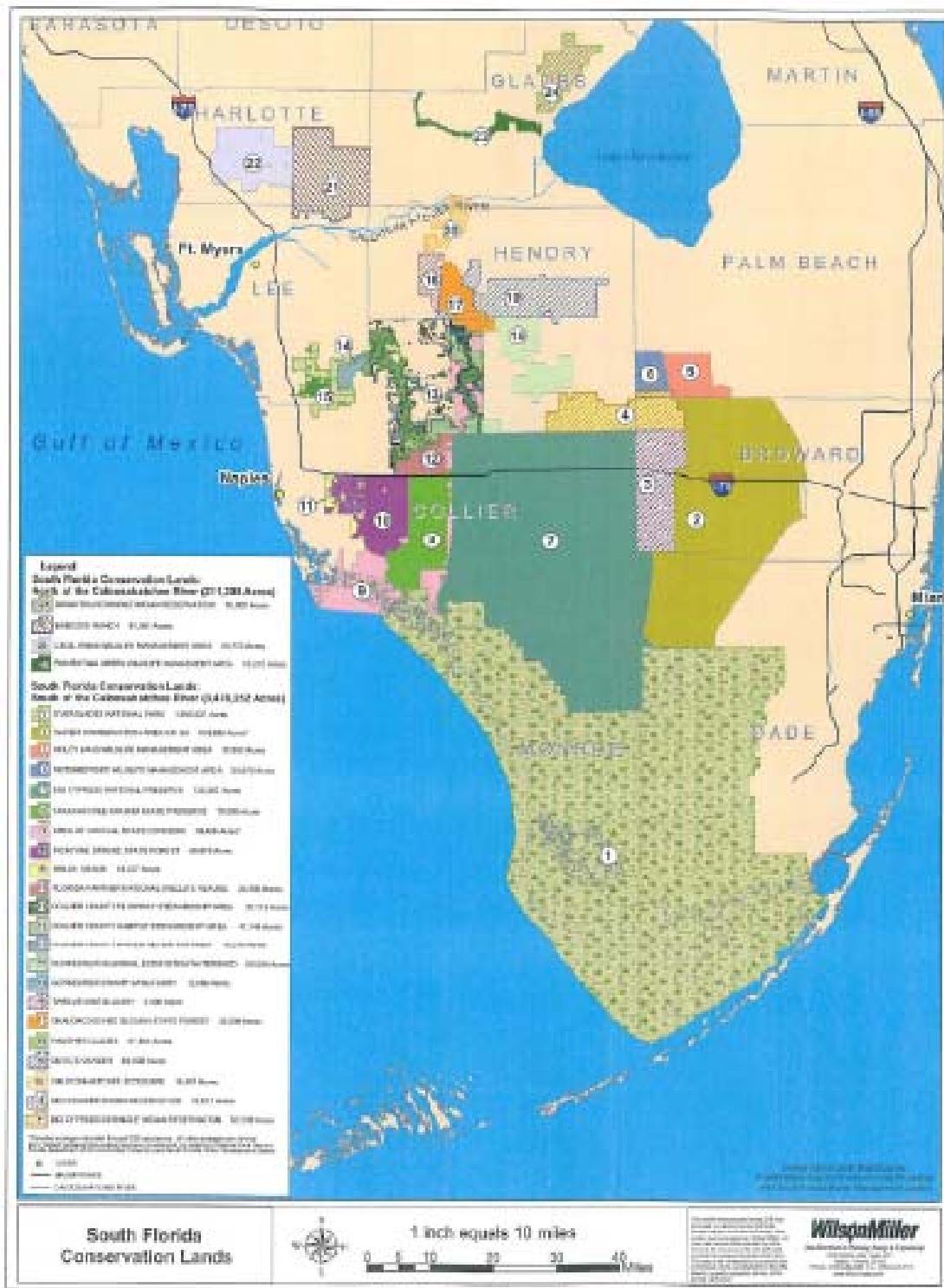


Figure 12. South Florida Conservation Lands.

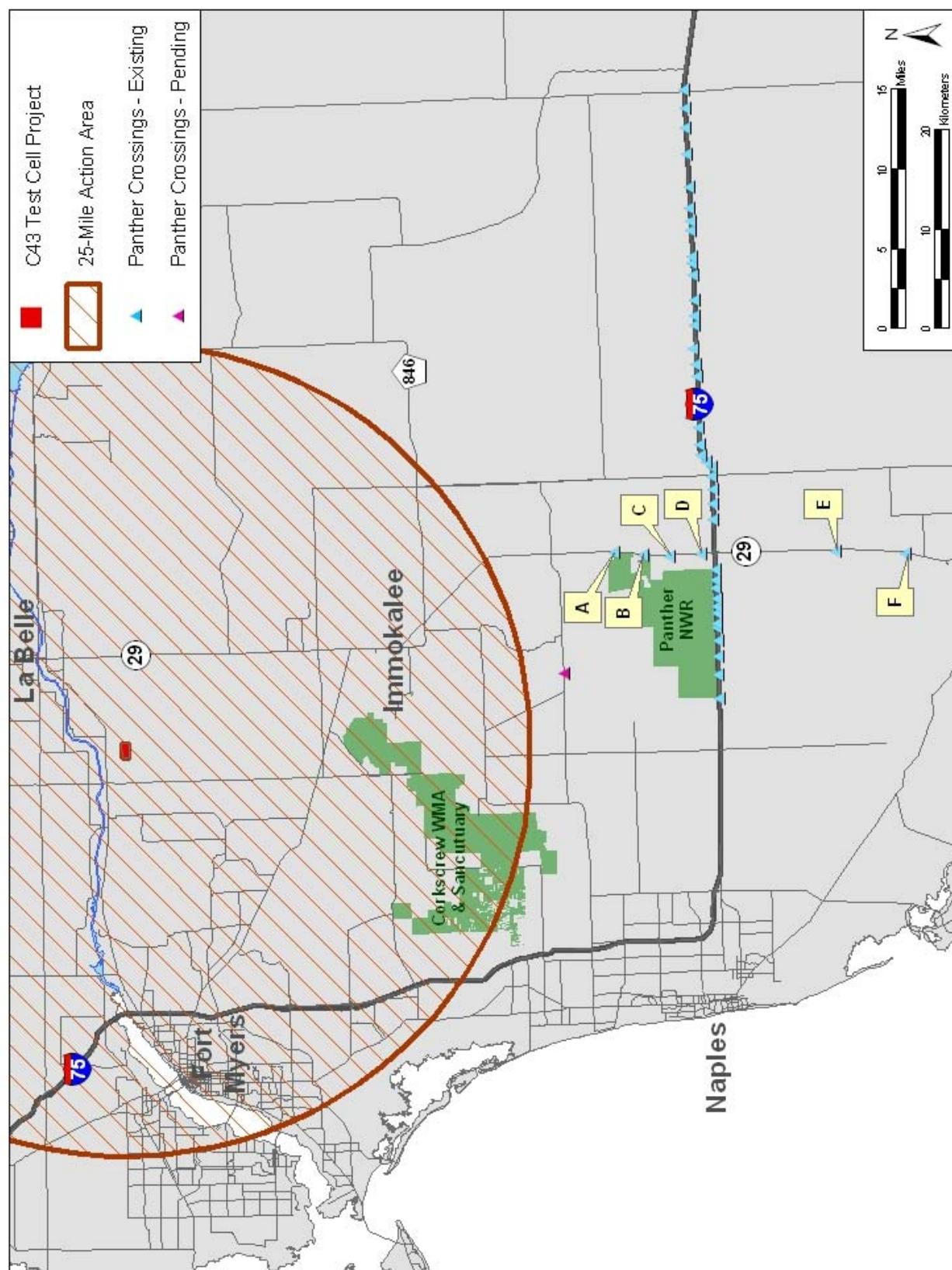


Figure 13. Location of Wildlife Crossings.

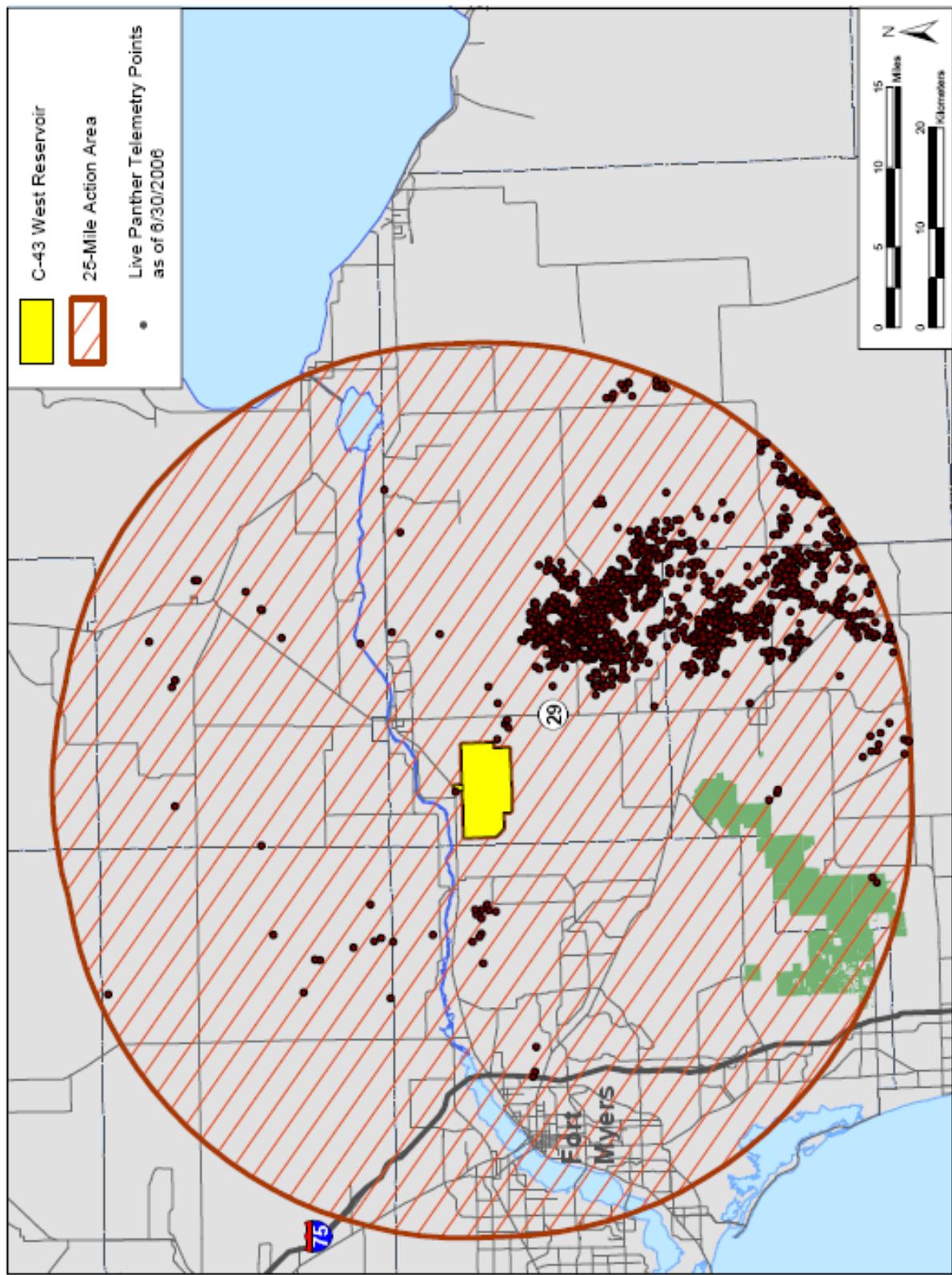


Figure 14. Telemetry Showing Live Panther Activity within the Action Area for the C-43 West Reservoir Project.

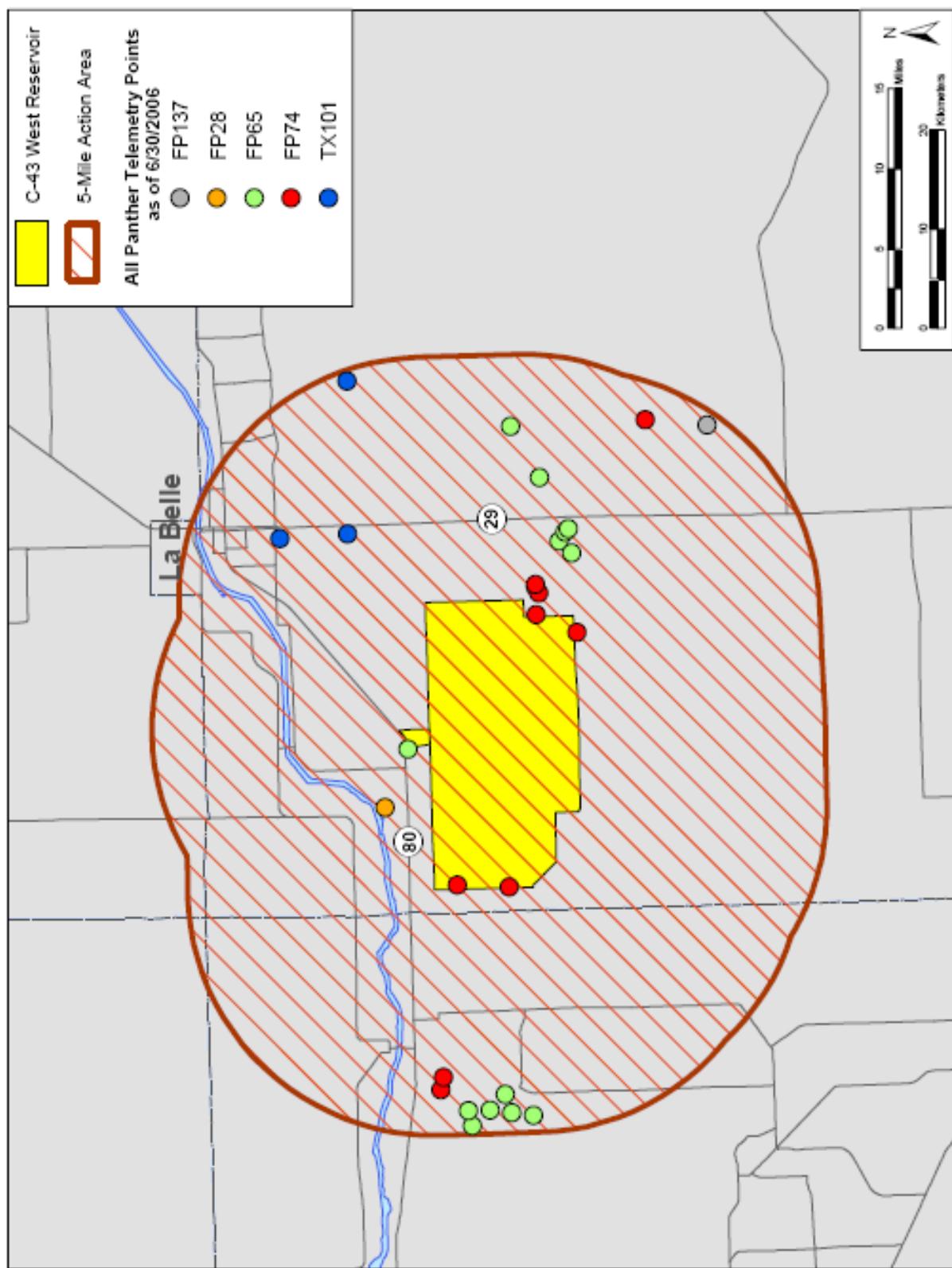


Figure 15. Telemetry Showing Panther Activity within 5 miles of the C-43 West Reservoir Project.

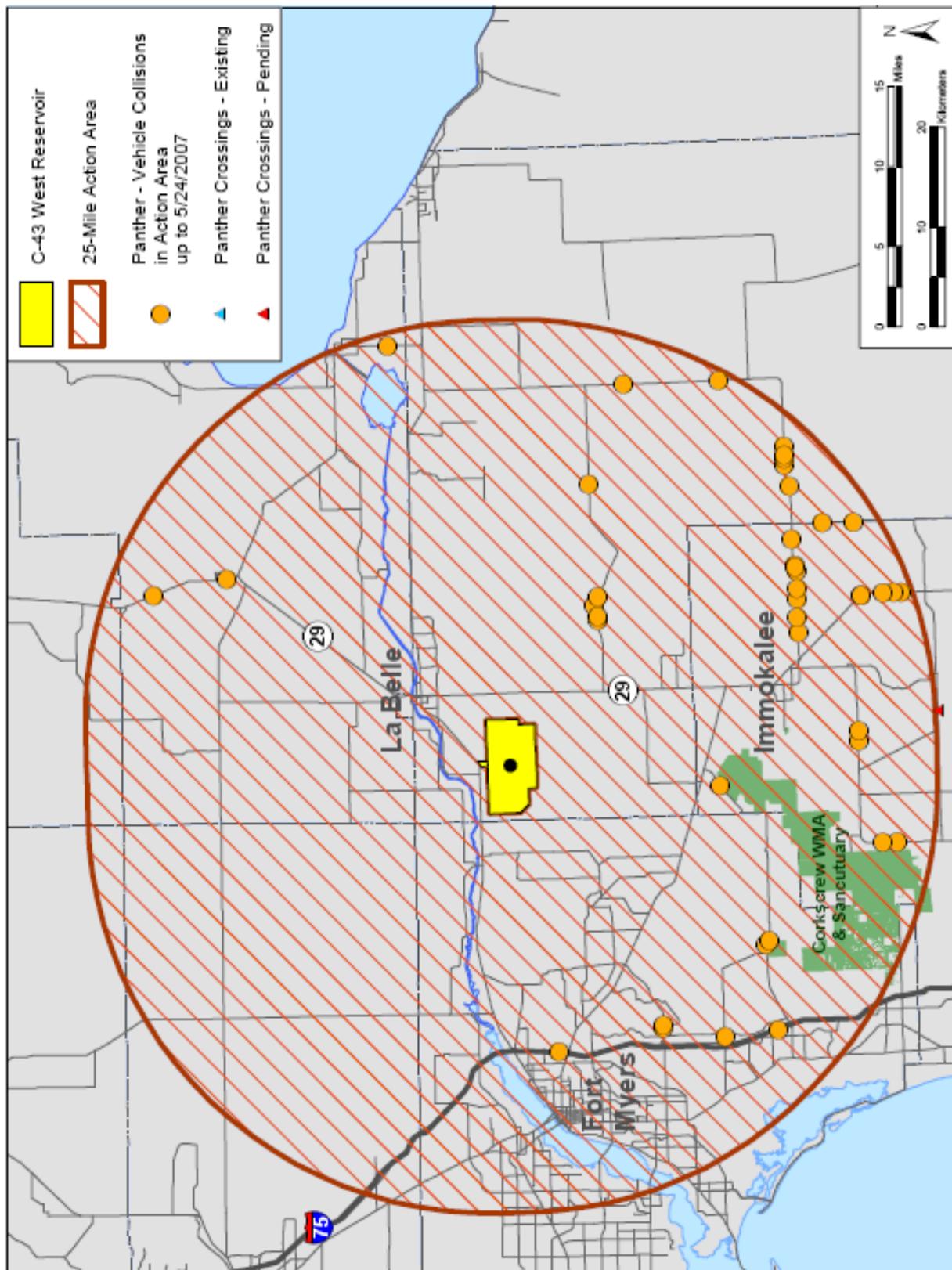


Figure 16. Panther-Vehicle Collisions Within the Action Area

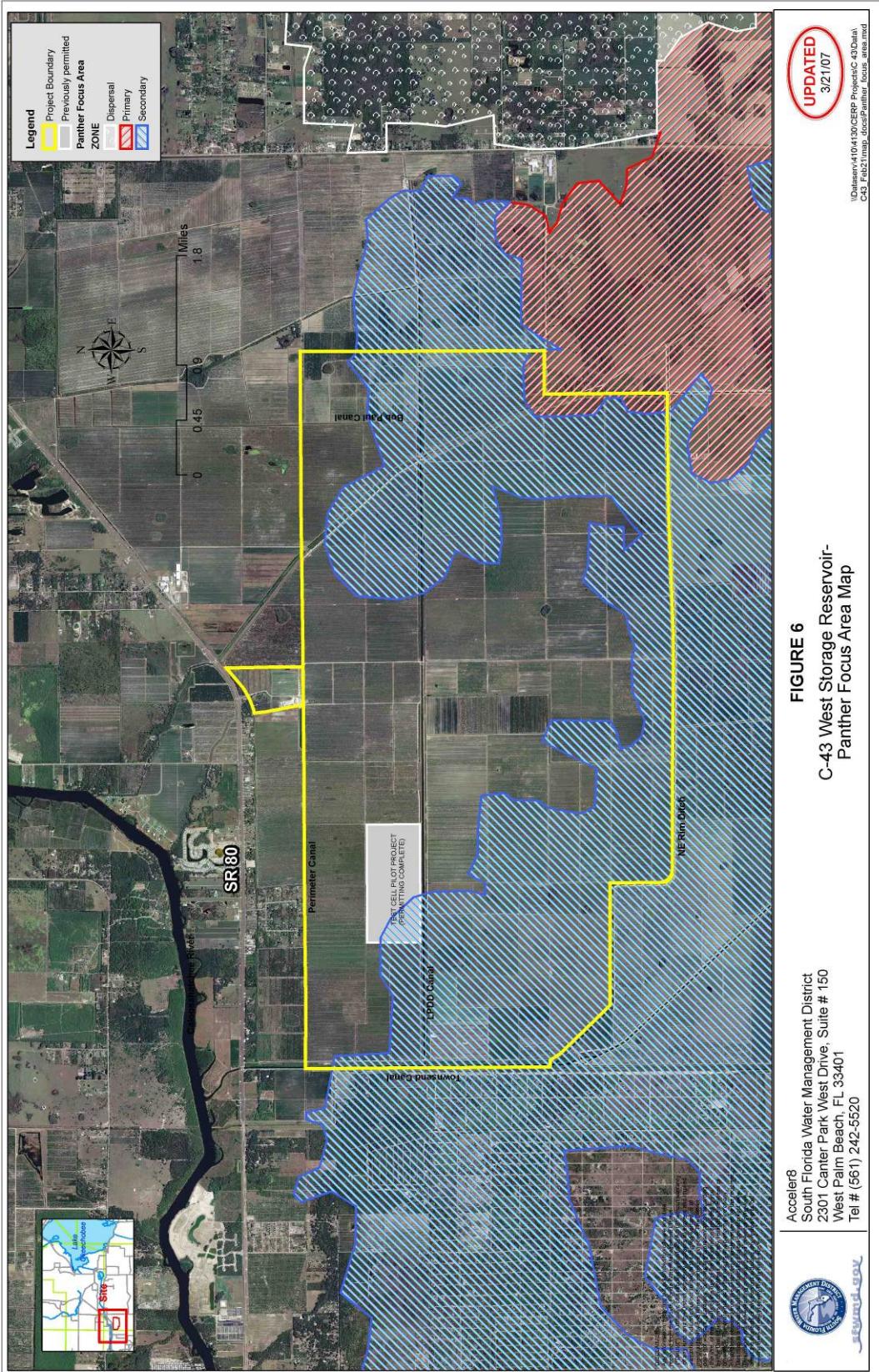


Figure 17. C-43 West Reservoir Project Area and Florida Panther Habitat Zones.

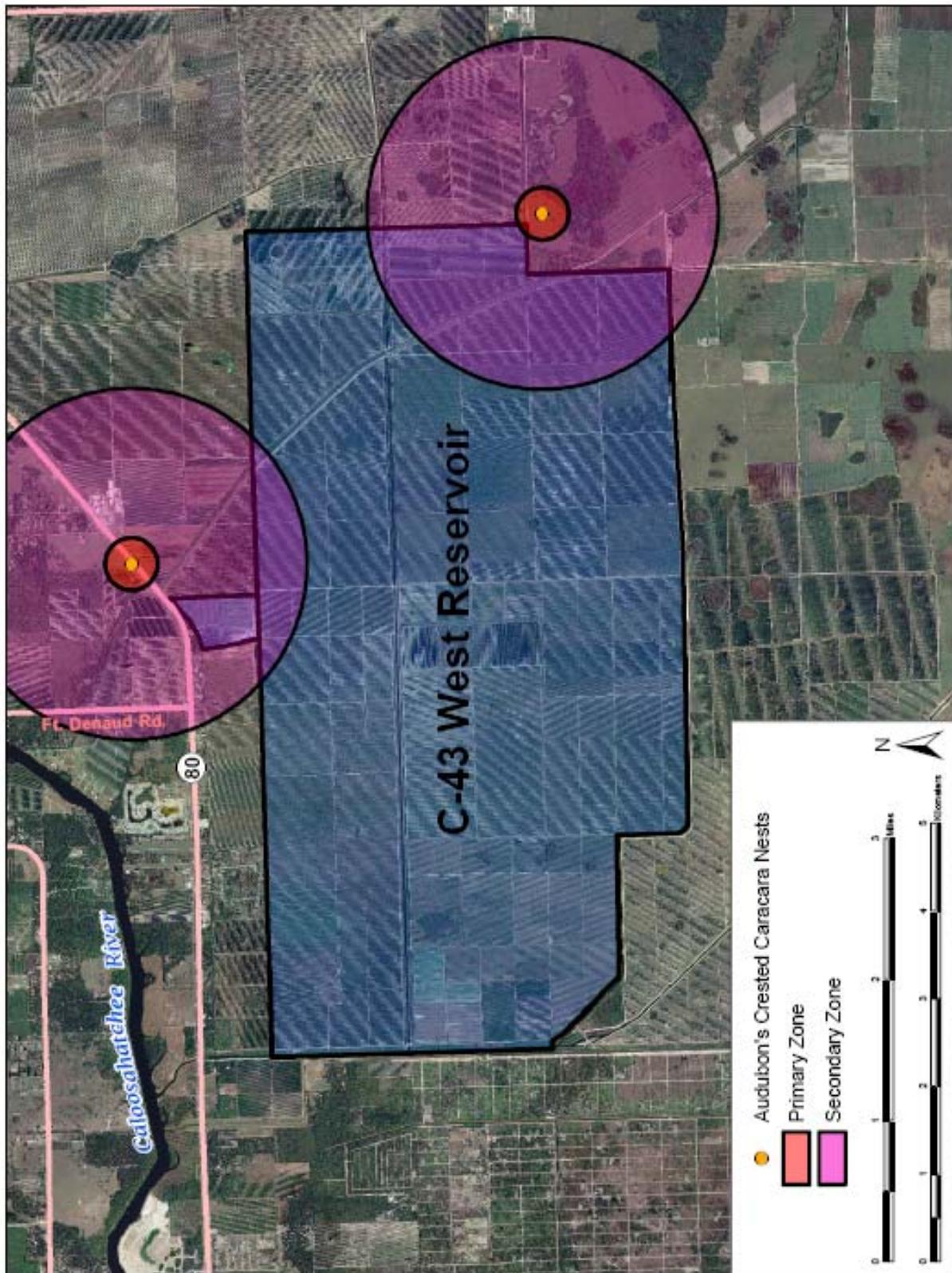
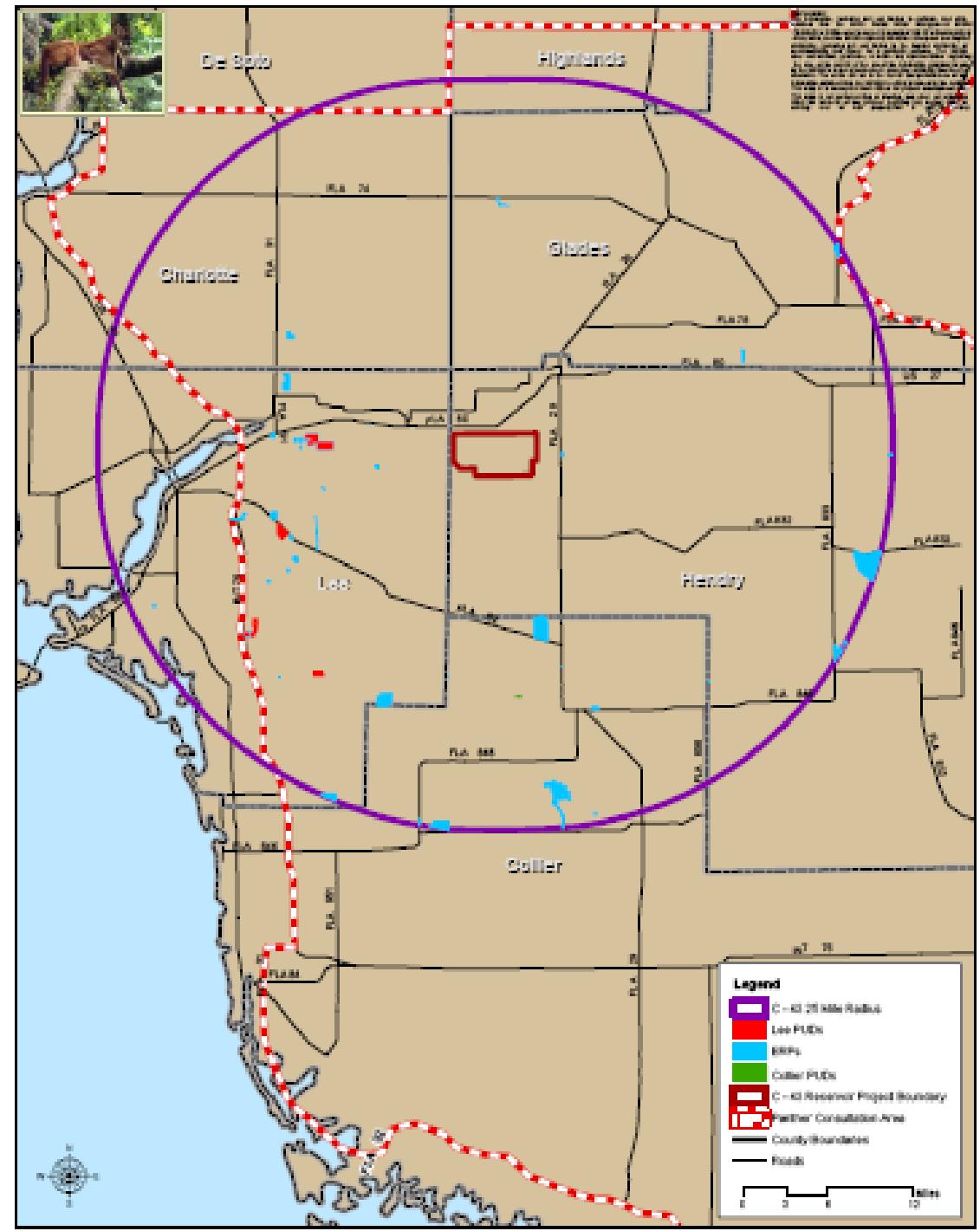


Figure 18. Audubon's Crested Caracara Nest Locations within the C-43 West Reservoir Project Area.



Acaciers
South Florida Water Management District
2301 Center Park West Drive, Suite #150
West Palm Beach, FL 33409
Tel # (561) 242-5520

Figure D-17
SFWMD ERP's & PUDs
C - 43 Reservoir

UPDATED
10 JUL 2007
Map developed by SFWMD Planning Division
Contact: (561) 242-5520, ext. 2417, 305-305

Figure 19. Northern Golden Gate Estates Vacant Lands.

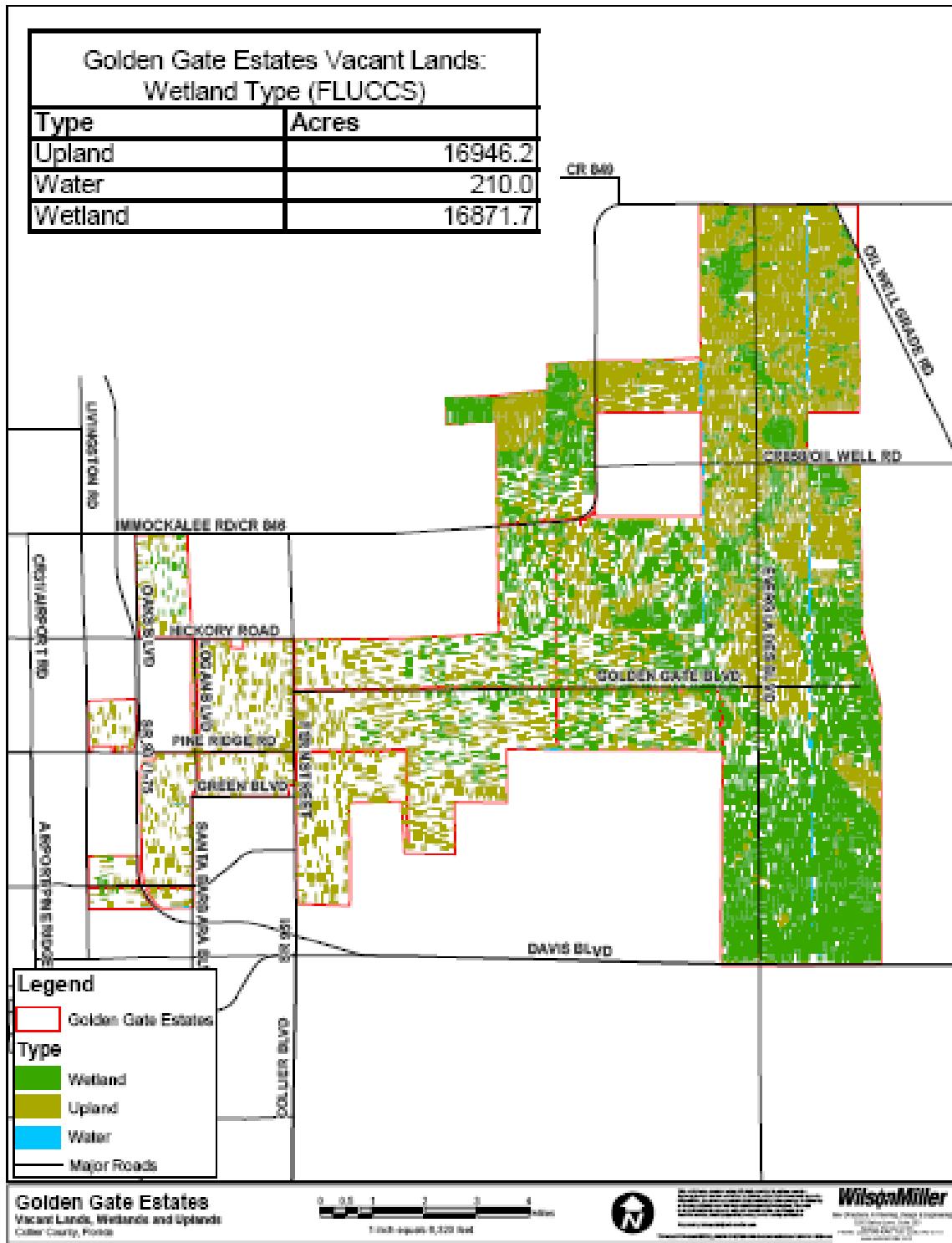


Figure 20. Northern Golden Gate Estates Vacant Lands.

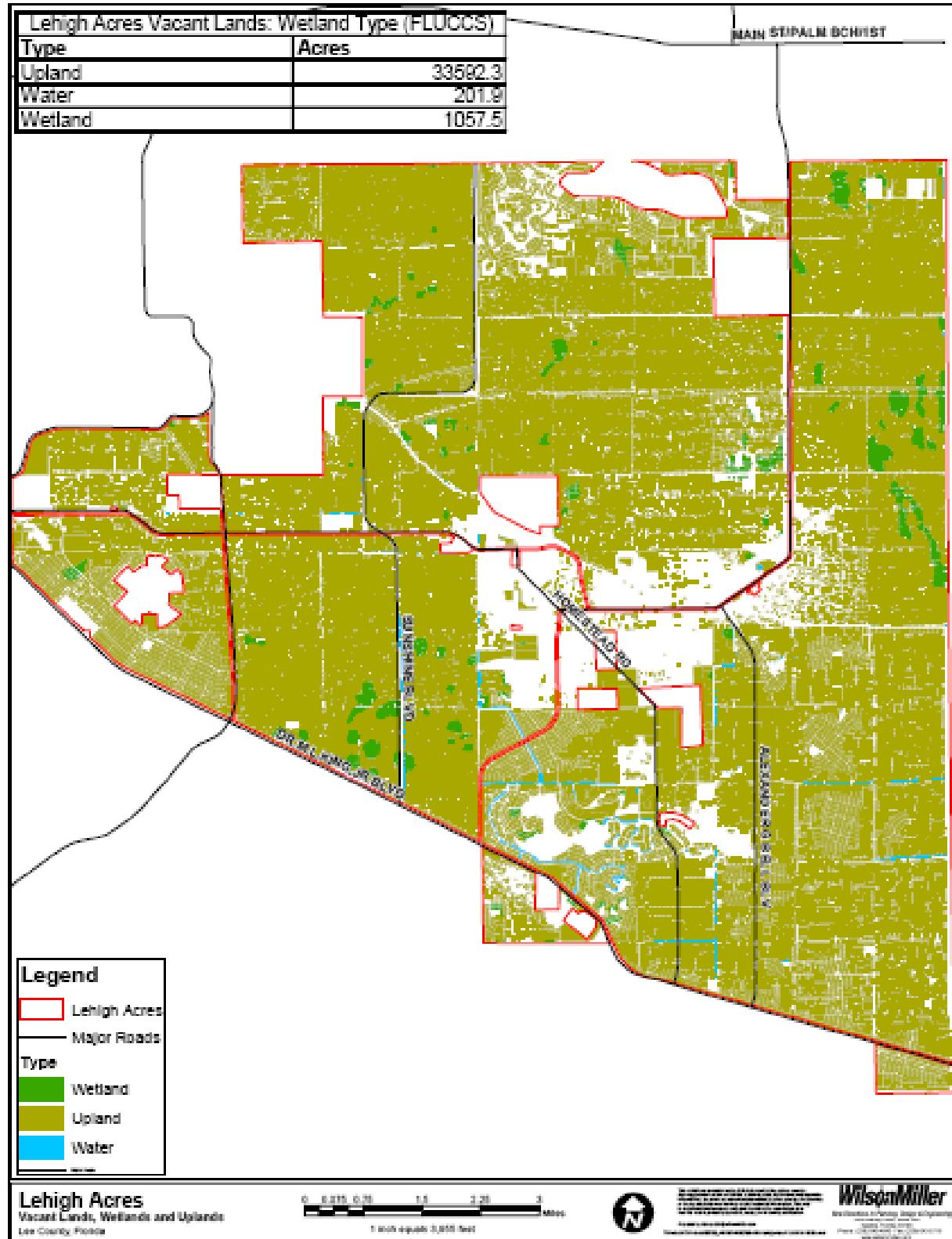


Figure 21. Lehigh Acres Vacant Lands.