United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
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Vero Beach, Florida 32960
February 7, 2012

Colonel Alfred A. Pantano
District Commander
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service Federal Activity Code:	41420-2007-FA-1478
Service Consultation Code:	41420-2007-F-0936
Corps Application No.:	SAJ-1997-6797 (IP-MLC)
Date Received:	February 5, 2009
Applicant:	Steve Torcise Jr., Atlantic Civil Incorporated
Project:	Card Sound Road
County:	Miami-Dade

Dear Colonel Pantano:

This document transmits the U.S. Fish and Wildlife Service's (Service) Biological Opinion (BO) for the construction of the Atlantic Civil, Incorporated (ACI), mining and agricultural fill projects and their effects on the endangered Florida panther (panther; *Puma concolor coryi*) 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 property is located just south of Florida City, northeast of Card Sound Road and east of U.S. Highway 1 (US1) in southern Miami-Dade County, Florida (Figure 1).

This BO is based on information provided by the U.S. Army Corps of Engineers (Corps) in their February 5, 2009, Public Notice, meetings, telephone conversations, email, other sources of information and additional information provided by the applicant. In the Public Notice and letter to the Service, the Corps determined the project "may affect" the panther and requested formal consultation. The Corps also determined the project "may affect, but is not likely to adversely affect" the threatened eastern indigo snake (*Drymarchon corais couperi*) and the threatened wood stork (*Mycteria americana*).

The Service has reviewed all information received and concurs with the Corps' determination that the proposed projects "may affect" the panther. The Service also concurs with the Corps' determinations that the projects "may affect, but are not likely to adversely affect" the eastern indigo snake and the wood stork.

Consultation History

On June 9, 2005, the Corps published a Public Notice for modification of the original ACI project [SAJ-1995-6797 (MOD-RK)] ("original project").

On August 21, 2006, the Service completed formal consultation and issued a BO, evaluating the original project's effects on the panther and the wood stork. The Service concluded the original project was not likely to jeopardize the survival and recovery of the panther or the wood stork. The Service indicated the applicant provided compensation for impacts to marginally suitable wood stork foraging habitat through the preservation and enhancement of 1,552.7 acres (ac) of freshwater marsh, wet prairie, hardwood swamp and wet forest, which comprise a higher quality foraging habitat than that being impacted. The Service anticipated no direct mortality or injury of wood storks or panthers as a result of the proposed action under the original project.

On June 11, 2007, ACI's Federal and State permits authorizing the original project expired. At that time, almost 800 ac of the 980.2 ac authorized for agricultural fill had been filled. Prior to the expiration of the federal and state permits, ACI submitted applications to both the South Florida Water Management District (District) and the Corps to modify its existing permits to allow the expansion of the existing quarry operations. Those applications became moot with the expiration of the underlying permits.

On February 5, 2009, the Corps issued a public notice of ACI's request to excavate 494.1 ac to create a quarry totaling 565.3 ac and subsequently reissued the public notice with minor changes on March 17, 2009 ("rock mining proposal").

On February 5, 2009, the Corps also issued a public notice to authorize fill of approximately 5 ac of freshwater wetlands for agriculture in the action area ("agricultural fill proposal").

On February 23, 2009, the Service sent the Corps a letter requesting additional information regarding the 565.3 ac mining project.

On February 25, 2009, the Service sent the Corps a letter requesting additional information regarding the 5 ac agricultural fill project.

On October 30, 2010, the Service received the final additional information requested for wood storks from the applicant's consultant.

On September 14, 2011, the Service received the final additional information requested for the rock mining proposal from the applicant's consultant.

As of September 14, 2011, we have received all the information necessary for initiation of formal consultation on the panther 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

Two actions are proposed in the project area, rock mining of 565.3 ac and filling 4.8 ac for agricultural use. The proposed rock mining and agricultural fill projects lay within the boundary limits of the previously permitted, but now expired, 980.2-ac original project area in South Miami-Dade County (Figures 1 and 1a). The original project consisted of 535.4 ac of Corps jurisdictional wetlands and 444.8 ac of uplands within the project boundary and an additional 1,552.7 ac of preserve areas to be enhanced through exotic removal and habitat restoration activities. To date, agricultural and mining operations have taken place on the property under the authorizations of previous local, state, and federal permits (as required for the individual activities).

The current rock mining proposal is to mine 565.3 ac of the property. Within the 565.3 acre project area, 317.8 ac (238.3 ac of which were previous Corps jurisdictional areas) have been filled pursuant to prior permits, and 71.2 ac consist of an existing mine in non-Corps jurisdictional areas. Within the balance of the project area (179.3 ac), where previous project work has not been conducted, there are 3 ac of non-jurisdictional wetlands and 176.3 ac of Corps jurisdictional wetlands that have not yet been impacted. Of the 179.3 ac, 158 ac consist of predominantly wet croplands and the remaining 18.3 ac consist of an on-site canal and unfilled sawgrass and saltbush wetlands with exotic vegetation. The proposed project area (565.3 ac) minus the existing mined area (71.2 ac) leaves 494.1 ac of panther habitat that will be directly affected by mining. Habitat acreages in the mining footprint are presented in Table 1.

The agricultural fill proposal is to fill the remaining 4.8 ac of disturbed wetlands on a 120.7-ac parcel for agricultural use. Currently there are 115.9 ac of previously filled croplands and 4.8 ac of unfilled disturbed wetlands on this parcel. The 4.8-acre wetland is primarily sawgrass and saltbush mixed with some exotic vegetation. Acreages of habitats in the agricultural fill footprint are presented in Table 2.

The 1,552.7-ac off-site preserve is under conservation easements and consists of freshwater marsh, water, grassland, shrub swamp, and mixed forest areas (Figure 2, "Original Mitigation Areas"). Several dirt roads run along or through the preserve areas. Portions of this preserve have been subject to restoration and enhancement activities for the past several years in conjunction with the original project permits. Restoration has proceeded in conjunction with mining and is currently up to date.

The site is located east of US 1, northeast of Card Sound Road and south of Southwest 352nd Street, in Sections 27 through 33, Township 57 South, Range 39 East, and Sections 4, 5, and 8, Township 58 South, Range 39 East, in southern Miami-Dade County. The site is bounded to the north by Southwest 352nd Street, to the west by Southwest 162nd Avenue, to the south by Southwest 376th Street and to the east by Southwest 152nd Avenue. The site is adjacent to Southwest 352nd Street on the north, to the south and east by mostly undeveloped lands and to the west by the intersection of Card Sound Road and US1 (Figures 1 and 1a).

Adverse effect to the Florida panther and proposed compensation

The project will result in the direct loss of 494.1 ac of habitat available for occasional use for stalking of prey and dispersal by the Florida panther. The habitat loss represents 2,362 Panther Habitat Units (PHUs) with a recommended compensation of 5,905 PHUs [see discussion under Panther Habitat Assessment Methodology (Appendix A) and Tables 3 and 4]. The project is within the Service's Panther Focus Area (see page 27) and within the panther Primary Zone (Kautz et al. 2006) (Figure 3). The applicant is proposing to protect 955.5 adjacent ac within the panther Primary Zone (Figures 1a and 3).

The applicant proposes to compensate the loss of habitat with remaining acreage in the existing preserve. Restoration, exotic removal, maintenance and monitoring will continue commensurate with mining activities. The applicant proposes to remove four sections of roads totaling 1.9 miles (mi) to minimize unauthorized off-road vehicle and hunting use of the properties and to improve hydrology. The applicant also proposes buffers between project residential developments and the preserve lands to minimize disturbance.

The proposed compensation plan provides habitat preservation and restoration within and near the project area, and is consistent with the habitat conservation recommendations of Panther Recovery Plan (Service 2008) goal 1.1.1.2.3. This goal recommends habitat preservation and restoration within the Primary Zone be provided in situations where land use intensification cannot be avoided. The applicant has proposed equivalent habitat protection and restoration, to compensate for the quantity, function and value of the lost habitat.

Action area

The Service defined the action area (Figure 4) as all lands within 25 mi of the ACI project where panthers may experience direct and indirect effects from the proposed development. The action area is slightly greater than the mean dispersal distance for subadult males. The Service identified this area to be a 25-mile radius of the project site based on studies by Maehr et al. (2002a) and Comiskey et al. (2002). Maehr et al. (2002a) documented an "average effective dispersal distance" of 37.3 km (23.2 mi) for subadult males. Comiskey et al. (2002) documented a "mean dispersal distance" for subadult male panthers as an average distance of 40 km (24.9 mi) from their natal range, which is similar to the dispersal distances referenced by Maehr et al. (2002a).

The action area does not include urban lands within 25 miles of the project site, but includes areas where panthers might be directly and indirectly affected by project impacts such as increased traffic, increased human disturbance, habitat fragmentation, and intraspecific aggression.

Panther movements 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.

STATUS OF THE SPECIES AND CRITICAL HABITAT

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 feet (ft) (2.1 meters [m]) from their nose to the tip of their tail and may exceed 161 pounds (lbs) (73 kilograms [kg]) in weight; but, typically adult males average around 116 lbs (52.6 kg) and stand about 24-28 inches (in) (60-70 centimeters [cm]) at the shoulder (Roelke 1990). Female panthers are smaller with an average weight of 75 lbs (34 kg) and length of 6 ft (1.8 m) (Roelke 1990). The skull of the Florida panther is unique in that it has a broad, flat, frontal region, and broad, high-arched or upward-expanded nasal bones (Young and Goldman 1946).

Florida panther kittens are gray with dark brown or blackish spots and five bands around the tail. The spots gradually fade as the kittens grow older and are almost unnoticeable by the time they are 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 were 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 these 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 of 1995. Since this introgression, rates of genetic defects, including crooked tails and cowlicks, have dramatically decreased (Mansfield and Land 2002, Land et al. 2004, Onorato et al. 2010, Johnson et al. 2010). The last of these females was removed in 2003.

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

The taxonomic classification of the *Felis concolor* group was revised and described by Nelson and Goldman (1929) and Young and Goldman (1946). These authors differentiated 30 subspecies using geographic and morphometric (measurement of forms) criteria and reassigned the Florida panther to subspecies 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*. Wozencraft (1993) promoted the subgenera of the old genus *Felis* to full generic status and placed a number of former *Felis* species, including the puma, in monotypic genera (Nowell and Jackson 1996). The taxonomic classification of the puma is now considered to be *Puma concolor* (Wozencraft 1993), making the accepted name for the Florida panther *P. c. coryi*.

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. Specifically, 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 (Service 2008). The Florida panther remains listed as a subspecies and continues to receive protection pursuant to the Act.

Federal Status: The Florida panther is the last subspecies of Puma (also known as mountain lion, cougar, painter, or catamount) still surviving in the eastern United States. Historically occurring throughout the southeastern United States (Young and Goldman 1946), today the panther is restricted to less than 5 percent of its historic range in one breeding population of approximately 100 animals, located in South 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 Florida Fish and Wildlife Conservation Commission [FWC]) designated 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 Florida panther as endangered (32 Federal Register 4001) throughout its historic range, and these animals received Federal protection under the passage of the Act in 1973. Also, the Florida Panther Act (State Statute 372.671), a 1978 Florida State law, made killing a panther a felony. The Florida panther is listed as endangered by the States of Florida, Georgia, Louisiana, and Mississippi.

Since the panther was designated as an endangered species prior to enactment of the Act, there was no formal listing package identifying threats to the species as required now by section 4(a)(1) of the Act. However, the Florida Panther Recovery Plan addressed the five factor threats analysis (Service 2008).

No critical habitat has been designated for the panther.

Life history

Reproduction: Male Florida panthers are polygynous, maintaining large, overlapping home ranges containing several adult females and their dependent offspring. The first sexual encounters for males normally occur at about 3 years based on 26 radio-collared panthers of both sexes (Maehr et al. 1991). Based on genetics work, some males may become breeders as early as 17 months (W. Johnson, National Cancer Institute, Personal Communication 2005). Females breed about every 2 years and 70 percent of litters average 2 to 3 kittens (Hostetler et al. 2009). Litters are produced throughout the year, but most occur from March through July (Service 2010). Females from 18 months to 11 years old have successfully reproduced (Maehr et al. 1989). However, older-adult females (age $\geq$ 10 years) are less likely to breed than younger females (Hostetler et al. 2009). The mean age of denning females is 4.6 years (FWC 2005). Age at first reproduction for 19 known-aged female panthers averaged 2.2 years and ranged from 1.8 to 3.2 years. The average elapsed time between successive litters is 19.8 months (FWC 2005). Females that lose their litters generally produce another more quickly; 5 of 7 females whose kittens were brought into captivity successfully produced another litter an average of 10.4 months after the removal (Land 1994).

Panther dens are usually located closer to upland hardwoods, pinelands, and mixed wet forests and farther from freshwater marsh-wet prairie (Benson et al. 2008). Most den sites are located in dense saw palmetto (*Serenoa repens*), shrubs, or vines (Maehr 1990; Shindle et al. 2003, Benson et al. 2008). Den sites are used for 6 to 8 weeks by female panthers and their litters from birth to weaning (Benson et al. 2008). 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: Benson et al. (2009) analyzed survival and cause-specific mortality of subadult and adult Florida panthers. They found that sex and age influenced panther survival. Females survived better than males, and adults older than 10 years survived poorly. Genetic ancestry strongly influenced annual survival of subadults and adults after introgression, as F_1 generation admixed panthers survived longer than pre-introgression panthers and non-F_1 admixed individuals (Benson et al. 2009).

Mortality records for uncollared panthers have been kept since February 13, 1972, and for radio-collared panthers since February 10, 1981. Through June 1, 2011, 316 mortalities have been documented (FWC 2011). As reported by Benson et al. in 2009, intraspecific aggression was the leading cause of mortality for panthers (35%) and was more common for males than females. Older-adult males had significantly higher mortality and sub-adult males had marginally higher mortality due to intraspecific aggression than prime-adult males (Benson et al. 2009). Although not common, aggressive encounters between males and females have resulted in the death of the female. Defense of kittens and/or a kill is suspected in half of the known instances where a male killed a female (Shindle et al. 2003).

Following intraspecific aggression, the greatest causes of mortality for radio-collared Florida panthers were from unknown causes, vehicles, and other reasons (Benson et al. 2009). From February 13, 1972, through March 24, 2011, 162 radio-collared and uncollared Florida panthers

were hit by vehicles (FWC 2011). Nine of the collisions were not fatal. The number of panther/vehicle collisions per year tracks very closely the annual documented panther count (McBride et al. 2008).

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. Male panthers are considered adult residents if they are older than 3 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; FWC 2005). Maehr et al. 1991 suggested, "Successful male recruitment appears to depend on the death or home range shift of a resident adult male." Turnover in the breeding population is low with documented mortality in radio-collared panthers being greatest in subadult and non-resident males (Maehr et al. 1991; Shindle et al. 2003).

Den sites have been visited since 1992 and the kittens tagged with passive integrated transponder (PIT) chips. Annual survival of these kittens has been determined to be about 33 percent (Hostetler et al. 2009). There was no evidence that survival rate differed between male and female kittens or was influenced by litter size. (Hostetler et al. 2009) found that kitten survival generally increased with degree of admixture with introduced Texas pumas and decreased with panther abundance. Kitten survival is lowest during the first 3 months of their lives (Hostetler et al. 2009).

Dispersal: Panther dispersal begins after a juvenile becomes independent from its mother and continues until it establishes a home range. Maehr et al. (2002a) showed dispersal distances are greater for males (n = 18) than females (n = 9) (42.5 mi verses 12.6 mi, respectively). The maximum dispersal distance was recorded for a young male, 139.2 mi over a 7-month period followed by a secondary dispersal of 145 mi. Comiskey et al. (2002) calculated that males disperse an average distance of 25 mi while females typically remain in or disperse short distances from their natal ranges. Female dispersers are considered philopatric because they usually establish home ranges less than 1 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 on average at 14 months for both sexes, but males disperse longer in time than females (9.6 months and 7.0 months, respectively) (Maehr et al. 2002a). Dispersing subadult males usually go through a transient (non-resident) period, moving through the fringes of the resident population and often occupying suboptimal habitat until an established home range becomes vacant (Maehr 1997).

Most 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 to 328 ft),

channelized river, probably is not a significant barrier to panther movements, but the combination of the river, SR 80 and land uses along the river seems to restrict panther dispersal northward (Maehr et al. 2002a). Documented physical evidence of at least 15 uncollared male panthers has 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 six radio-collared panthers monitored between 1985 and 1990 averaged 128,000 ac for resident adult males and 48,000 ac for resident adult females; transient males had a home range of 153,599 ac (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 to 2000 and found resident males had a mean home range of 160,639 ac and females had a mean home range of 97,920 ac. 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 to 293,759 ac, averaging 89,600 ac for 20 resident adult males and 44,160 ac for 32 resident adult females (Land et al. 1999; Shindle et al. 2000, 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 for females ($n = 11$) and 62,528 ac for males ($n = 11$) (FWC 2005). The average home range was 35,089 ac for resident females ($n = 6$) and 137,143 ac ($n = 5$) 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, Personal Communication, 2005). Home range overlap is extensive among resident females and limited among resident males (Maehr et al. 1991).

Activity levels 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. 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 movements of 12 mi are not uncommon (Maehr et al. 1990a).

Intraspecific Interactions: Interactions between panthers occur indirectly through urine markers or directly through contact. Urine markers are made by piling ground litter using a backwards-pushing motion with the hind feet. This pile is then scent-marked with urine and occasionally feces. Both sexes make urine markers; 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 males and females last from 1 to 7 days and usually result in pregnancy (Maehr et al. 1991). Independent subadult males have been known to associate for several days without being aggressive. Aggression between males is the most common cause of male mortality and an important determinant of male spatial and recruitment patterns based on radio-telemetry (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 prey species are white-tailed deer and feral hog (*Sus scrofa*) (Maehr et al. 1990b; Dalrymple and Bass 1996). Generally, feral hogs constitute the greatest biomass consumed by panthers north of the Alligator Alley section of I-75, while white-tailed deer are the greatest biomass consumed to the south (Maehr et al. 1990b). Secondary prey includes raccoons (*Procyon lotor*), nine-banded armadillos (*Dasypus novemcinctus*), marsh rabbits (*Sylvilagus palustris*) (Maehr et al. 1990b) and alligators (*Alligator mississippiensis*) (Dalrymple and Bass 1996). No seasonal variation in diet has been detected. Maehr et al. (1990b) documented domestic livestock infrequently in scats or kills, although cattle were readily available on their study area. Recently, a male, believed to be associated with calf depredations, was captured and collared in eastern Collier County (FWC 2010).

Little information on feeding frequency is available. However, the feeding frequency of the panther is likely similar to the puma. Ackerman et al. (1986) reported that a resident adult male puma generally consumes one deer-sized prey every 8 to 11 days. Moreover, a female puma will consume one deer-sized prey item every 14 to 17 days for a resident female and one deer-sized prey item every 3.3 days for a female with three 13-month-old kittens.

Infectious Diseases, Parasites, and Environmental Contaminants:

Panthers are affected by a variety of 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 was negative from 1978 (when testing began) 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 to 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. The exposures were apparently self-limiting and did not result in any known mortalities. Positive antibody results, in the absence of an active infection, indicate that panthers can be exposed and overcome the infection (Cunningham 2005). Genetic analysis of the panther FeLV determined that the source of this outbreak was a cross-species transmission from a domestic cat (Brown et al. 2008).

Management of the disease includes vaccination (Cunningham et al. 2008) 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 (Cunningham et al. 2008). No new positive cases have been diagnosed since July 2004; however, the potential for reintroduction of the virus remains (Cunningham et al. 2008).

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 radio-collared panther has also died of rabies (Taylor et al. 2002).

Feline immunodeficiency virus (FIV) is a retrovirus of felids that is endemic in the panther population. About 28 percent of 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) panthers tested positive (M. Cunningham, FWC, unpublished data). 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 Everglades National Park (ENP) (Roelke 1991). One individual panther had mercury concentrations of 150 parts per million (ppm) in its hair (Land et al. 2004). Elevated levels of the persistent DDT metabolite, p, p'-DDE (1,1-dichloro-2,2-bis(p-chlorophenyl)ethylene) were also detected in fat from that panther. The role of mercury and/or p, p'– DDE in this panther's death is unknown and no cause of death was determined despite extensive diagnostic testing. Elevated mercury concentrations have also been found in panthers from Florida Panther National Wildlife Refuge (FPNWR). Two sibling neonatal kittens from this area had hair mercury concentrations of 35 and 40 ppm. Although other factors were believed to have been responsible, these kittens did not survive to leave their natal den. Other environmental contaminants found in panthers include polychlorinated biphenyls (Arochlor 1260) and other organochlorines (Dunbar 1995; Land et al. 2004).

Population dynamics / status and distribution

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

Although generally considered unreliable, sightings regularly occur throughout the southeast. However, no reproducing populations 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 radio-telemetry locations recorded between 1981 and 2004 clearly define the 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 the breeding 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 signs (*e.g.*, tracks, urine markers, scats), camera-trap photographs, seven highway mortalities, four radio-collared animals, two captured animals (one of which was radio collared), 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, Charlotte, and Volusia) north of the river (Belden et al. 1991; Belden and McBride 2005). However, no evidence of a female or reproduction has been documented north of the Caloosahatchee River since 1973 (Nowak and McBride 1974; Belden et al. 1991; Land and Taylor 1998; Land et al. 1999; Shindle et al. 2000; McBride 2002; Belden and McBride 2005).

Population size

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 et al. (1986a) determined that all resident puma, 78 percent of transient puma, and 57 percent of kittens could be detected by track searches in Utah. During 2 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, Professional Tracker-Houndsman, personal communication 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 "there could be as few as 10 individuals panthers in the area around Lake Okeechobee and southward in the State" (Nowak and McBride 1975). This initial survey, while brief in nature, proved 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 1983; Belden et al. 1991).

Using a population genetics approach, Culver et al. (2008) estimated that to reduce the microsatellite variation to that seen in the Florida panther, a very small bottleneck size of approximately two animals (N_e) for several generations and a small effective population size (N_e) in other generations would be necessary. Using demographic data from Yellowstone pumas, Culver et al. (2008) estimated the ratio of effective (N_e) to census (N) population size to be 0.315 (N_e)/N). Using this ratio, they determined for the Florida panther, the census population size necessary to explain the loss of microsatellite variation was approximately 41 (0.315=12.9/41) for the non-bottleneck generations and 6.2 (0.315=1.95/6.2) for the two bottleneck generations.

Minimum Population Counts - McBride et al. (2008, 2010) reported minimum population counts (*i.e.*, number known alive) based on physical evidence (*e.g.*, tracks, urine markers, panther treed with hounds, trail-camera photos). They counted adult and subadult panthers, but not kittens at the den. Three rules were used to distinguish individuals. (1) Gender was determined by track size or stride length; (2) time (freshness) was determined by known events within the past 24 hours, such as wind or rain; and (3) distance between individual track sets. These rules were used as an exclusionary tool to avoid over-counting (McBride et al. 2008). The number of panthers detected and verified by physical evidence from 1981 to 1994 fluctuated between a high of 30 and a low of 19 adult and juvenile panthers, with the lowest point occurring in 1991 following the removal of seven juveniles and three kittens to initiate a captive breeding program (McBride et al. 2008). In 1995, eight female pumas from Texas were released to address suspected deleterious effects of inbreeding. From 1996 to 2003, the panther population was increasing at a rate of 14 percent per year with 26.6 kittens being produced annually (Johnson et al. 2010). The effective population size (N_e) rose from 16.4 in 1995 to 32.1 in 2007 with a corresponding

census populations (N) of 26 and 102, respectively. The corresponding N_e/N ratios were 0.631 and 0.314 (Johnson et al. 2010). The deterministic annual growth rate (λ) for pre-1995 panthers was 0.952 ± 0.026 (SE), suggestive of a shrinking population (Hostetler et al. 2009). However, the λ for the overall population now is 1.052 ± 0.023 suggestive of a growing population (Hostetler et al. 2009).

The population has tripled since 1995 (McBride et al. 2008, Johnson et al. 2010), reaching a high of 117 by 2007 (mortalities not subtracted) (McBride et al. 2008). Data reported in McBride (2000, 2001, 2004, 2006, 2007, and 2008), McBride et al. (2008, 2010), Johnson et al. (2010), and FWC (2002, 2003) noted minimum population counts of 62 panthers in 2000, 78 in 2001, 80 in 2002, 87 in 2003, 78 in 2004, 82 in 2005, 97 in 2006, 117 in 2007, 104 in 2008, 113 in 2009, and 115 in 2010.

Population Density - Maehr et al. (1991) provided an estimate of population density of 1 panther per 27,520 ac based on 17 concurrently radio-collared and 4 uncollared panthers. They extrapolated this density to the area occupied (1,245,435 ac) by radio-collared panthers during the period 1985 to 1990 to achieve a population estimate of 46 adult panthers for southwest Florida (excluding ENP, eastern 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. Kautz et al. (2006) provided a density estimate of 1 panther per 31,923 ac by dividing the panther count at that time (67) by the area within the Primary Zone. However, panther densities are variable across the landscape. Using an average of the 2007 to 2009 panther counts in the eight survey units covered by McBride et al. (2008) and Kautz et al. (2006), the density estimates range from a low of one panther per 81,479 ac to a high of one panther per 7,850 ac for the primary zone lands within these survey units.

The FWC (2010) calculated an upper bound population estimate of 0.0177 panthers per square-kilometer (km^2) or one panther per 13,929 ac. Applying this density estimate to the Primary Zone (9,189 km^2) (2,270,652 ac) yields an upper estimate of 163 adult panthers. FWC's lower boundary limit is 100 panthers (1.09 panthers per 100 km^2 or 1 panther per 22,707 ac) and is based on annual verified panther sign data (McBride et al. 2008) and minimum number of panthers known to be alive. Applying the four densities to the Primary zone would yield a population from Kautz et al.'s (2006) density estimate of 71 panthers (1 panther per 31,923 ac). Maehr et al.'s (1991) estimate would yield a population of 83 panthers (1 panther per 27,520 ac) and FWC's (2010b) estimate would yield a low of 100 panthers (1 panther per 22,707 ac) and a high of 163 panthers (1 panther per 13,929 ac). For our evaluations however, the Service is continuing to use the average densities provided by Kautz et al. (2006) of one panther per 12,919 ha (31,923 ac) or one panther per 129 km^2.

Habitat characteristics/ecosystem

Landscape Composition - Noss and Cooperrider (1994) considered the landscape implications of maintaining viable panther populations. Assuming a male home range size of 137,599 ac (Maehr

1990), an adult sex ratio of 50:50 (Anderson 1983), and some margin of safety, they determined that a reserve network as large as 15,625 - 23,438 mi^2 would be needed to support an effective population size of 50 individuals (equating to an actual adult population of 100 to 200 [Ballou et al. 1989]). However, to provide for long-term persistence based on an effective population size of 500 individuals (equating to 1,000 to 2,000 adults [Ballou et al. 1989]), could require as much as 156,251 - 234,376 mi^2. This latter acreage corresponds to roughly 60 to 70 percent of the panther's historical range. Although it is uncertain whether this much land is needed for recovery, it does provide some qualitative insight into the importance of habitat conservation across large landscapes for achieving a viable population (Noss and Cooperrider 1994).

Between 1981 and 2010, more than 90,000 locations were collected from more than 180 radio-collared panthers (FWC 2010). The most recent capture and collar event was associated with the capture and collar of a male thought to be associated with recent calf depredations in eastern Collier County (FWC 2010). Belden et al. (1988), Maehr et al. (1991), Maehr and Cox (1995), Maehr (1997), Kerkoff et al. (2000), Comiskey et al. (2002), Cox et al. (2006), and Kautz et al. (2006) provide information on habitat use based on various subsets of these data. Since almost all locations from radio collars have been collected during daytime hours (generally 0700 to 1100), using very high frequency (VHF) aerial telemetry, and because panthers are most active during nocturnal and crepuscular periods (Maehr et al. 1990a), daytime telemetry data may be insufficient to describe habitat use patterns of nocturnal animals (Beyer and Haufler 1994; Comiskey et al. 2002; Beier et al. 2003; Dickson et al. 2005; Beier et al. 2006). However, Land et al. (2008) investigated habitat selection of 12 panthers in the northern portion of the breeding range using Global Positioning System (GPS) telemetry data collected during nocturnal and diurnal periods as well as VHF telemetry data collected only during diurnal periods and found that analysis of both types of telemetry data yielded similar results.

Panther Zones - A landscape-level strategy to conserve the panther population in South Florida was developed using a potential habitat model based on the following criteria: (1) forest patches greater than 4.95 ac; (2) non-urban cover types within 656 ft of forest patches; and (3) exclusion of lands within 984 ft of urban areas (Kautz et al. 2006). In developing the model, radio-telemetry data collected from 1981 through 2000 were used to identify important land cover types. 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 important to the long-term viability and persistence of the panther in the wild; (2) Secondary Zone – lands contiguous with the Primary Zone that could be restored to accommodate population expansion and (3) Dispersal Zone – the area which may facilitate future panther expansion north of the Caloosahatchee River (Kautz et al. 2006) (Figure 5). The Primary Zone is currently occupied and supports the breeding population. The Secondary Zone could support resident panthers with sufficient restoration. Although panthers move through the Dispersal Zone, it is not currently occupied by resident panthers.

These zones vary in size, ownership, and land cover composition. The Primary Zone is 2,270,711 ac in size; 73 percent is publicly owned (Kautz et al. 2006) including portions of the Big Cypress National Preserve (BCNP), ENP, Fackahatchee Strand Peserve State Park (FSPSP),

FPNWR, Okaloacoochee Slough State Forest, and Picayune Strand State Forest (PSSF). 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 in size, and 38 percent is publicly owned (Kautz et al. 2006). 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 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 habitat, in addition to the average density estimate of one panther per 27,181 ac developed by Maehr et al. (1991), Kautz et al. (2006) estimated the average density during the timeframe of the study, based on telemetry and other occurrence data, to average one panther per 31,923 ac. 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 value (Kautz et al. 2006) and the higher number is based on the 27,181 ac value (Maehr et al. 1991).

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

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

Even though some suitable habitat remains in south-central Florida, it is widely scattered and fragmented (Belden and McBride 2005). Thatcher et al. (2006, 2009) 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 population. They identified four potential habitat patches: the Avon Park Bombing Range area, Babcock-Webb Wildlife Management Area, eastern Fisheating Creek Wildlife Management Area, and the Duette Park/Manatee County area. These habitat patches are smaller and more isolated compared with the current panther range, and the landscape matrix where these habitat patches exist provides relatively poor habitat connectivity among the patches (Thatcher et al. 2006, 2009). 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).

Panther Habitat Use - Radio-collar data and ground tracking indicate that panthers use the mosaic of habitats available to them as resting and denning sites, hunting grounds, and travel routes. The majority of telemetry locations (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; Cox et al. 2006; Kautz et al. 2006; Land et al. 2008) and natal den sites (Benson et al. 2008) were within or close to forested cover types, particularly cypress swamp, pinelands, hardwood swamp, and upland hardwood forests. Global Positioning System (GPS) data have shown that panthers (n = 12) use all habitats contained within their home ranges by selecting for forested habitat types and using all others in proportion to availability (Land et al. 2008).

Kautz et al. (2006) found the smallest class of forest patches (*i.e.*, 9 to 26 ac [3.6 to 10.4 ha]) were the highest ranked forest patch sizes within panther home ranges. The diverse woody flora of forest edges probably provides cover suitable for stalking and ambushing prey (Belden et al. 1988; Cox et al. 2006). Also, a dense saw palmetto understory provides some of the most important resting and denning cover (Maehr 1990; Benson et al. 2008). Shindle et al. (2003) estimated that 73 percent of dens were in saw palmetto thickets.

Prey Habitat Use - Panther habitat selection is related to prey availability (Janis 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 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 in pine forest, 1/299 ac in swamps, 1/1,280 ac in prairie, 1/250 ac in marshes, and 1/111 ac in hammocks. Schortemeyer et al. (1991) estimated deer densities at 1/49-247 ac in three management units of BCNP based on track counts and aerial surveys. Labisky et al. (1995) reported 1/49 ac in southeastern BCNP. Using track counts alone, McCown (1994) estimated 1/183 to 225 ac on the FPNWR and 1/133 to 200 ac 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. Other vegetation types (*e.g.*, marshes, rangeland, and low-intensity agricultural areas) can support high deer densities. In the Everglades, for example, deer appear to be adapted to a mosaic of intergrading patches comprised of wet prairie, hardwood tree islands, and peripheral wetland habitat (Fleming et al. 1994; Labisky et al. 2003). High-nutrient deer forage, especially preferred by females, includes hydrophytic marsh plants, white waterlily (*Nymphaea odorata*), and swamp lily (*Crinum americana*) (Loveless 1959; Labisky et al. 2003). Wetland willow (*Salix spp.*) thickets also provide nutritious browse for deer (Loveless 1959; Labisky et al. 2003). However, the importance of these habitat types to panthers is dependent upon the availability of stalking and ambush cover.

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

Travel and Dispersal Corridors - In the absence of direct field observations/measurements, Harrison (1992) suggested 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 to 10.9 mi (9.8 to 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 to 4 mi (1 to 7 km) should be more than 1,312 ft (400 m) wide. The Dispersal Zone encompasses 44 mi^2 (113 km^2) with a mean width of 3.4 mi (5.4 km). Although it is not adequate to support even one resident 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 males currently utilize this zone as they disperse northward into south-central Florida.

Panther Habitat Evaluation and Compensation

Population Viability Analysis (PVA) has emerged as a key component of endangered species conservation. This analysis incorporates demographic information into models that predict a population's likelihood of persisting in the future. PVAs incorporate deterministic and stochastic events, including demographic and environmental variation and natural catastrophes. PVAs have been criticized as being overly optimistic about future population levels (Brook et al. 1997) and should be viewed with caution. However, they have been shown to be 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. 1988; Fieberg and Ellner 2000).

Shaffer (1981) originally defined a viable population as follows: "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).

From 1981 through June 2010, 182 panthers were radio-collared and monitored on public and private lands throughout South Florida (FWC 2010a). Radio-telemetry data were used to estimate survival rates and fecundity and were incorporated into PVA models (Seal and Lacy 1989, 1992; Cox et al. 1994; Kautz and Cox 2001; Maehr et al. 2002b). These models incorporated a range of different parameters such as sex ratios, survival rates, age distributions,

and various levels of habitat losses, density dependence, and intermittent catastrophes or epidemics. The models predicted a variety of scenarios needed to ensure persistence of the population.

Root (2004) developed an updated set of panther PVA models based on RAMAS Geographic Information System (GIS) software. 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 population monitoring (Shindle et al. 2001). All of the 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), which was the approximate population size in 2001 and 2002 (McBride 2001, 2002).

The use of 41 females in the model was based on the best available data when the model was developed. The total of 41 females represents the number of individual panthers documented in surveys by McBride (2001, 2002). While the total of 41 females includes subadults that do not yet breed, it is reasonable to use this total number in modeling to evaluate population trends for several reasons. First, it is not feasible to differentiate between subadults and adults through field observation. Second, although it is possible that some of the 41 females were not breeding in year one of the model, these females would mature to breeding age by year 2 of the model. Third, the Root (2004) model assumed females to have "a 50 percent chance of breeding in a given year," and therefore only half of the 41 females were modeled as breeding each year. The primary reason the model (Root 2004) assumed a 50 percent chance of breeding in a given year is that kittens stay with their mother from 15 to 24 months prior to dispersal. However, this assumption accounts for the likelihood that some of the 41 females would not breed in a given year, including subadult status of some individuals. Fourth, the Service recognizes the McBride data is not intended to provide a total population estimate. Although the Service recognizes population estimates derived through field surveys can be close to the actual population number, they are in fact estimates and are only as good as their assumptions. For these reasons, the Service believes it is reasonable to use the best available count of 41 subadult and adult females as the breeding population for modeling purposes.

Basic PVA 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 with a 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 an earlier, conservative PVA model run done by Seal (1989) 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. Later work based on an improved panther modeling and a larger sample of monitored panthers produced both a moderate and optimistic scenario (Root 2004). The moderate model resulted in a 5 percent probability of extinction and a 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.

Root (2004) also modeled the probability of extinction for 1 percent loss of habitat per year for the first 25 years of the model run based on both the moderate and optimistic scenarios. The 1 percent habitat loss equates to essentially all remaining non-urban privately owned lands in the Primary Zone and corresponds to the estimated rate of habitat loss from 1986 to 1996 for the five southwest counties based on land use changes (Root 2004). For the moderate model, the model runs predict a probability of extinction increase of about 1 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, the 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 that the mean final abundance of females would decrease from 41 to 31 feamles, a 24.3 percent reduction for the moderate model and from 41 to 38 feamles, a 7.3 percent reduction for the optimistic model.

The model runs 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 also 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 the 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.

Root's (2004) moderate model runs, which have a carrying capacity of 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, when applied to the populations predicted by Root's (2004) moderate models, describe the "with habitat loss" population (62 panthers) as barely viable and expected to decline by 25 percent over a 100-year period. The "without habitat loss" population (84 panthers) is likely stable but would still be subject to genetic problems.

As discussed above, the panther population has shown an increase in the number of panthers reported yearly, beginning in 2000. The Service believes McBride's verified population of 97 panthers in 2006, 117 panthers in 2007, 104 in 2008, 113 in 2009, and 115 in 2010 is within Kautz et al.'s (2006) population guidelines representing a population that is likely stable but still may be subject to genetic problems.

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

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 habitat loss is occurring at an estimated 0.8 percent loss of habitat per year (R. Kautz, FWC, personal communication, 2003, as cited in Service 2009). The Service has accounted for some habitat loss and changes in habitat quality within its regulatory program, 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.

Recovery Goals - The recovery objectives identified in the final revision of the Florida Panther Recovery Plan (Service 2008) 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.

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 one of the most important elements to achieving panther recovery. While efforts have been made to secure habitat, 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 the Service, National Park Service, Seminole Tribes of Florida, Miccosukee Tribe of Indians of Florida, FWC, Florida Department of Environmental Protection (DEP), Florida Division of Forestry (FDOF), Water Management Districts, non-governmental organizations, counties, and private landowners.

Public Lands - Between 1944 and the present, approximately 2,756,802 ac of public lands in South Florida have been acquired for the benefit of the Florida panther (Figure 6).

Tribal Lands - Lands of the Seminole Tribe of Florida and Miccosukee Tribe of Indians of Florida encompass over 350,079 ac in South Florida. Of these, 115,840 ac are used by panthers, and comprise 5 percent of the Primary Zone (Kautz 2006). In general, these lands are not specifically managed for the panther and are largely in cultivation. However, in 2007, the Seminole Tribe of Florida reserved about 4,144 ac within the Big Cypress Seminole Indian Reservation Native Area, an area encompassing about 14,724 ac, specifically for the benefit of the Florida panther. The remaining native area, about 10,580 ac, although not specifically managed for the Florida panther, provides high quality value habitat for the Florida panther and panther prey species.

Private Lands - A variety of Federal, State, and private incentive programs are available to assist private landowners and other individuals with the protection and management of wildlife habitat. Voluntary agreements, estate planning, conservation easements, land exchanges, and mitigation banks are all methods for conserving private lands. In 1954, the National Audubon Society established the nearly 10,880-acre 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 for purchase by the Florida Forever Program are used by panthers (e.g., Devil's Garden, Half Circle F Ranch, Pal Mal, and Panther Glades). North of the Caloosahatchee River, the Fisheating Creek Conservation Easement consists of 41,600 ac in Glades County and is a private holding used by dispersing male panthers.

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 regulation of hunting and Off-Highway Vehicle (OHV) use.

Responses 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 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). However, depending upon the frequency and effects upon upland habitat communities, prescribed fire may alter the vegetation structure and composition that are necessary for panther den sites (Maehr and Larkin 2004). Responses of puma to logging activities (Van Dyke et al. 1986b) indicate they generally avoid areas within their home range with intensification of disturbance.

Panthers may be disturbed by recreational use of public lands. Maehr (1990) reported indirect human disturbance of panthers may include activities associated with hunting and 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 OHV 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 OHV trails during the hunting season.

Transportation - Roads and highways adversely affect the Florida panther. The construction of new roads and the widening of existing roads can result in the direct loss of wildlife habitat (Fornan et al. 2003). Moreover, disturbance resulting from motorized vehicles may cause panthers to avoid busy roads. Maher (1990) reported that female panthers are less likely to cross busy highways. Consequently, roads may act as barriers affecting panther movement and fragmenting panther habitat. Panthers are also injured or killed due to collisions with motorized vehicles when attempting to cross highways, and the potential for collisions increases as traffic increases. Adverse effects from roads and highways are a threat to the panther population.

Collisions with motor vehicles on highways are a significant source of panther mortality. As discussed above, the FWC documented 157 vehicle-related mortalities and 5 vehicle-related injuries from 1972 to the present on highways in South Florida (FWC 2011). In portions of the panther's range, the rate of vehicle-related mortalities may be increasing. Smith et al. (2006) found vehicle-related panther mortalities in Collier County have increased by a factor of four from 2000 to the present compared to previous decades. This increase in mortality is likely related to the increase in traffic from Collier County's population growth. Unfortunately, the effect of vehicle-related mortality on the existing panther population is largely unknown.

Wildlife underpasses, or crossings, can be constructed within highway corridors to reduce the potential for panther injuries and mortalities resulting from vehicle collisions. Underpasses allow panthers and other wildlife to safely cross under busy roadways, and maintain connectivity and gene flow within the panther population. Underpasses usually consist of a bridge, prefabricated concrete box, or culvert (Fornan et al. 2003). Effective crossing structures are large enough to allow passage and include adequate wing fencing to funnel panthers to the crossing site. Crossings should be designed so panthers have an unobstructed view of habitat on the opposite side of the underpass (Foster and Humphrey 1995). The status of lands adjacent to the crossing site should also be considered when determining the location of a crossing. Unprotected private lands adjacent to the crossing could be developed and render the crossing unviable. Accordingly, lands adjacent to crossings should be acquired or placed under a conservation easement or other protective covenant to ensure the crossing will function in perpetuity.

A number of wildlife crossings with associated fencing have already been constructed within major roadways in South Florida to benefit the panther and other wildlife species. In 1991, the FDOT finished the construction of 28 wildlife crossings within I-75 corridor from U.S. Highway 27 to just west of Everglades Boulevard. A total of five vehicle-related panther mortalities were documented within this corridor prior to construction of the crossings. Following construction of the crossings, a total of four vehicle-related panther mortalities (all in 2009) were recorded in the corridor from 1991 to the present. For three of these mortalities, it appears that the panther had entered the I-75 right-of-way through gaps in the fence at existing roadway intersections. The FDOT recently constructed three wildlife crossings on U.S. Highway1 between Florida City and Key Largo. Wildlife crossings represent a commendable effort by the FDOT and others to reduce panther deaths resulting from collisions with motor vehicles. However, more crossings are needed within the major roadways of South Florida to further reduce this threat to the panther and other wildlife species (Smith et al. 2006).

Accordingly, recent studies have been conducted to identify locations for wildlife crossings in South Florida. Swanson et al. (2005) used a LCP modeling approach to identify the most likely travel routes for panthers among six major use areas in southwest Florida. LCP modeling takes into consideration elements in the landscape that permit or impede panther movement when traveling. Swanson et al. (2005) identified 20 key highway segments where LCPs intersected improved roadways. Smith et al. (2006) studied the movements of the panther, the Florida black bear, and other wildlife species along SR 29, CR 846 and CR 858 in Collier County, Florida. Data analyzed in the study were obtained from roadkill and track surveys, infra-red camera monitoring stations, existing data provided by the FWC (radio telemetry and vehicle mortality reports), and other studies. Smith et al. (2006) recommended that new wildlife crossings be considered at various sites along these roadways to reduce vehicle-related mortality of panthers and other wildlife species, and increase connectivity among wildlife populations. The Service continues to work with the FDOT, county road departments, and other entities to ensure that need wildlife crossings are installed as needed to promote safe passage of panthers and other wildlife across roadways.

Panther habitat assessment:

The Service developed a Panther Habitat Assessment methodology (Appendix A) and refugia design in 2003 (revised in 2009) to help guide the agency in evaluating permit applications for projects that could affect panther habitat (see discussion below). This 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 the development of this methodology, the Service, from March 1984 through August 2003, concluded consultation on 43 projects involving the panther and habitat preservation. The minimum expected result of these projects is impacts to 71,650 ac and the preservation of 14,677 ac of panther habitat. Of the 71,650 ac of impacts, 38,932 ac are due to agricultural conversion and 32,718 ac to development and mining. Portions (10,370 ac) of the largest agricultural conversion project, 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 Comprehensive Everglades Restoration Plan (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 through the date of this BO, the Service concluded consultations on 103 development projects affecting 25,107 ac with preservation of 27,337 ac. Following our refugia design assessment approach, the projects affected 13,074 ac in the Primary Zone, 7,475 ac in the Secondary Zone, and 4,558 ac in the Other Zone. Compensation provided included 24,767 ac in the Primary Zone, 272 ac in the Secondary Zone, 652 ac in the Dispersal Zone, and 1,646 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. The functional habitat value of these lands, using our Panther Habitat Assessment methodology (Appendix A), showed a PHU loss from development of 110,492 primary equivalent PHUs, with a corresponding PHU preservation and enhancement complement of 218,269 primary equivalent 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.

South Florida panther population goal - Although the Service supports Kautz et al.'s (2006) guideline 4 "that a population greater than 240 panthers have a high probability of persistence for 100 years and are demographically stable and large enough to retain 90 percent of original genetic diversity," we believe, for the southwest Florida population, Kautz et al.'s (2006) guideline 3 is a more appropriate threshold. The support for this guideline is that there is an insufficient acreage of non-urban lands, based on Kautz et al.'s (2006) average density value of 31,923 ac per panther, available in southwest Florida south of the Caloosahatchee River for a panther population of 240 animals. However, based on Kautz et al.'s (2006) average density value, sufficient lands are available for a population of 80 to 100 panthers. This size population does not meet the full recovery goals in the Service's Florida Panther Recovery Plan (Service 2006, 2008). However, based on Kautz et al.'s (2006) evaluation, a population of 80 to 100 would provide a population that is likely stable, still subject to genetic problems and would be consistent with objective (1) of the Service's Florida Panther Recovery Plan (Service 2006, 2008), which is to maintain, restore and expand the population and its habitat in South Florida and, if feasible, expand the known occurrence of panthers north of the Caloosahatchee River to maximize the probability of long-term persistence of this metapopulation.

The Service proposes to achieve this landscape scale effort 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 landscape scale effort, based on Kautz et al. (2006) average density of 31,923 ac per panther is 2,553,840 ac for 80 panthers or 3,192,300 ac for 100 panthers.

The principal regulatory mechanism that allows the Service to work directly with private landowners 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 on panthers in accordance with their 7a(1) responsibilities under the Act, developed the panther interim Standard Local Operating Procedures for Endangered Species (SLOPES) (Service 2000)(update in 2007) (Service 2007b). The document is available on the Corps' web site at: http://www.saj.usace.army.mil/regulatory/what/species/panther.htm

The panther SLOPES provide guidance to the Corps for assessing project effects to the panther and recommends actions to minimize these effects. The panther SLOPES also includes a consultation area map that identifies an action area where the Service believes land alteration projects may affect the 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 habitat usage. Specifically, we have received two documents the Service believes reflect the most likely 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 clarified the boundaries of the Map to better reflect areas where panthers predominate (Figure 5) and refer to these areas cumulatively as the Panther Focus Area (Service 2006). As part of this review, we also made revisions in coordination with the Corps to components in the SLOPES documents that address actions that can be taken by the Service, Corps, and project applicants that may benefit panthers and minimize effects from proposed actions (Service 2006).

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

Thatcher et al. (2006) developed a habitat model using home ranges in South Florida to identify 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 south of the Caloosahatchee River is divided into Primary, Secondary, and Dispersal Zones, and north of the Caloosahatchee River into the Primary Dispersal/Expansion Area. These zones are defined as follows:

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

Secondary Zone: These lands are contiguous with the Primary Zone, and although they are used to a lesser extent, 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: Marked panthers have been documented using a known corridor between the Panther Focus Area south of the Caloosahatchee River and the Panther Focus Area north of the Caloosahatchee River. This Zone may facilitate dispersal and future population expansion to areas north of the Caloosahatchee River (Kautz et al. 2006).

Primary Dispersal/Expansion Area: This area is located within the Fisheating Creek/Babcock-Webb WMA 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.

"Other" Zone - The Service also consults on lands outside of the Primary, Secondary, and Dispersal Zones that may affect panthers, such as agricultural lands 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 panther, identified three categories of lands, *i.e.,* Primary Zone, Secondary Zone, and Dispersal Zone, and documented the relative importance of these lands to the panther. These lands, generally referred to as Kautz et al.'s panther core lands, include the majority of the home ranges of the current population of the panther. The Service, in our evaluation of habitat needs for the 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. (2006) panther core lands and represent the lands within the Service's 2000 consultation area boundary south of the Caloosahatchee River as shown in Figure 5. These lands (core lands and other zone lands) together are referred to by the Service as the Panther Core Area. The "Other" Zone lands, as well as the lands within the Secondary Zone, provide less landscape benefit to the panther than the Primary and Dispersal Zones, but are important as a component of our strategy 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 strategy 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) 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 these values, the habitat value of the Secondary Zone is roughly 69 percent (4.79/6.94=0.69) of the Primary Zone, and restoration is needed to achieve landscape function. Using this assessment, the 503,481 ac of Secondary Zone lands equate to 347,402 ac of Primary Zone equivalent lands. Dispersal Zone lands are considered equivalent to Primary Zone lands with a 1 to 1 value.

At-risk lands in the Other Zone total 819,995 ac. Actions on some of the Other Zone lands, such as actions in areas that have already been urbanized, will in most situations not have an impact on panthers or their habitat. We are considering within the Other Zone lands, these types of actions will account for 20 percent of the available lands and actions on the remaining 80 percent of available lands may have an impact on panthers and could affect our southwest panther population strategy. We will monitor this consideration carefully as we review proposed actions within the Other Zone. To estimate the ac of Primary Zone equivalent lands the 819,995 ac of Other Zone lands represent, we applied the 80 percent factor and the 33 percent factor to the available ac, which equal 216,479 ac of Primary Zone equivalent lands (819,995 x 0.8 x 0.33 = 216,479).

Landscape Preservation and Compensation Recommendations:

The Service recognizes the need for a landscape level conservation and compensation strategy to ensure the continued existence of the panther.

Land Preservation Needs - The Service appointed a Florida Panther Subteam (Subteam) in February 2000 to further refine the land preservation needs and to specifically develop a landscape-level strategy for the conservation of the population. The results of this collaborative effort are partially presented in Kautz et al. (2006). One of the primary goals was to identify strategically located lands containing sufficient area and appropriate land cover types to ensure the long-term survival of the south population. Kautz et al. (2006) focused their efforts on the area south of the Caloosahatchee River, where the reproducing population currently exists. Kautz et al. (2006) created an updated potential habitat model based on the following criteria: (1) forest patches greater than 4.95 ac; (2) non-urban cover types within 656 ft of forest patches; and (3) exclusion of lands within 984 ft of urban areas. The potential habitat map was reviewed in relation to telemetry data, recent satellite imagery (where available), and home range polygons. Boundaries were drawn around lands defined as the Primary Zone (Figure 5), defined as the most important area needed to support a self-sustaining 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 5), defined as the area capable of supporting the population in the Primary Zone, but where habitat restoration may be needed (Kautz et al. 2006).

Kautz et al. (2006) also identified, through an LCP 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 LCP models and identify optimum panther dispersal corridor(s). The LCP models operated on a cost surface that ranked suitability of the landscape for use by dispersing panthers with lower scores indicating a higher likelihood of use. Those dispersal routes connecting lands between the Panther Focus Area south of the Caloosahatchee River and the Panther Focus Area north of the Caloosahatchee River were defined as the Dispersal Zone (Figure 5) (Kautz et al. 2006). Land preservation in this zone is important for the survival and recovery of the panther, as these lands are the dispersal pathways for expansion of the population. The Primary Zone covers 2,270,590 ac; the Secondary Zone covers 812,104 ac; and the Dispersal Zone covers 27,883 ac; providing a total of 3,110,578 ac (Kautz et al. 2006).

As part of their evaluation of occupied habitat, in addition to the average density estimate of one panther per 27,181 ac 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 one panther per 31,923 ac. In the following discussions of panther numbers a particular zone may support, the lower number is based on the 31,923 ac value (Kautz et al. 2006) and the higher number is based on the 27,181 ac value (Maehr et al. 1991).

Based on these average densities, the Primary Zone could support 71 to 84 panthers; the Secondary Zone could support 8 to 10 panthers without habitat restoration and 25 to 30 panthers with habitat restoration (existing high quality panther habitat currently in the Secondary Zone is estimated at 32 percent of the available Secondary Zone lands); and the Dispersal Zone could support 0 panthers. Taken together, the three zones in their current condition apparently have the capacity to support about 79 to 94 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 - Our process to determine compensation recommendations for project affects that cannot be avoided in both our section 7 and section 10 consultations is based on the amount and quality of habitat that we believe is necessary to support a population of 90 panthers in South Florida. To achieve our landscape scale effort to locate, preserve, and restore lands containing sufficient area and appropriate land cover types to ensure the long-term survival of panthers south of the Caloosahatchee River, the Service chose the midpoint (90 panthers) of Kautz et al.'s (2006) population guidelines that a population of 80 to 100 panthers is likely to be stable through 100 years, although subject to genetic problems. 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.

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. The combined acreage of lands within the Primary, Dispersal, and Secondary Zones is 3,110,577 ac (Kautz et al. 2006). Currently, 2,073,865 ac of Primary Zone equivalent lands are preserved (Table 5), and 799,205 additional ac are needed to support a population of 90 panthers in South Florida (2,873,070 - 2,073,865 = 799,205).

The equivalent values for Primary, Secondary, Dispersal Zones 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 and in Appendix A.

Analysis of the species likely to be affected

The panther is an endangered animal restricted to two to three million ac 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 also 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.

Other species within the action area

Wood Stork

Wood storks are known to forage in suitable wetlands outside breeding colony core foraging areas, including the project sites. However, the proposed project site is not located within the core foraging area (within 18.6 mi) of an active wood stork breeding colony. Further, much of the wetlands to be impacted by this project are unsuitable for foraging by wood storks. ACI's consultant conducted a functional assessment of the 23.1 ac (18.3 ac associated with the mining proposal and 4.8 ac associated with the agricultural proposal) of wood stork foraging habitat lost due to the projects, considering the preservation and enhancement of about 1,522 ac of wetlands on-site (Tables 7 to 11). The functional assessment was based on the Service's wood stork foraging habitat methodology (Service 2010c). The 23.1 ac of wetlands lost due to the projects

provide an estimated 31.9 kg of forage biomass (Table 13). The loss of potential wood stork foraging habitat attributable to the proposed projects has been offset by the preservation and enhancement of about 1,552.7 ac of adjacent wetlands, which provide an increase in wood stork suitable foraging biomass of about 1,557 kg. The enhancement of the preserve more than offsets the additional 31.9 kg of biomass associated with the proposed wetland impacts. Moreover, 100 percent of the proposed preserve area is short hydroperiod wetlands (defined by the Service as Classes 1-3). All potential impacts to wood stork foraging prey base have been fully off-set by the proposed enhancement and preservation activities. Based on the small impacts to wood stork habitat resulting from the projects and the proposed compensation, the Service concurs with the Corps' determination that the project "may affect, but is not likely to adversely affect" the wood stork. Critical habitat has not been designated for the wood stork and will not be affected.

Eastern Indigo Snake

The eastern indigo snake has not been observed on the project site during past resource surveys and operations. During construction, ACI has agreed to follow the Service's *Standard Protection Measures for the Eastern Indigo Snake* (Service 2004), to minimize adverse effects to this species. Based on the protection measures proposed, the Service provided concurrence for the Corps' determination for the eastern indigo snake through our January 25, 2010, effect determination key for the eastern indigo snake (Service 2010b).

In summary, the Service concurs that the proposed agricultural fill and mining are not likely to adversely affect the wood stork and eastern indigo snake. Therefore, these species will not be considered further in this Biological Opinion.

ENVIRONMENTAL BASELINE

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.

Climate change

According to the Intergovernmental Panel on Climate Change Report (IPCC 2007), warming of the earth's climate is "unequivocal," as is now evident from observations of increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising sea level. The IPCC Report (2007) describes changes in natural ecosystems with potential wide-spread effects on many organisms, including marine mammals and migratory birds. The potential for rapid climate change poses a significant challenge for fish and wildlife conservation. Species' abundance and distribution is dynamic, relative to a variety of factors, including climate. As climate changes, the abundance and distribution of fish and wildlife will also change. Highly specialized or endemic species are likely to be most susceptible to the stresses of changing

climate. Based on these findings and other similar studies, the Department of the Interior requires agencies under its direction to consider potential climate change effects as part of their long-range planning activities (Service 2007a).

Climate change at the global level drives changes in weather at the regional level, although weather is also strongly affected by season and by local effects (*e.g.*, elevation, topography, latitude, proximity to the ocean). Temperatures are predicted to rise from 2°C to 5°C for North America by the end of this century (IPCC 2007). Other processes to be affected by this projected warming include rainfall (amount, seasonal timing and distribution), storms (frequency and intensity), and sea level rise. However, the exact magnitude, direction and distribution of these changes at the regional level are not well understood or easy to predict. Seasonal change and local geography make prediction of the effects of climate change at any location variable. Current predictive models offer a wide range of predicted changes.

Prior to the 2007 IPCC Report, Titus and Narayanan (1995) modeled the probability of sea level rise based on global warming. They estimated the increase in global temperatures could likely raise sea level 6 in by 2050 and 13 in by 2100. While these estimates are lower than the estimates described in the IPCC Report (2007), Titus and Narayanan's (1995) modeling efforts developed probability-based projections that can be added to local tide-gauge trends to estimate future sea level at specific locations.

Whittle et al. (unpublished data 2008) applied several prominent climate change models to panther habitat in southwest Florida. Their review indicated a climate change-induced sea level rise of 3 ft will reduce southwest panther habitat by 29 percent, at 9.8 ft by 62 percent, and at 16.4 ft by 90 percent. The consequences would be particularly dire for the panther which has no other populations outside of low-lying South Florida. Their cost surface analyses identified likely migration routes that would link the south panther population to suitable habitat to the north. However, without rapid conservation actions that establish a population to the north, they predict that the panther may go extinct in the wild due to climate change effects.

Climatic changes in South Florida could exacerbate current land management challenges involving habitat fragmentation, urbanization, invasive species, disease, parasites, and water management (Pearlstine 2008). Global warming will be a particular challenge for endangered, threatened, and other "at risk" species. It is difficult to estimate, with any degree of precision, which species will be affected by climate change or exactly how they will be affected. The Service will use Strategic Habitat Conservation planning, an adaptive science-driven process that begins with explicit trust resource population objectives, as the framework for adjusting our management strategies in response to climate change (Service 2006a).

It should be noted Titus and Narayanan's (1995) worst-case scenario was premised on a 1 percent chance that global warming would raise sea level that high. However, most climate change researchers agree with the findings in the IPCC Report (2007) which estimates a 90 percent probability of 7 in to 23 in of sea level rise by 2100. Scientific evidence that has emerged since the publication of the IPCC Report (2007) indicates an increase in the speed and scale of the

changes affecting the global climate. Important aspects of climate change seem to have been underestimated and the resulting impacts are being felt sooner. For example, early signs of change suggest the less than 1.8°F of global warming the world has experienced to date may have already triggered the first tipping point of the Earth's climate system – the disappearance of summer Arctic sea ice. This process could open the gates to rapid and abrupt climate change, rather than the gradual changes that have been currently forecasted.

Comprehensive Everglades Restoration Plan (CERP)

The Service is concerned the Atlantic Civil Project may affect CERP's Biscayne Bay Coastal Wetlands Project (BBCW). The Preferred Alternative (Alternative O) for the BBCW includes features (pump stations) that are designed to rehydrate wetlands on the east and west sides of the Atlantic Civil Project. It is our general understanding large, open, water-filled pits have exceedingly high evaporation rates compared to evapotranspiration rates in wetlands, particularly if the stage in the wetlands is below ground surface elevation. We are concerned water diverted into the wetlands by the BBCW project will essentially seep into the mine pit and negate anticipated hydrologic benefits to the wetlands provided by the project's diversion features.

The groundwater flow modeling report (Earthfx Incorporated 2011) provided by the applicant indicates a slight lowering of water levels on the western side of the quarry as a result of the project. These results support our concern that the lowering of water levels in this area would induce seepage into the quarry from the adjacent wetlands. Seepage is a result of headwater differences between the mining lake and the surrounding wetlands. The Everglades experiences this near man-made canals. It is widely documented canals not maintained at an adequate level will over-drain the surrounding wetlands. Thus, active management of canal stages is necessary. The deeper the mining lake, the higher the discharge rate from the surficial aquifer into the lake due to increasing the head water difference. Assuming the bottom of the lake will be mostly fine sand, most of the seepage will occur from the upper portions of the surficial aquifer. This will lead to faster saturation rates of rainfall on the wetlands into the surficial aquifer, which will likely lead to faster drying rates of surface water of the surrounding wetlands.

Phase 1 of the BBCW Project, which does not include the rehydration features described above, is in its final planning stages and will likely be on the next Water Resources Development Act Bill submitted to Congress. It is anticipated planning for Phase 2 of the BBCW Project, which will include the rehydration features, will begin shortly thereafter.

The project site is also in the vicinity of the C-111 Spreader Canal project, but it is probably too far north and east to have any noticeable effect on Phase 1 of the C-111 Project. The footprint of Phase 2 has not been determined. However conceptual alternatives for a spreader canal location that were located further north along the wooded vegetation zone and extended east of U.S. 1 could be affected by the build-out of the current Atlantic Civil mining operation located further south between US 1 and Card Sound Road. There has been discussion about tying the built-out quarry lake into the spreader canal, similar to the CERP Lake Belt Pilot Project, to possibly get the additional benefits of storage, flood control, and a salinity barrier.

We anticipate the proposed mitigation should help to re-hydrate and re-vegetate some of the surrounding habitat and provide opportunities to mediate some of the hydrologic effects of mining on the surrounding areas.

Status of the species within the action area

As stated previously, for the purposes of this consultation, the action area includes the two project sites plus all lands within 25 mi (Figure 4). The proposed action may have direct and indirect effects on the ability of panthers to breed, feed, and 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). Comiskey et al. (2002) suggested because telemetry data is collected when panthers are least active, these data may present an incomplete picture of panther activity patterns and habitat use.

This potential bias was not detected in a recent analysis by Land et al. (2008) using GPS satellite location data collected throughout a 24 hour day. This study revealed panther habitat selection patterns are similar when using either aerial telemetry data collected during the day or 24-hour satellite location data. Both methods showed upland and wetland forests were the habitats most selected by panthers. There was an indication assland-dry prairie habitats were used more at night than during daytime hours.

Only a subset of the panther population has been radio-collared. However, the large database of telemetry locations taken from radio-collared panthers south of the Caloosahatchee can be used to estimate the size and number of home ranges and travel corridors 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 proximity of an adult female are assumed to have engaged in breeding activity during that year.

Both the entire project site and mitigation area are mapped as Primary Zone panther habitat in the Panther Focus Area. However, analysis of the property during past permitting efforts and this current review has shown that it offers, at best, limited use potential for the panther due to the existing habitat quality.

Panther Use of the ACI Action Area: Telemetry data has been collected since 1981. The property offers a limited prey base and possibly no denning opportunities due to the current agricultural and mining activities. Telemetry data indicate there have been 20 radio-collared panthers tracked within the action area. Telemetry locations of currently living panthers as of 2007 are shown in Figure 7.

Within a 5-Mile radius of the Project Site - There has been only 1 radio-collared panther (FP 21, female) recorded within 5 mi of the project site (Figure 8). FP21 was located on 300 occasions from 1987 through 1988. FP21 was euthanized in 1988. The extent of use of the project site by uncollared panthers is unknown. No data have been collected on uncollared panthers on this property.

Within a 25-Mile radius of the Project Site - The 2011 telemetry data document six panthers (FP61, FP94, FP95, FP142, TX105 and TX108) using the area west of US1/ Krome Avenue, to within about 8.5 mi of the project site. Another uncollared panther, UCFP80, was documented 7 mi from the project site. UCFP80 was killed in a vehicle collision on February 2, 2006, on Card Sound Road. McBride (FWC 2003) documented four collared panthers, one uncollared female and one uncollared male who had ranges in the same survey unit as this property (Unit 1- Everglades National Park), which overlapped from 2002 to 2004. However, none of the ranges were on this property.

Road Mortality - Five vehicular deaths have been recorded in the action area, two of which occurred in the vicinity of the mine (Figure 9). Vehicular mortality includes two euthanizations from vehicular injuries (FP21 in 1988 and FP125 in 2004) and 1 uncollared panther vehicular death (UCFP80 in 2006). Six cause-unknown deaths (including FP15, FP16, FP27 and FP85) have been recorded.

Prey Value: A census survey for panther prey was conducted for the property in October 2005 and February 2006 by Turrell, Hall & Associates, Inc. The results of the survey yielded a calculation of 1 deer per 480 to 963 ac. A desirable wildlife management area deer count might be 1 deer to 165 to 250 ac (Steelman et al. 1999). In part, this property provides poor foraging habitat due to the past disturbances as well as the ongoing agricultural and mining activities. Therefore, the prey base is less than optimal for panthers.

Habitat Quality - Historical vegetation on the property included a mosaic of upland and wetland habitats that provided a seasonal pattern of plant growth. However, past agricultural practices and the invasion of the habitats by the exotics, such as melaleuca (*Melaleuca quinquenervia*) and Brazilian pepper (*Schinus terebinthifolius*), have resulted in the growth of dense stands of monotypic plant species that provide reduced quality forage for resident deer populations. Florida Land Use, Cover, and Classification System (FLUCCS) mapping of the habitats on the property document that exotic vegetation, primarily melaleuca, has infested just under 69 percent of the project site (1,172 ac), averaging greater than 50 percent of existing vegetative cover. The area proposed for development is infested with melaleuca, averaging just under 69 percent (572 ac), with greater than 50 percent exotics. The adjacent off-site compensation site, with its growth of invasive exotic plant species and altered hydrology, also displays similar foraging restrictions, with melaueuca infesting just under 60 percent of the site (529 ac), with greater than 50 percent of existing vegetative cover. However, the proposed enhancements (including exotic vegetation removal) will result in a more diverse mosaic of plant species, which will in turn provide an increased foraging value to resident deer populations.

Factors affecting species environment within the action area

Factors that positively and negatively affect the panther's environment 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 (*e.g.*, prescribed fire, exotic eradication, etc.), hydrological restoration projects, and public and private land protection efforts. 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 injury or death due to vehicle collisions. 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 panther population. Panther hunting is no longer sanctioned, although there still may be instances of intentional or unintentional shooting of individuals for various reasons.

Federal and State Actions: 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. The Service has formally consulted on three projects within the 25-mile action area since January 14, 1992. These were all recent projects within 5 miles of the ACI project site. The total impacts to Primary and Other Zone habitats were 90 ac with 173 ac being preserved off-site. Increased development within the South Florida panther consultation area led the Service to develop a concurrence key in May 2005 to assist the Corps in their determinations for impacts to the panther.

From April 21, 2004, through July 1, 2009, the Service completed informal consultation with the Corps for 8 projects affecting 65 ac affecting panthers in Miami-Dade County (database entries for informal consultations prior to 2000 are incomplete for projects in the panther consultation area). Five of the 8 projects consisted of altering panther habitat in more urbanized areas and were relatively small in size. The remaining three projects were associated with restoration activities in Everglades National Park. Although panthers have been known to cross these areas to access other parts of their range, prey base and denning utilization of these areas have been affected by the level of development and the addition of these small projects 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." These projects have been incorporated into the Service's environmental baseline for the Florida panther and the Service has determined these projects do not jeopardize the survival and recovery of the Florida panther.

We received information the Corps issued permits for 45 projects within the action area between June 23, 2005, and March 18, 2011, impacting 483.12 ac. One of these was a restoration project that affected 170 ac. 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 eastern 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, that these projects individually and cumulatively do not jeopardize the survival and recovery of the Florida panther. However, loss of marginal panther habitat and panther prey habitat may occur from construction of these projects.

The District and the Miami-Dade Department of Environmental Resources Management (DERM) from 2000 to 2010 issued, respectively, 1009 and 1007 environmental resource permits impacting about 35,329 ac and 14,072 ac. Several of these permits were for habitat preservation and restoration of large acreages (including this project and Everglades Mitigation Bank [EMB], for example) and many were outside the Panther Focus Area.

Activities within the action area have also benefited panthers. Benefits have resulted from the acquisition and restoration of high quality habitat by other Federal, State, and County resource agencies. The 32,000-acre Southern Glades Wildlife and Environmental Area and Frog Pond are located within the action area and are being managed by the District and the State of Florida. Miami-Dade County obtained 17,208 ac in acquisition, preservation and restoration in the action area between 2000 and 2010, including 13,779 ac of wetland preservation in the Everglades Mitigation Bank (EMB). EMB is located in the action area and currently provides preservation and restoration of 13,249 ac of which about 3,000 ac are in the Primary Zone. Table 18 is a summary of the State and County acquisitions and mitigation acreage required through permitting within the action area in the last 10 years. Table 15 is a summary of publicly owned lands within 5 and 25 miles of the action area. Figure 10 shows the location of publically owned lands within the action area. Since January 2006, DERM has restored 1,967 ac within the 25-mile action area and its Environmentally Endangered Lands (EEL) program has purchased 6,384 ac for preservation since 2000. Lands continue to be preserved, restored and protected in the action area.

Moreover, the management of public lands, including prescribed fire and eradication of exotic vegetation in the ENP, District lands, Miami-Dade County environmental lands and other conservation areas, improves habitat for panther prey species, which in turn benefits panthers.

Miami-Dade County and the Florida Department of Transportation (FDOT) have also added additional conservation measures to help protect the panther. The County agreed to place panther crossing signs and rumble strips on Card Sound Road to slow traffic, and FDOT constructed four wildlife crossings north of the C-111 Canal during the 18-Mile US1 road widening project. These wildlife crossings are in the Primary and Other Zones.

The panther is a wide-ranging species needing large contiguous expanses of forested cover for foraging and dispersing. The property offers very limited opportunities for panther utilization due the presence of agricultural activities dominating 96 percent of the property. The positive and negative factors affecting panthers in the action area are: highways, urban use, agricultural use, resource extraction, public lands management (*e.g.*, prescribed fire, public use, exotic eradication, etc.), restoration projects, and public and private land protection efforts. Under the proposed action, a large (1,552.7-ac) preserve area will be set aside in the Primary Panther Zone

and enhanced through exotic removal, hydrological improvements, and maintenance activities. While the action will decrease the total net acreage of land available for transient activities, the preservation and enhancement proposed will increase the preserve area's ability to support transient activities. The preserve area habitat is higher quality panther habitat than the areas being impacted and, once restored, will be available for use as denning and resting areas or transient activities. It will also provide better foraging sources and shelter for panther prey.

The current mitigation monitoring is in the third year of quarterly reporting. The areas enhanced and being surveyed at this time are primarily restored farm fields. EAS Engineering, Inc., noted in the 9th Quarterly Report (September 2009) an average of 52.83% native plant species coverage was now present in the restored areas. Wading birds and birds of prey were reported to regularly utilize the restored areas.

EFFECTS OF THE ACTION

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

Factors to be considered

Development projects may have a number of direct and indirect effects on the panther and panther habitat. Direct effects, which are primarily habitat based, may include: (1) permanent loss and fragmentation of habitat; (2) permanent loss and fragmentation of habitat that supports prey; (3) loss of available habitat for feeding, breeding, and dispersing; (4) reduction in the geographic distribution of habitat; (5) harassment due to construction activities and (6) enhancement, restoration and preservation of habitat resulting from habitat compensation. Indirect effects may include: (1) increased risk of roadway mortality due to increases in vehicular traffic; (2) increased disturbance to panthers and prey due to human activities (human/panther interactions); (3) reduction in value of adjacent habitat due to habitat fragmentation; and (4) potential increase in intraspecific aggression due to reduction of the geographic distribution of habitat.

This project site contains panther habitat and is located on the periphery of the panther's geographic range. The construction for this project will be continuous, and therefore can potentially affect all sensitive periods of the panther's life cycle. Panthers may be found on and adjacent to the proposed construction footprint year-round. The project will be a continuous, disruptive event and result in permanent loss and alteration of existing ground cover. The time required to complete construction is anticipated to be 25 years or longer. Habitat restoration will be concurrent with habitat loss. The disturbance associated with the project will be permanent and result in a permanent loss of available panther habitat.

Analyses for effects of the action

To assess habitat value for panthers, the Service, based in part on an evaluation of habitat use data for the Florida panther provided by Swainson et al. (2005) and Kautz et al (2006), developed an assessment approach that provides a comparison of pre- and post-development habitat as a matrix of Primary zone equivalent lands. The Primary zone equivalent lands were

then equated to the habitat preferences of the Florida panther and incorporated as a component of our goal to conserve sufficient lands to support a population of at least 90 panthers in south Florida. Additional information on the Primary zone equivalent lands can be found in the Status of the Species section and Appendix A.

As of January 2005, the Service has been using a panther habitat suitability ranking system based in part on methods in publications by Swainson et al. (2005) and Kautz et al (2006) and adjusted by the Service to consolidate similar types of habitats and to include CERP water treatment and retention areas located in the panther's range. Since the implementation of this ranking system, the Service has received two additional, published habitat assessment studies (Cox et al. 2006 and Land et al. 2008) that further assess habitat usage by the Florida panther. As it is the Service's policy to incorporate the most current peer-reviewed science into our assessment and review of project effects on the Florida panther, we have revised the current habitat suitability ranking system. For a full description of the original habitat assessment methodology and the associated updates done in 2009, please see Appendix A (Panther Habitat Assessment Methodology) at the back of this document.

The project site is located within, but on the periphery of, the Service's Panther Focus Area and the Primary Zone (Kautz et al. 2006). The 494.1-ac site currently provides 494.1 ac of panther habitat, which will be lost. Offsite habitat compensation near the project sites is also located in the Primary zone and will result in the restoration of about 955.5 ac equating 5,905 PHUs.

Habitat Assessment: The application of the habitat assessment methodology including the base ratio, landscape multiplier, PHU determinations, and compensation recommendations, are presented below for the ACI project and compensation areas. The 980.5-ac original project, as previously permitted, resulted in a net loss of 43 PHUs (3,900 pre-development PHUs minus 3,857 post-development PHUs). With landscape and base multipliers applied, there were 108 PHUs needed for compensation. The compensatory mitigation proposed provided 10,510 PHUs. When the original calculations were revised (Table 12) using the updated habitat values, there was a new net loss figure of 35 PHUs. Compensation also decreased by 920 PHUs for a new mitigation figure of 9,590 PHUs.

An analysis of activities that have occurred within the project boundaries since the original permitting shows that 1,588 PHUs have been lost due to rock mining.

The proposed mining plan would alter the permitted agricultural use 494.1 ac consisting of 18.3 ac of sawgrass and saltbush wetlands with exotics; 161 ac of unfilled croplands; and 314.8 ac of filled croplands for the purpose of mining limestone rock. The mining schedule anticipates 10-20 ac of mining will be completed per year. For the purpose of scoring the proposed impacts, habitat values for Exotic/ Nuisance Plants (3) and Shrub Swamp/ Brush (5.5) were averaged for a habitat score of 4.25. Habitat scoring was as follows:

The pre-impact (2,351 PHUs) minus the post-impact score (0 PHUs) equaled 2,351 PHUs; 2,362 PHUs times the base ratio (2.5) equals 5,905 PHUs. Then 5,905 PHUs times the primary zone multiplier (1) equals 5,905 PHUs required for impacts compensation (See Table 3).

Existing mitigation of 7,945 PHUs minus the 5,905 PHUs required for this work, would leave 2,040 PHUs of compensation available for future works (See Table 13).

Compensation for habitat loss primarily occurs on large, mostly contiguous areas within the primary zone, with habitat that is typically of higher quality and more viable than that being impacted. Although documented panther use of the property and mitigation area is low, wandering juveniles are known to travel within the vicinity of the property. Between 1987 and 1988, 25 to 35 telemetry locations were recorded in the project area for a panther designated as FP21. FP21 was recorded within a 5-mile radius of the preserved areas for the same time period. Telemetry notes ceased when FP21 was euthanized in 1988. No telemetry for this property has been recorded since and no known dens exist within a 5-mile radius. There also has been no data on uncollared panthers on the property.

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) the loss of available habitat for feeding, breeding, and dispersing panthers; (4) a reduction in the geographic distribution of habitat for the species; (5) harassment by construction activities and the ongoing operation of the recreational facility; and (6) the enhancement, restoration, and preservation of panther habitat through habitat compensation.

Habitat Loss and Fragmentation: The mining project will result in the permanent loss of 494.1 ac of panther habitat located within the Primary Zone. The project sites provide low quality panther habitat, and the habitat loss may adversely affect the panther by decreasing the spatial extent of available lands. The projects will also result in the fragmentation of existing panther habitat, which affects the panther's ability to move freely throughout their home ranges.

Temporary impacts will occur in removing exotic species in the preserve area, by filling 4.8 ac of wetlands, by removing existing roads within the mitigation area and scraping select areas to remove exotics and improve hydrology.

In the preserve area, following initial exotic treatment, quarterly maintenance treatments will be necessary to eliminate exotics that reappear. The preserve area will be left to regenerate naturally for at least 1 year before replanting. Planting, plowing, mowing, prescribed burning, or increased herbicide application will be taken immediately if there is less than 80 percent native vegetation coverage by the end of year 3. Exotic plant species will be controlled within the project footprint and monitoring will occur consistent with the ACI Mitigation and Monitoring Plan.

Although there will be a temporary impact and fragmentation of habitat in the preserve areas during site restoration, these actions will restore these lands to habitats that may be used more frequently by panthers or their prey. The restored lands may provide a beneficial effect to the panther through an increase in quality of habitat and may reduce the local and landscape-scale effects of the initial habitat loss and fragmentation.

Panther Prey – Deer and other panther prey species are known to occur within the project site and the action area. While the project site and adjacent lands support panther prey species, the property provides poor foraging habitat for panther prey due to the past disturbances as well as the ongoing agricultural and mining activities, as discussed above. Overall, the projects will result in the loss of about 494.1 ac of Primary Zone habitat used by panther prey species, and will result in fragmented habitat for prey species adjacent to the project site.

Feeding, Breeding, and Dispersing Panthers - The site contains panther habitat that is occasionally used for feeding and dispersing. Thus, habitat loss may adversely affect the panther by decreasing the spatial extent of lands available for these functions.

Reduction in the Geographic Distribution of Habitat - The projects will result in temporary impacts to about 956 ac of restoration areas during enhancement and management activities and the permanent loss of 494.1 ac of panther habitat in the panther Primary Zone. This permanent loss represents 0.041 percent of the 1,202,699 ac of available non-urban private lands at risk in the Service's panther core area (Table 6). The Service's intent, as stated in the South Florida Panther Population Goal, is to preserve 2,873,070 ac of primary zone equivalent lands for a population of 90 panthers. Currently, 2,073,865 ac of primary zone equivalent lands are preserved (Table 5) and 1,202,699 ac of primary zone equivalent lands are at-risk (private ownership) (Table 6), leaving 799,205 additional ac to be preserved in South Florida (2,873,070 - 2,073,865 = 799,205). The existing 1,552.7-ac preserve represents 0.19 percent (1,552.7 ÷ 799,205) of the lands needed for the Service's refugia design. The lands proposed for conservation and restoration are consistent with the Service's efforts to locate, conserve, and restore sets of lands containing sufficient area, access, and appropriate cover types to ensure the long-term survival of the panther south of the Caloosahatchee River.

Disturbance by Construction Activities: Construction will be ongoing, relative to sensitive periods of the panther's lifecycle, potentially for decades. Land clearing and restoration will also be an ongoing process. There are no known den sites within the project boundaries. Therefore, we find that it is unlikely that project construction will result in direct panther mortality, but it may result in temporary disturbance to resident or dispersing panthers.

Habitat Compensation: To compensate for the projects' impacts to the panther, the applicant has dedicated 955.5 ac of the 1552.7 ac preserve. Although the projects will result in a net habitat loss, the habitat quality provided to the panther through restoration and preservation will provide higher function and value than that of the impacted areas. The preservation area has already been protected in perpetuity with conservation easements held by Miami-Dade DERM. Lands at the site and surrounding areas presently provide a diverse mosaic of native plant species, which provide foraging value to resident deer and other panther prey species. The compensation site will be managed to prevent infestation by exotic vegetation in perpetuity. This habitat compensation is consistent with the Service's goal to preserve lands containing sufficient area and appropriate cover types to ensure the long-term survival of the panther south of the Caloosahatchee River.

Habitat Fragmentation: Panthers, because of their wide-ranging movements and extensive spatial requirements, are particularly sensitive to habitat fragmentation (Harris 1984), as discussed previously. For panther conservation, this underscores the need to maintain contiguous habitat and protected habitat corridors in key locations in South Florida. Habitat fragmentation can result from a variety of human activities and, specifically in regards to road networks, may affect female panthers more than males.

Temporary Fragmentation - Temporary impacts will occur over the projected 20-year life of the project from restoration, maintenance and monitoring of the preserve. A temporary loss of 4.8 ac of disturbed wetland panther habitat will result from filling exotic-shrub swamp for agricultural purposes. Temporary impacts from unauthorized hunting and ORV use will be reduced as a result of road removal within the preserve areas.

Permanent Fragmentation - The two current proposals will reduce the availability of marginal panther habitat onsite by 494.1 ac. We anticipate this loss is unlikely to significantly increase fragmentation effects on the panther since the site has no recent history of use and has low prey density. Additionally, the applicant has preserved and is managing lands in excess of what is needed to offset these impacts. Our analysis shows there will be2,040 PHUs remaining after this project is completed. Monitoring reports indicate that restoration efforts are on schedule and are meeting mitigation goals.

Though the habitat value of the existing project site to the panther has been reduced by exotic infestation, the permanent loss and fragmentation of habitat may adversely affect the panther by decreasing the overall spatial extent of lands available to the panther. Although there will be a permanent loss of panther habitat from construction of the project, the proposed restoration of lands in the preserve will restore these lands to habitats that may be used more frequently by panthers or their prey, thereby increasing, over time, distribution and quality of habitat which could reduce the local and landscape-scale effects of the initial habitat loss and fragmentation.

Indirect effects

Indirect actions are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Indirect effects may occur outside of the area directly affected by the action.

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

Five vehicular mortalities have been recorded in the action area, which include two euthanizations from vehicular injuries (FP21 in 1988 and FP125 in 2004), and one uncollared panther vehicular death (UCFP80 in 2006) (Figure 9). However, recent construction on US 1

resulted in fencing the highway in the area of the mine, from Key Largo to Florida City, and installation of four wildlife crossings suitable for panthers.

No traffic increases above current conditions are expected to result from the project. Current daily truck volume is between 150 and 300 trucks per day. This traffic enters and exits the site along SW 167th Avenue from SW 344th Street (Figure 11). ACI traffic accounts for about 80 percent of all traffic on SW 344th Street, east of US1, and 20 percent of all traffic on SW 344th Street, east of SW 167th Avenue. The applicant has provided information that indicates that about 80 percent of the daily traffic goes west toward highway US1 and the Florida Turnpike and about 20 percent goes east. About 18 percent of the daily volume is delivered to the Keys via US1. US1 is fenced and has wildlife passageways to minimize wildlife/vehicular interaction. An average of 300 trucks per day translates to about 0.3 percent of all traffic on US1 and 0.1 percent of all traffic on SR 905 (Card Sound Road) in 2005. These percentages are projected to be 0.2 and 0.03 percent respectively in the year 2035 (Table 16).

As no increase in traffic is anticipated to occur as a result of the current action, and traffic generated by the project represents a discountable fraction of the general traffic in the area, the risks to the panther from collisions with vehicles as a result of the ACI project are difficult to quantify. Although, to date, no panther-vehicular mortality has been tied to ACI traffic, the risk remains that traffic generated by the project may potentially contribute to mortality of panthers in the action area.

Disturbance: The project life will cover all sensitive periods of the panther's lifecycle. Land clearing, vehicle access, human presence, heavy equipment operation, road traffic, noise and lighting associated with the project will occur primarily during daylight hours and last several years. Land clearing will be almost immediate and these lands will no longer be available as habitat for the panther. Exotic species removal, restoration, maintenance and monitoring in the preserve lands will occur over several years. These activities may cause panthers and their prey to temporarily avoid the areas. We anticipate any resident panthers with overlapping home ranges in the vicinity of the project areas will adjust the size and location of their ranges to account for this loss and disturbance and that adjustment is anticipated to occur in concert with project construction.

Prey - Potential increases in disturbance to panther prey were considered. As land alteration proceeds at the site, prey/human interactions and prey disturbance may occur due to heavy equipment operations, filling, site grading, removal of vegetation and other activities necessary for the project. Prey may avoid construction disturbance during development and exotic species removal and in turn cause a shift in panther use. Prey are anticipated to return to the preserve areas once enhancement activities are completed.

Panther/Human interactions - The enhanced habitat in the preserve increases the potential for direct and indirect panther/human interaction. The applicant proposes buffers between project residential developments and the preserve lands to minimize this affect. Although panthers may cross the buffers, the project activities and disturbances may cause panthers and/or their prey to avoid the areas.

Off-road vehicle use and hunting occurs in the action area and illegally on the project sites. These activities can temporarily disrupt panther activities. To minimize this problem and to improve hydrology, the applicant proposes to remove four sections of roads totaling about 1.9 miles within the preserve area.

Intraspecific Aggression: Intra-specific aggression is a common behavioral attribute of this species. Potential increases and decreases in panther intraspecific aggression are evaluated by comparing temporary and permanent losses of habitat, which might cause panthers to compete for limited space within their territories. Increases in intraspecific aggression could occur from permanent losses of habitat associated with these projects.

The potential for increased intraspecific aggression is difficult to quantify. In this project, habitat fragmentation and loss are compensated by the preserve area. Also, telemetry within the area has not shown this to be part of a known home range. Rather, the project lands more likely serve transient animals dispersing through the area. As such, it is unlikely intraspecific competition would increase.

Interrelated and interdependent actions

An interrelated activity is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. No interrelated or interdependent actions have been identified for this project.

Species response to the proposed action

The proposed action will not result in increased human activity and noise because the proposed activities are a continuation of similar ongoing activities. And, since it is likely panthers only infrequently use lands within and adjacent to the project site, project activities are not anticipated to significantly increase risk of panther disturbance, although some temporary disturbance may occur.

The project will result in the loss of 494.1 ac of potential panther habitat. According to the most current home range estimates of the panther (Lotz et al. 2005), this loss represents 1.7 percent of a female panther's average home range (29,059 ac) and 0.8 percent of a male panther's average home range (62,542 ac). The project area provides panther habitat and panthers have been occasionally documented onsite, therefore, the loss of habitat may contribute to a slight increase in intraspecific aggression and a decrease in the spatial extent of lands available to the panther for hunting, 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 eastern fringe of occupied habitat, is adjacent to some urban development, and is not located

within known dispersal corridors (FWC 2006) between larger publicly owned managed lands. Therefore, insignificant fragmentation of panther habitat is expected to result from project implementation.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions reasonably certain to occur in the action area considered in this Biological Opinion. 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.

To identify future non-Federal actions affecting the listed species that may be reasonably certain to occur in the action area, the Service identified the types of non-Federal actions that could occur. The Service projected future non-Federal actions by enumerating and projecting past non-Federal actions. The Service identified the potential loss of 117.81 ac in the action area that could be developed without a Federal wetland permit, and we find this represents future non-Federal actions expected to occur in the action area. This represents a small percentage (0.006 percent of the 1,881,318 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 eastern, more urbanized portion of the Florida panther's consultation area. Although 117.8 ac may be lost from potential panther conservation, this loss will not adversely affect the Service's land conservation and preservation goals.

SUMMARY OF EFFECTS

Panther Usage: The timing of construction for this project, relative to sensitive periods of the panther's lifecycle, is unknown. However, it is likely all land clearing associated with the development will be completed in phases over several years. There are no known den sites within the project boundaries. The project will result in the loss of 494.1 ac of potential panther habitat. According to the most current panther home range estimates (Lotz et al. 2005), a loss of 494.1 ac represents 1.7 percent of one female panther's average home range (29,059 ac) and 0.8 percent of one male panther's average home range (62,542 ac). This loss may contribute to a slight increase in intraspecific aggression and a decrease in lands available for hunting, 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.

Traffic: No traffic increases above current conditions are expected to result from the project. Current daily truck volume is between 150 and 300 trucks per day. An average of 300 trucks per day translates to about 0.3 percent of all traffic on US1 and 0.1 percent of all traffic on SR 905 (Card Sound Road) in 2005. These percentages are projected to be 0.2 and 0.03 percent respectively in the year 2035 (Table 20).

Habitat Loss: The Service, based on the habitat evaluations discussed previously, believes the project will result in the direct and indirect loss of about 494.1 ac of habitat within the Primary Zone (see discussion under Wildlife Assessment). Habitat types are primarily exotic-infested

wetlands and other natural communities. The prevalence of exotics within the project area provides limited foraging value to panther prey species. Panther use is limited; however, the permanent loss will adversely affect the panthers in the action area by decreasing the spatial extent of lands available for foraging, breeding, and dispersing. The loss of 494.1 ac of habitat represents about 0.03 percent of the 1,962,294 ac of available non-urban private lands in the core area. This small loss (0.03 percent) of non-urban private lands on the eastern edge of the panther's range will not adversely affect the Service's land conservation and preservation goals.

Compensation: The project will provide for the preservation of about 955.5 ac of Primary Zone habitat. The value of the habitats to the panther will be maintained long-term through hydrological restoration and the removal of exotic vegetation. The preservation of these lands in the panther core area represents 0.12 percent of the 799,205 ac of private lands still needed for the population of 90 individuals. The preservation of about 955.5 ac of habitat in the Primary Zone will minimize the direct habitat impact of the loss of 494.1 ac lower quality panther habitat and is consistent with the Service's panther conservation goal.

The proposed compensation plan, which provides habitat preservation and restoration inside and outside the project action area, will benefit the panther and is consistent with the Panther Recovery Plan (Service 2008) goal 1.1.1.2.3. This goal recommends habitat preservation and restoration within the Primary Zone be provided in situations where land use intensification cannot be avoided. The applicant has proposed equivalent habitat protection and restoration, to compensate for both the quantity and value of the lost habitat.

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

Intraspecific Aggression: The Service found the habitat on the property provides low quality forage for prey species, which directly affects the frequency and duration of panthers use. The risk of increased intraspecific aggression is difficult to quantify. However, given the limited use by panthers of this area, the risk of increasing intraspecific competition is considered slight.

Cumulative Analysis: In the cumulative analysis, the Service identified the potential loss of 117.81 ac within the action area within the immediate future 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 annual level of development represents a small percentage (0.006 percent of the 1,798,295 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 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 finds the loss of these lands will not adversely affect its land conservation and preservation goals for the panther.

Conservation Land Acquisitions: The State and County land acquisition programs acquired about 23,597 ac of lands within the action area from 2000 to 2010 (Table 14), which represents about 3 percent of the 799,205 ac of private lands still needed for the population of 90 individuals. These lands are generally located within the primary zone of the panther and are intended to be actively managed for the benefit of many wildlife species including the panther. The preservation of these lands in the panther core lands will have a beneficial effect on the panther and further the Service's goals for this species.

CONCLUSION

In conclusion, the Service finds no direct take in the form of panther mortality or injury resulting from this project. Traffic and intraspecific aggression are not expected to significantly increase and we are unable to quantify minor increases that may be directly tied to this project. Therefore, the Service determined the project is not anticipated to appreciably diminish or preclude the survival and recovery of the panther.

As discussed previously, the low value habitat loss is a small fraction of the panther's occupied habitat. The habitat loss will be minimized by the protection and restoration of about 955.5 ac of Primary Zone habitat. Based on our analysis, the Service finds the proposed ACI project is not likely to jeopardize the continued existence of the panther. Critical habitat has not been designated for this species; therefore, none will be affected.

Although the potential exists for panther injury or mortality to result from collisions with motor vehicles adjacent to and within the project area, traffic resulting from the project is not expected to increase. Therefore, it is unlikely the project will substantially increase the likelihood of panthers being struck by motor vehicles.

The project will result in the loss of 494.1 ac of habitat used by panthers and their prey, and also result in a permanent loss in the geographic range of the species. Therefore, the project could slightly increase the potential for intraspecific aggression resulting in panther mortalities. According to the most current home range estimates of the panther (Lotz et al. 2005), the loss of 494.1 ac of habitat represents 1.7 percent of a female panther's average home range (29,059 ac), 0.8 percent of a male panther's average home range (62,542 ac), and 0.03 percent of the 1,962,294 ac of available non-urban private lands in the Service's panther core area. Based on the amount and location of habitat lost (494.1 ac), the Service finds the project should not significantly affect the panther population or increase the potential for intraspecific aggression in the action area. Moreover, the loss of panther habitat due to the project will be offset by preservation, restoration, maintenance, and monitoring of 955.5 ac (5,905 PHUs) of panther habitat. The compensation site will be managed to prevent infestation by exotic vegetation in perpetuity. This habitat compensation is consistent with the Service's goal to locate and preserve lands containing sufficient area and appropriate cover types to ensure the long-term survival of the Florida panther south of the Caloosahatchee River.

Finally, the project will also result in potential disturbance to the Florida panther resulting from human activities related to the construction of the project and habitat restoration in the preservation site. Panthers may respond to the disturbance by avoiding the project area or they

may habituate to the disturbance. However, if panthers choose to avoid the project site, 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.

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 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 Steve Torcise Jr., 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 Steve Torcise Jr., 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 Steve Torcise Jr., 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

The Service anticipates incidental take of the panther will be difficult to detect for the following reasons: (1) the panther is wide-ranging; (2) the lands on the project site provide limited value to the panther and panther prey species; and (3) lands adjacent to the project site consist of varying levels of existing and proposed urban development and mines that reduce their suitability for use by either resident or dispersing panthers. Therefore, the Service does not anticipate the project will result in the direct mortality or injury of any panthers. However, the Service anticipates indirect take of the panther in the form of harassment and harm due to traffic, loss and fragmentation of habitat and interspecific aggression within the 25-mile radius action area. As previously discussed, traffic, habitat loss and interspecific aggression are risks to the panther that are cumulative in nature, and, as such, they are difficult to quantify or to tie to any specific project.

Although there is a potential for indirect take to occur as described above, we believe that the level of incidental take resulting from the loss of 494.1 ac of panther habitat within the Primary Zone is moderated by the preservation and enhancement of 955.5 ac of panther habitat in the Primary Zone. The impact areas have an equivalent loss of 5,905 PHUs, which has been provided by the applicant in their compensation and mitigation proposal.

The loss of 494.1 ac of panther habitat is equivalent to 1.7 percent of a female panther's home range (29,056 ac) and 0.8 percent of a male panther's home range (62,528 ac), using the conservative estimates. The habitat loss is on the edge of urbanization and panther range, is a small fraction of a panther's home range and the proposed mitigation is providing panther habitat value over and above what is being lost. Therefore, the Service finds the level of incidental take exempted by this permit will not result in jeopardy of the species.

EFFECT OF TAKE

In the accompanying Biological Opinion, the Service determined this level of anticipated take is not likely to result in jeopardy to the Florida panther. Critical habitat has not been designated for the Florida panther and will not be affected.

REASONABLE AND PRUDENT MEASURES

The Service has determined the Corps and the applicant have developed a project that has conservation measures necessary and appropriate to minimize incidental take of the panther. The applicant has provided a mitigation and monitoring plan that includes management actions and an annual submittal of a financial assurance mechanism to ensure adequate funding of the mitigation, maintenance and monitoring. Annual reports to the Service are a component of the management plan. In summary, the Corps and the applicant will ensure no more than 494.1 ac of panther habitat will be lost as a result of implementation of the proposed action, and 1,552.7 ac of total mitigation areas will continue to be restored, preserved, and maintained to benefit the Florida panther and its prey.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline reporting/monitoring requirements. The terms and conditions described below are non-discretionary, and must be undertaken by the Corps so they become binding conditions of any grant or permit issued to ACI, 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 ACI, 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 ACI, must report the progress of the action and its impact on the species to the Service as specified in the Incidental Take Statement (50 CFR § 402.14(i)(3)). Although we have not identified any specific Reasonable and Prudent Measures not incorporated in the project, we are providing the following for clarification:

1. The preservation sites will be managed in perpetuity for the control of invasive exotic vegetation as defined by the current Florida Exotic Pest Plant Council's Pest Plant List Committee's List of Invasive Species (Category 1)(2011) and managed for the benefit of the panther in accordance to the management and monitoring plan provided as part of this action;

2. The method of preservation for the proposed mitigation parcels is a conservation easement for the adjacent 1552.7 ac in the Panther Primary Zone. It is also the responsibility of the applicant to reach the success criteria outlined in the ACI Mitigation, Monitoring, and Maintenance Plan.

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. The Corps will provide documentation to the Service of all proposed restoration within 1 year of completion of the restoration;

5. 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; 10426 NW 31st Street, Miami, Florida 33172; 305-526-2695. Secondary notification should be made to the FWC; South Region; 3900 Drane Field Road; Lakeland, Florida; 33811-1299; 1-800-282-8002; and

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

CONSERVATION RECOMMENDATIONS

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

REINITIATION NOTICE

This concludes formal consultation on the ACI development projects. 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 Biological 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 in the effort to protect fish and wildlife resources. If you have any questions regarding this project, please contact Winston Hobgood at 772-469-4306.

Sincerely yours,

Larry Williams

Larry Williams
Field Supervisor
South Florida Ecological Services Office

cc: electronic only
Corps, Miami, Florida (Albert Gonzalez)
EPA, West Palm Beach, Florida (Ron Miedema)
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Service, Atlanta, Georgia (Ken Graham)

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Table 1. Acreages of Habitats within the Proposed Mining Footprint

	Pre-Development Acreage Total (565.30)		< 25% Exotic Coverage	25% - 50% Exotic Coverage	50% - 75% Exotic Coverage	> 75% Exotic Coverage
UPLANDS						
214 – Farm Fields (Cropland)	317.8		317.8			
WETLANDS						
163 – Open Water (Rock Quarry)	71.2		71.2			
214 – Farm Fields (Cropland)	158.0		158.0			
631e3 – Wet Shrub	18.3				18.3	
DEVELOPMENT TOTAL	**565.30**		**547.0**		**18.30**	

Table 2. Acreages of Habitats within the Proposed Agricultural Footprint

	Pre-Development Acreage Total (120.70)		< 25% Exotic Coverage	25% - 50% Exotic Coverage	50% - 75% Exotic Coverage	> 75% Exotic Coverage
UPLANDS						
214 – Farm Fields (Cropland)	115.9		115.9			
WETLANDS						
631e3 – Wet Shrub	4.8				4.8	
DEVELOPMENT TOTAL	**120.70**		**115.9**		**4.8**	

Table 3. Florida Panther Habitat Matrix and Units for Development of ACI Mining Project

Land Cover Types	Habitat Types	Mining Project Size (Primary Zone) 565.3 Acres			
		PRE		POST	
		Acres	*PHU*	Acres	*PHU*
Reservoirs/ Water	0	71.2	*0.00*	565.3	*0.00*
Cropland	4.8	475.8	*2283.84*	0.00	*0.00*
*Exotics - Shrub Swamp	4.25	18.3	*77.78*	0.00	*0.00*
Totals		**565.3**	***2361.62***	**565.3**	***0.00***

*Note- Exotics/ Nuisance species and Shrub swamp/ Brush were averaged to get a value for mixed exotic, sawgrass and saltbush habitat.

Impacts:PHUs: 2,362 (pre) - 0 (post) = 2,362 PHUs

Compensation Required: 2,362 PHUs x 2.5 (base ratio) = 5,905 PHUs.
No conversion multiplier needed as both impacts and compensation are within Primary Zone (1:1).

There are 7,945 PHUs of original permitted mitigation available, taking into account activities that have occurred since original permitting that have not needed Corps authorizations but have used PHUs from the overall mitigation area. 7,945 PHUs available minus 5,905 PHUs compensation needed leaves a balance of 2,040 PHUs remaining for future use.

Table 4. Florida Panther Habitat Matrix and Units for Development of ACI Agricultural Fill Project

Land Cover Types	Habitat Types	Agricultural Project Size (Primary Zone) 120.70 Acres			
		PRE		POST	
		Acres	*PHU*	Acres	*PHU*
Cropland	4.8	115.90	*556.32*	120.70	*579.36*
*Exotics - Shrub Swamp	4.25	4.80	*20.40*	0.00	*0.00*
Totals		**120.70**	*576.72*	**120.70**	***579.36***

*Note- Exotics/ Nuisance species and Shrub swamp/ Brush were averaged to get a value for exotics, sawgrass and saltbush habitat.

Due to the level of exotic infestation of the wetlands being impacted, we anticipate that the function and value of agricultural areas post-project will be similar to that pre-project. Therefore, no additional compensation is needed for this portion of the project.

Table 5. Land Held for Conservation within the Florida Panther Core Area

Zone	Acres	Primary Equivalent Factor	Primary Equivalent Acres
Dispersal	0	1.00	0
Primary	1,659,657	1.00	1,659,657
Secondary	308,623	0.69	212,950
Other	609,872	0.33	201,258
Total	**2,578,152**		**2,073,865**

Table 6. Undeveloped Privately Owned Land within Florida Panther Core Area

Zone	Acres	Primary Equivalent Factor	Primary Equivalent Acres
Dispersal	27,883	1.00	27,883
Primary	610,935	1.00	610,935
Secondary	503,481	0.69	347,402
Other	655,996*	0.33	216,479
Total	**1,798,295**		**1,202,699**

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

Table 7. Hydroperiod Classes of Wetlands Suitable for Wood Stork Foraging in the Preserve Area. (Pre and Post enhancement activities)

Hydroperiod	Potential Foraging Area Pre-Enhancement	Potential Foraging Area Post-Enhancement
Class 1 - 0 to 60 Days		787.64
Class 2 - 60 to 120 Days		
Class 3 - 120 to 180 Days	484.68	735.06
Class 4 - 180 to 240 Days		
Class 5 - 240 to 300 Days		
Class 6 - 300 to 330 Days		
Class 7 - 330 to 365 days		

Additional acreage post-enhancement is the result of exotic vegetation removal, native habitat restoration and enhancement, and some limited topographical enhancement opening up areas to potential foraging

Table 8. Original Project Impacts – Wood Stork Foraging Habitat Prey Base Loss

Original Habitat Code	Wetland Impact Acres	Wetland Impacts (m^2)	Habitat Suitability Value	Grams / m^2 / Hydroperiod Class	Wood Stork Consumption Percentage	Grams of Fish Biomass
DBNF	476.00	1,926,305.36	1.00	0.31	0.55	328,435.06
P	0.47	1,902.02	1.00	1.32	0.55	1,380.87
OW	16.30	65,963.82	1.00	3.63	0.55	131,696.76
TOTAL	**492.77**	**1,994,171.20**				**461,512.70**

Table 9. Wood Stork Suitable Foraging Prey Base Loss (Proposed Mining and Ag Areas)

FLUCFCS Code	Wetland Impact Acres	Wetland Impacts (m^2)	Habitat Suitability Value	Grams / m^2 / Hydroperiod Class	Wood Stork Consumption Percentage	Grams of Fish Biomass
631	23.10	93,482.47	1.00	0.62	0.55	31,877.52
TOTAL	**23.10**	**93,482.47**				**31,877.52**

Table 10. ACI Preserve – Wood Stork Suitable Foraging Prey Base Pre-Enhancement

Habitat Code	Wetland Acres	Wetland Impacts (m^2)	Habitat Suitability Value	Grams / m^2 / Hydroperiod Class	Wood Stork Consumption Percentage	Grams of Fish Biomass
PAP	199.0	805,324.43	0.03	0.31	0.55	4,119.23
P	486.9	1,970,414.39	1.00	1.32	0.55	1,430,520.85
FW	790.4	3,198,635.31	0.03	0.31	0.55	16,361.02
DBNF	1.7	6,879.66	1.00	0.31	0.55	1,172.98
DIST	7.5	30,351.42	0.00	0.00	0.55	0.00
Road ROW	67.2	271,948.75	0.00	0.00	0.55	0.00
TOTAL	**1,552.7**	**6,283,553.96**				**1,452,174.08**

Table 11. ACI Preserve – Wood Stork Suitable Foraging Prey Base Post Construction

Habitat Code	Wetland Impact Acres	Wetland Impacts (m^2)	Habitat Suitability Value	Grams / m^2 / Hydroperiod Class	Wood Stork Consumption Percentage	Grams of Fish Biomass
P	486.9	1,970,414.39	1.00	1.32	0.55	1,430,520.85
P	199.0	805,324.43	1.00	0.31	0.55	137,307.82
FW(not scraped)	403.9	1,634,525.30	1.00	0.31	0.55	278,686.57
FW(Scraped)	395.7	1,601,341.09	1.00	1.32	0.55	1,162,573.63
Road ROW	67.2	271,948.75	0.00	0.00	0.55	0.00
TOTAL	**1,552.7**	**6,283,553.96**				**3,009,088.87**

Table 12. Revised Analysis of Original Project Impacts with New Habitat Methodology.

Land Cover Types	Habitat Types	Project Site (Primary Zone) 980.5 Ac.				Adjacent Mitigation (Primary Zone) 1552.7 Ac.			
		PRE		POST		PRE		POST	
		Acres	*PHU*	Acres	*PHU*	Acres	*PHU*	Acres	*PHU*
Water	0	16.30	*0.00*	16.30	*0.00*	24.10	*0.00*	24.10	*0.00*
Urban	0	0.00	*0.00*	0.00	*0.00*		*0.00*	0.00	*0.00*
Exotics	3	11.90	*35.70*	0.00	*0.00*	547.10	*1,641.30*	0.00	*0.00*
Croplands	4.8	920.80	*4,419.84*	964.20	*4,628.16*	409.60	*1,966.08*	0.00	*0.00*
Orchard/Grove	4.7	16.60	*78.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*
Dry Prairie	6.3	9.80	*61.74*	0.00	*0.00*	85.60	*539.28*	488.80	*3,079.44*
Marsh/ Wet Prairie	6.3	0.00	*0.00*	0.00	*0.00*	174.00	*1,096.20*	566.50	*3,568.95*
Hardwood Swamp	9.2	5.10	*46.92*	0.00	*0.00*	262.60	*2,415.92*	262.60	*2,415.92*
Up/Hydric Pine Forest	9.5	0.00	*0.00*	0.00	*0.00*	47.90	*455.05*	210.70	*2,001.65*
Totals		**980.5**	**4,642.22**	**980.5**	**4,628.16**	**1,552.70**	***8,113.83***	**1,552.70**	***11,065.96***

Impacts: PHUs: 4,642 PHU (pre) minus 4,628 PHU (post) = 14 PHUs.

Compensation Required: 14 PHUs times 2.5 (base multiplier) = 35 PHUs. No multiplier needed as both impacts and compensation are in Primary Zone (1:1).

Compensation Offered: 11,066 PHUs minus 8,114 PHUs = 2,952 PHUs, 2,952 PHUs times 1/2 = 1,476 PHUs lift. 8,114 PHUs (base land value) plus 1,476 PHUs (lift) = 9,590 PHUs available compensation.

Summary: 9,590 PHUs available compensation minus 35 PHUs needed to offset original impacts = **balance 9,555 PHUs still available**.

Table 13. Comparison of Original Project to Current and Proposed (Ag and Mining Permits) Conditions

Land Cover Types	Habitat Types	Project Site (Primary Zone) 980.5 Ac.							
		Original Project Preexisting Conditions		Original Project Permitted Conditions		Current Project Existing Conditions		Current Project Proposed Conditions	
		Acres	*PHU*	Acres	*PHU*	Acres	*PHU*	Acres	*PHU*
Water	0	16.30	*0.00*	16.30	*0.00*	148.50	*0.00*	642.60	*0.00*
Urban	0	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*
Exotics	3.0	11.90	*35.70*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*
Exotic-Shrub Swamp	4.25	0.00	*0.00*	0.00	*0.00*	23.10	*98.12*	0.00	*0.00*
Croplands	4.8	920.80	*4,419.84*	964.20	*4,628.16*	808.90	*3,882.72*	337.90	*1,621.92*
Orchard/Grove	4.7	16.60	*78.02*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*
Dry Prairie	6.3	9.80	*61.74*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*
Marsh/ Wet Prairie	6.3	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*
Hardwood Swamp	9.2	5.10	*46.92*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*
Up/Hydric Pine Forest	9.5	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*	0.00	*0.00*
Totals		**980.50**	**4,642.22**	**980.50**	**4,628.16**	**980.50**	***3,908.84***	**980.50**	***1,621.92***

Impacts
PHUs Needed: 4,642 PHU (pre) minus 1,622 PHU (post) equals 3,020 PHUs. 3,020 times base multiplier of 2.5 equals 7,550 PHUs of loss. 7,550 times 1 (primary zone multiplier) equals 7,550 PHUs required for impacts to the Primary Zone habitat.

Mitigation (From Table 12)
11,066 PHUs minus 8,114 PHUs equals 2,952 PHUs times 1/2 equals 1,476 PHUs lift
8,114 PHUs plus 1,476 PHUs equals 9,590 PHUs available compensation.

Summary: 7,550 PHUs needed as compensation and 9,590 PHUs are provided, leaving a **balance 2,040 PHUs still available**.

Table 14. County and State Acquisitions/Mitigation within the Action Area (Ac).

Year	*Miami-Dade* EEL	*Miami-Dade Regulatory*	*State*	*Total*
2000-2010	6,384	17,208	5	23,597

Table 15. Publically Owned Lands within 5 and 25 Miles of the Action Area (Ac).

Entity	*5 Miles*	*25 Miles*
Miami-Dade County	7,436	15,014
United States of America	59	3,122
South Florida Water Management District	5,912	53,018
State of Florida	20	4,736
Miccosukee Tribe of Indians	0	331
City of Homestead	0	220
TOTAL	13,427	76,441

Table 16. ACI Traffic Analysis

Location of Volume Estimate	**LRTP 2005**	**ACI % of Average (at 300 Truck/day distributed by**	**LRTP 2035**	**ACI % of Average (at 300 Truck/day distributed by**
SW 344 Str. West of SW 167 Ave	8,003	(80% * 300) / 8033 = 3.0%	22,807	(80% * 300) / 22807 = 1.1%
SW 344 Str. East of SW 167 Ave	2,891	(20% * 300) / 2891 = 2.1%	13,637	(20% * 300) / 13637 = 0.4%
US1	22,950	(18% * 300) / 22950 = 0.3%	27,015	(18% * 300) / 27015 = 0.2%
Card Sound Road (SR 905)	8,038	([18% * 300] * 10%) / 8038 = 0.1%	15,878	([18% * 300] * 10%) / 15878 = 0.03%

*Data from the Miami Dade County's Long Range Transportation Plan (LRTP) for 2005, projected for 2035.

Atlantic Civil, Inc
Overall Property Location

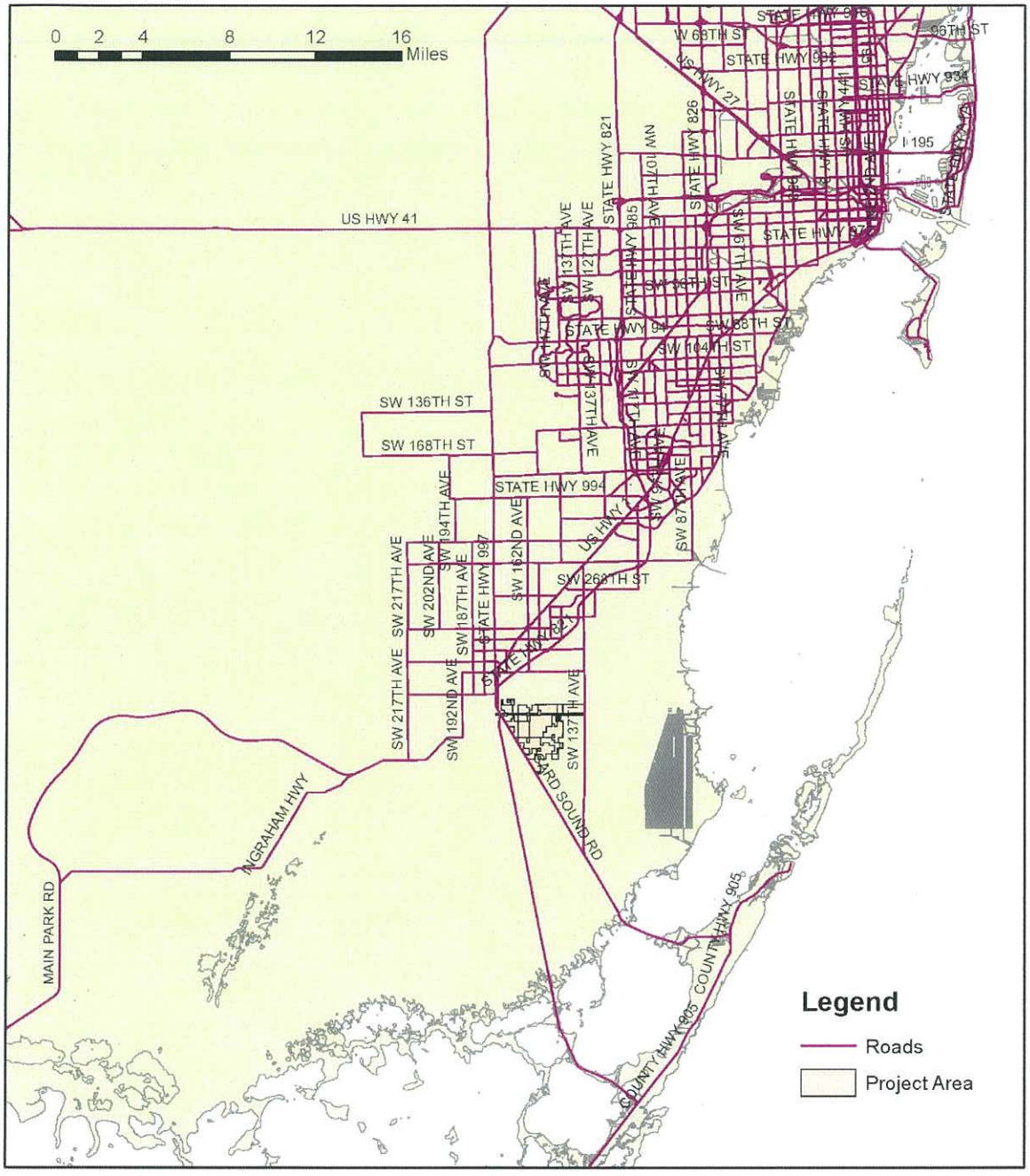

Figure 1. Project Location

Atlantic Civil, Inc
Agricultural and Mining Site Locations

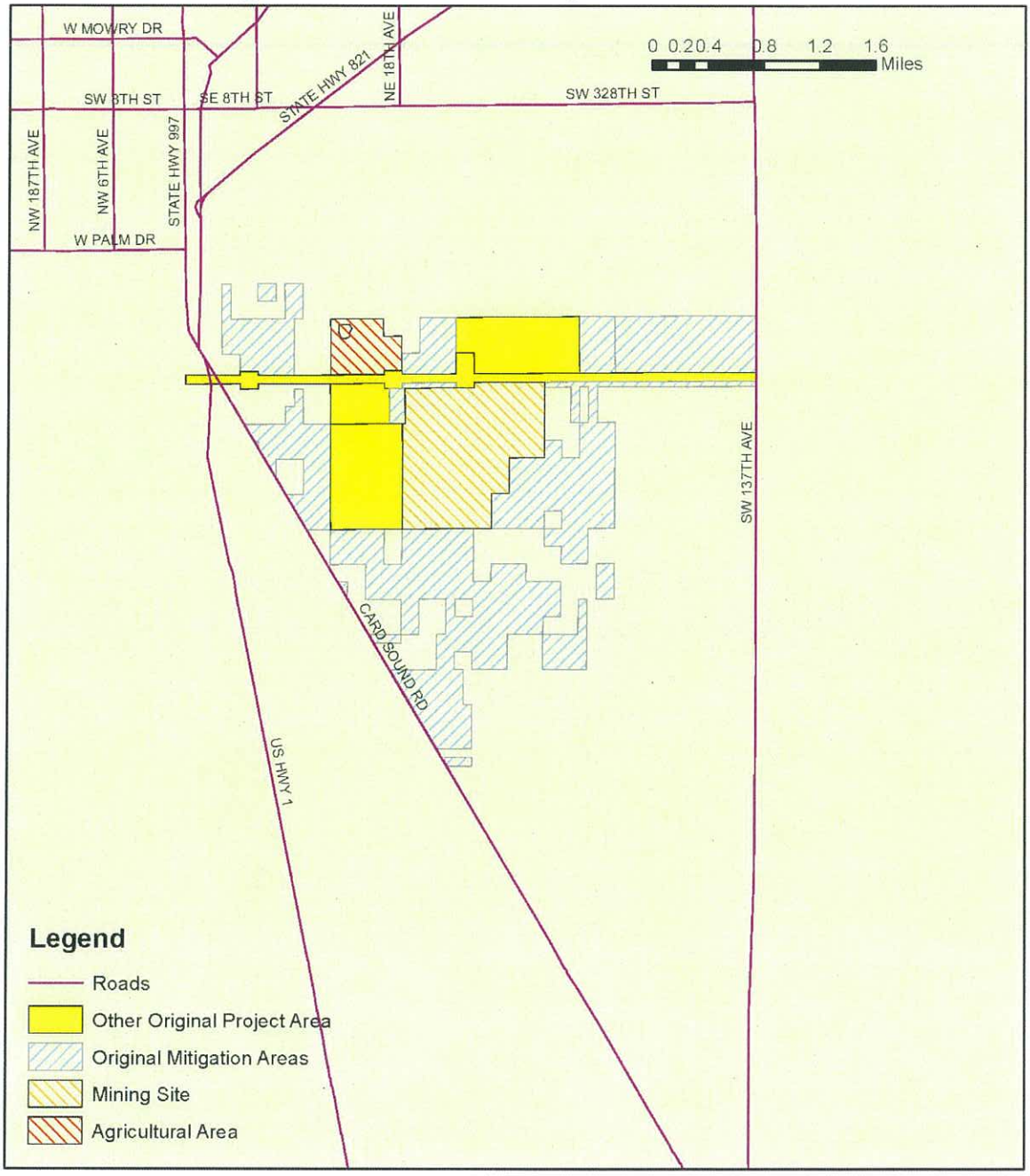

Figure 1a. Specific Project Location

Figure 2. Atlantic Civil Project Site and Compensation Sites

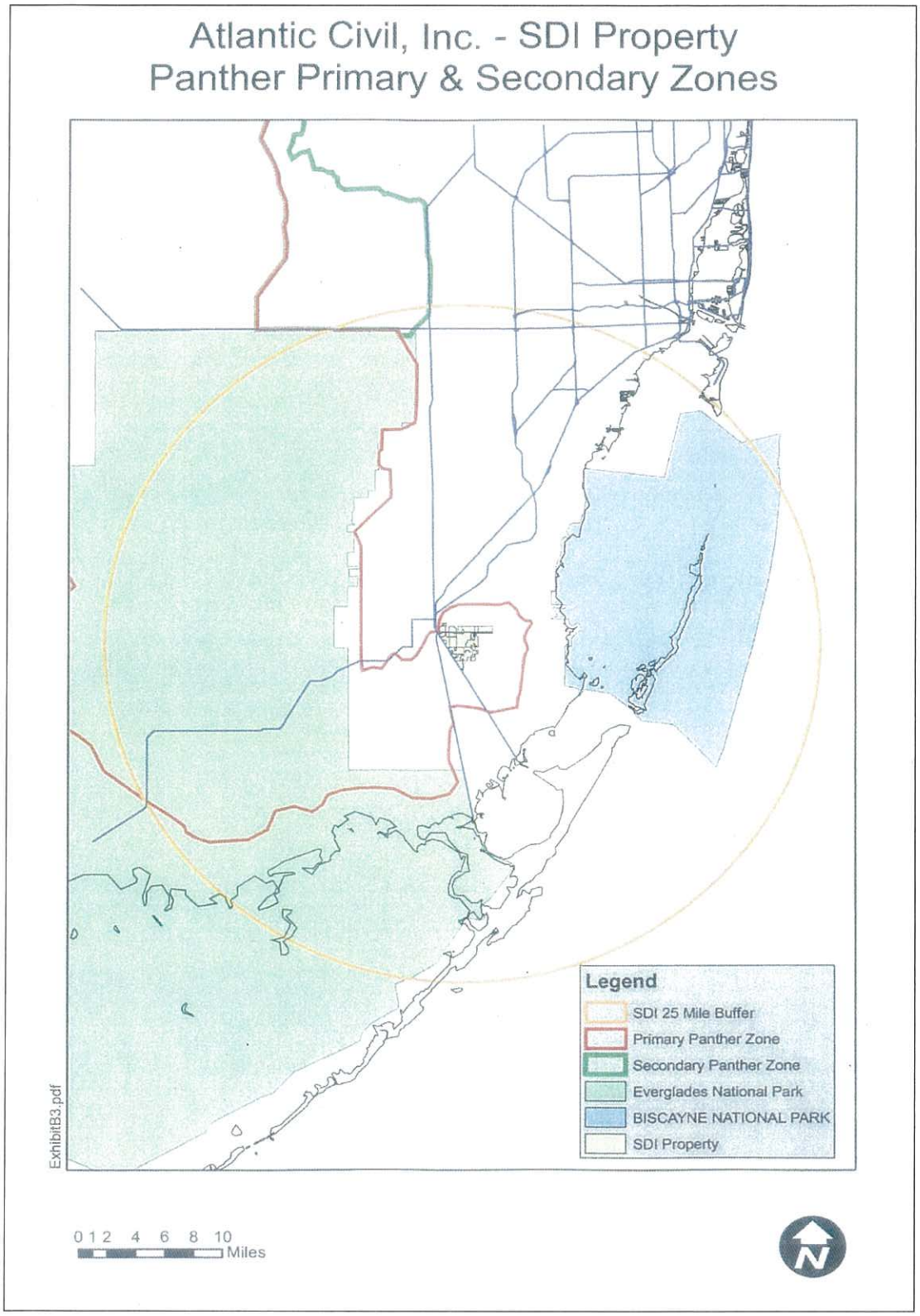

Figure 3. Atlantic Civil in Relation to Panther Primary Zone

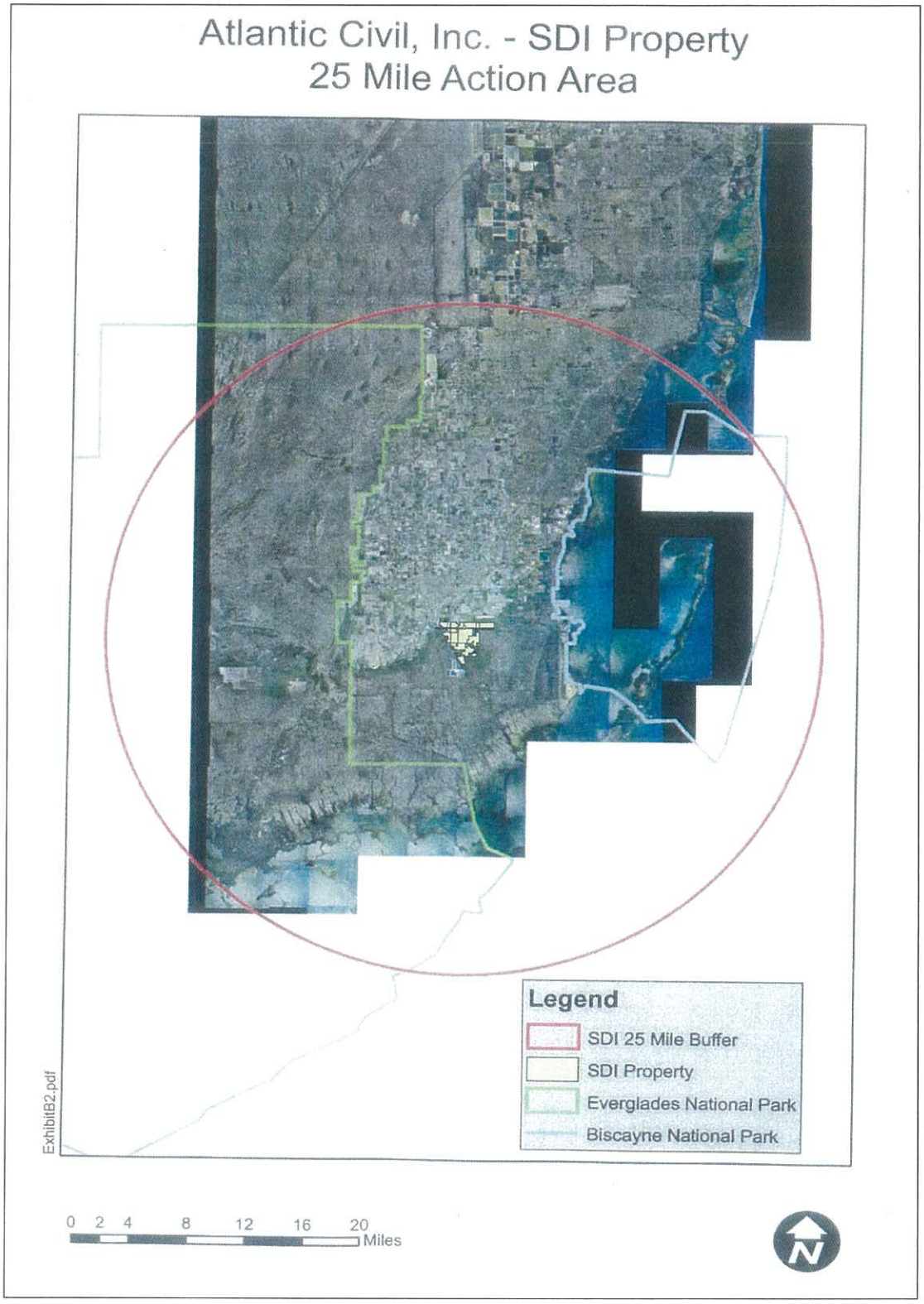

Figure 4. Regional Map with Project and 25-Mile Radius Action Area

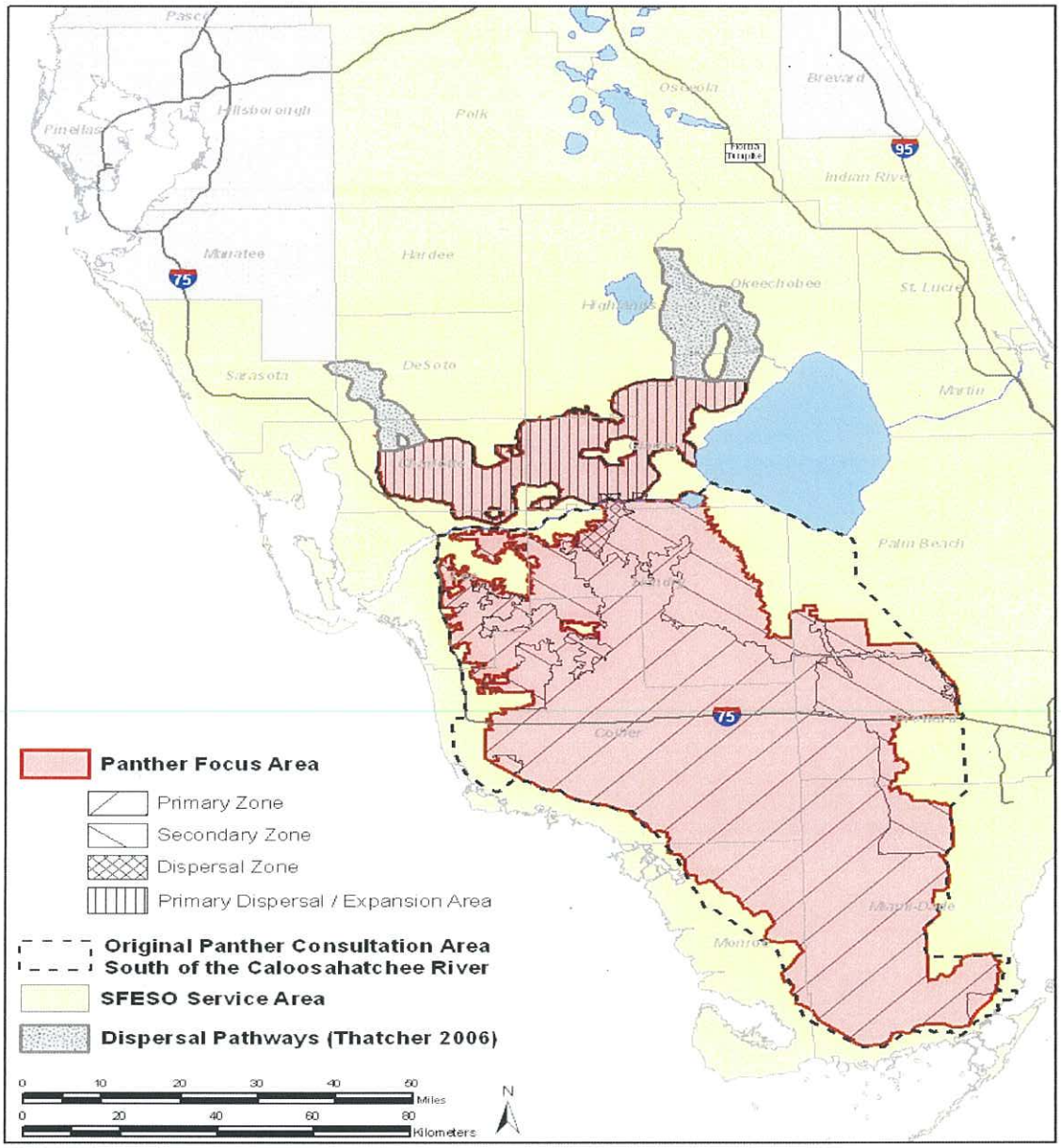

Figure 5. Florida Panther Consultation Area

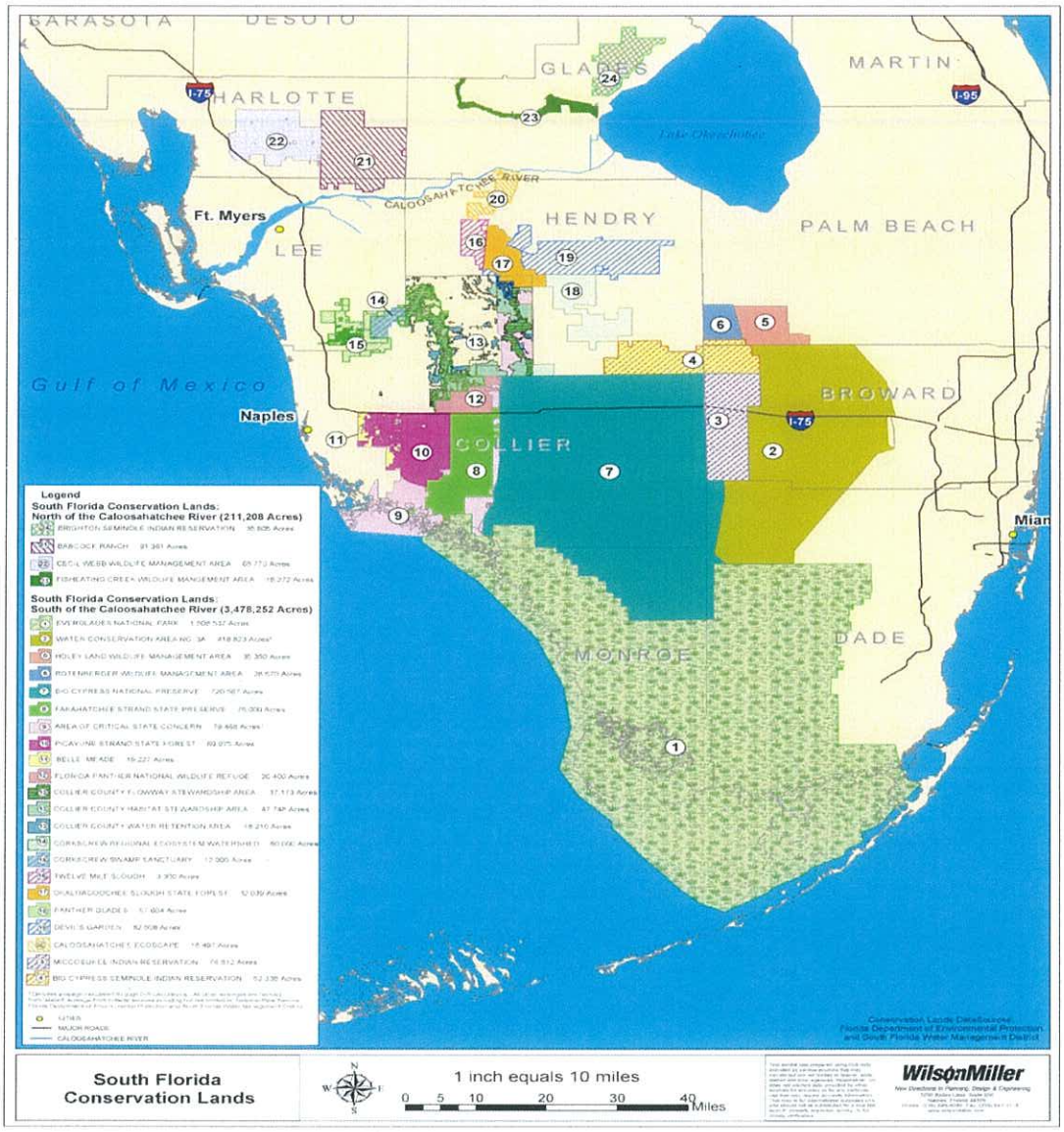

Figure 6. South Florida Conservation Lands

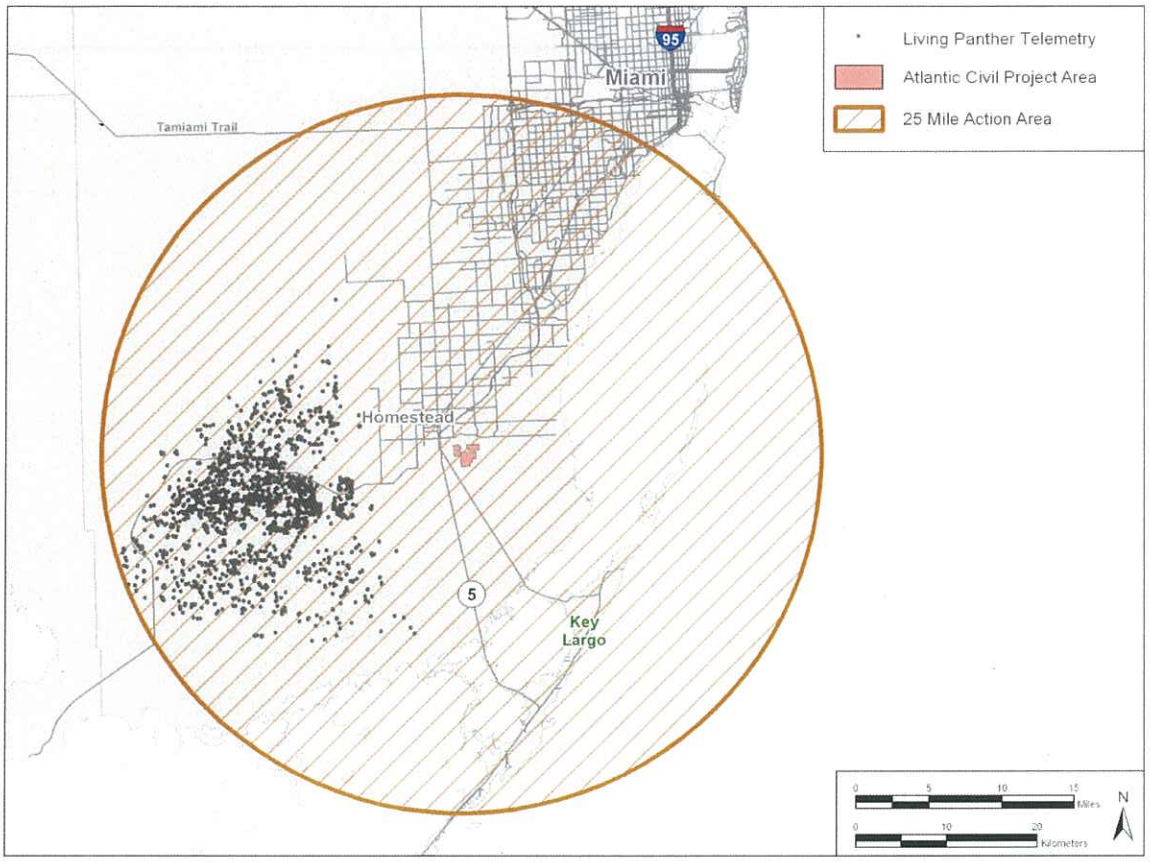

Figure 7. Current Living Panther Locations within 25-Mile Action Area.

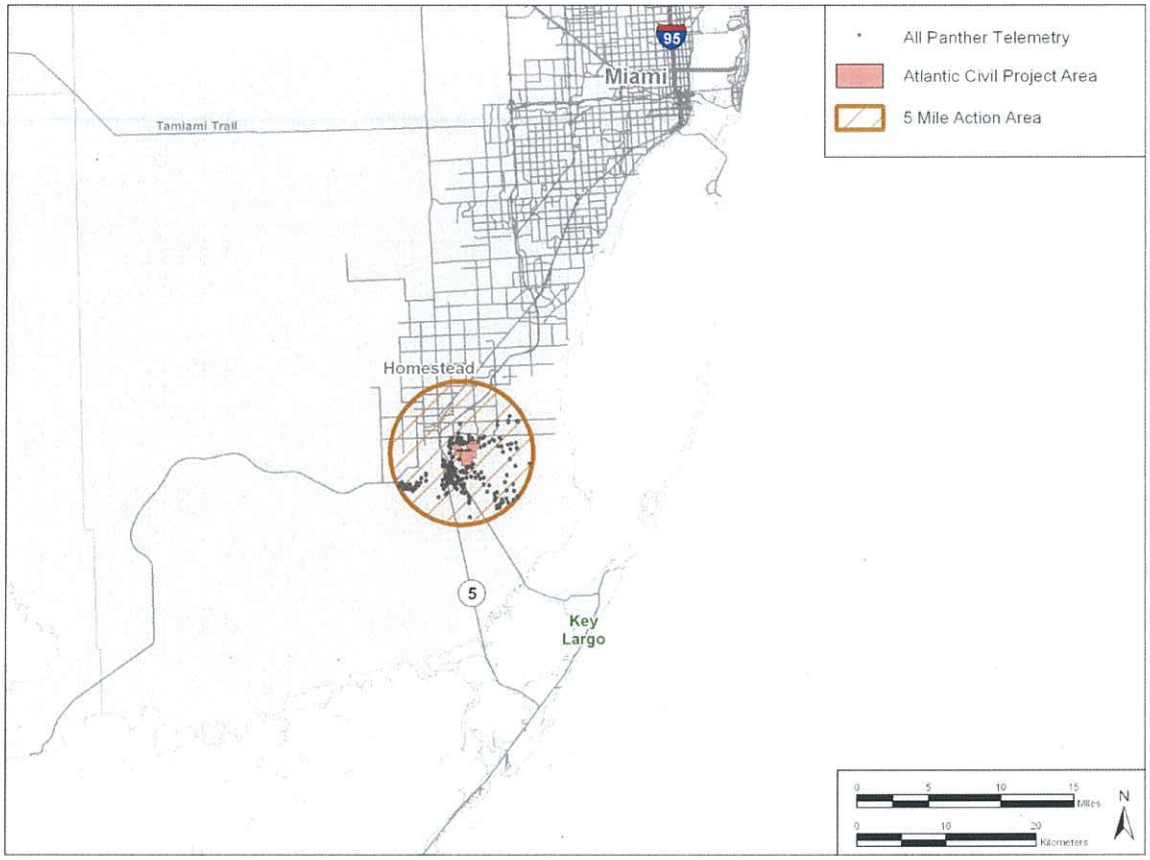

Figure 8. Past Recored Panther Locations within 5 Miles of the Project Site.

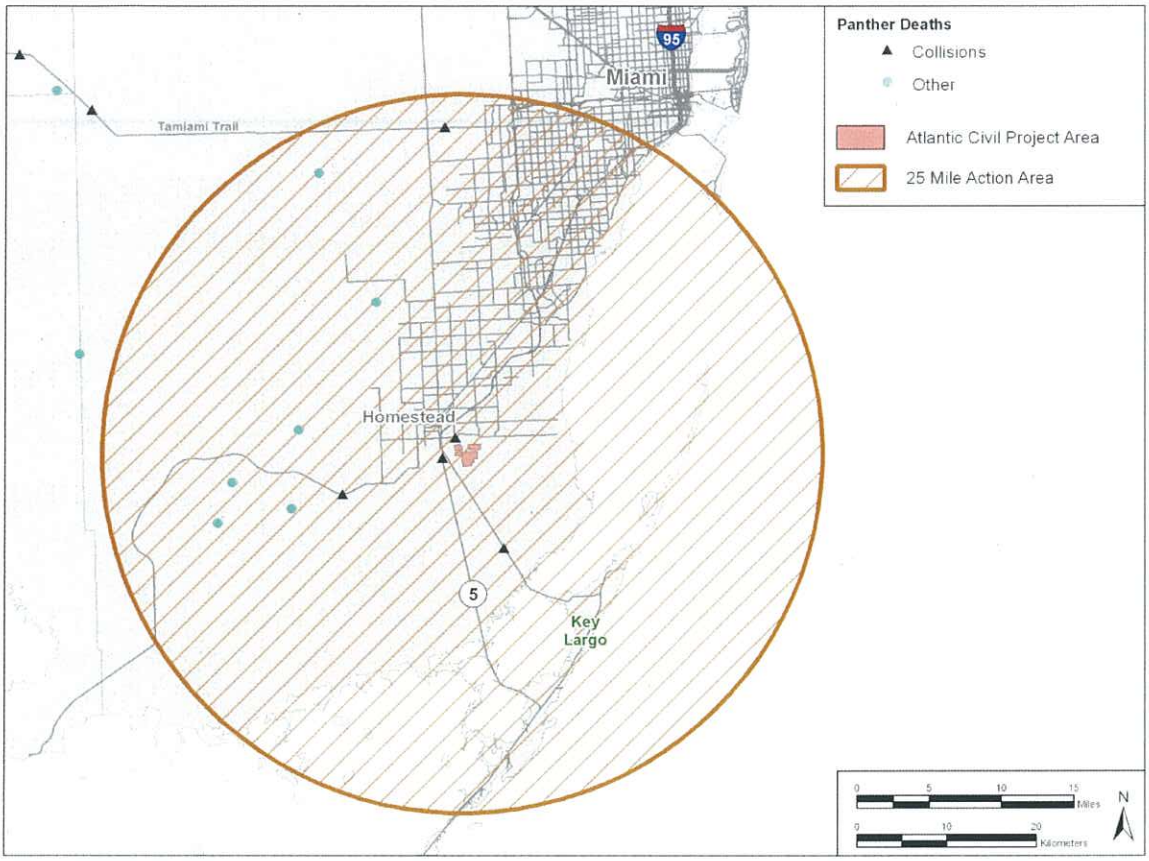

Figure 9. All Recorded Vehicular Panther Deaths within the 25-Mile Action Area.

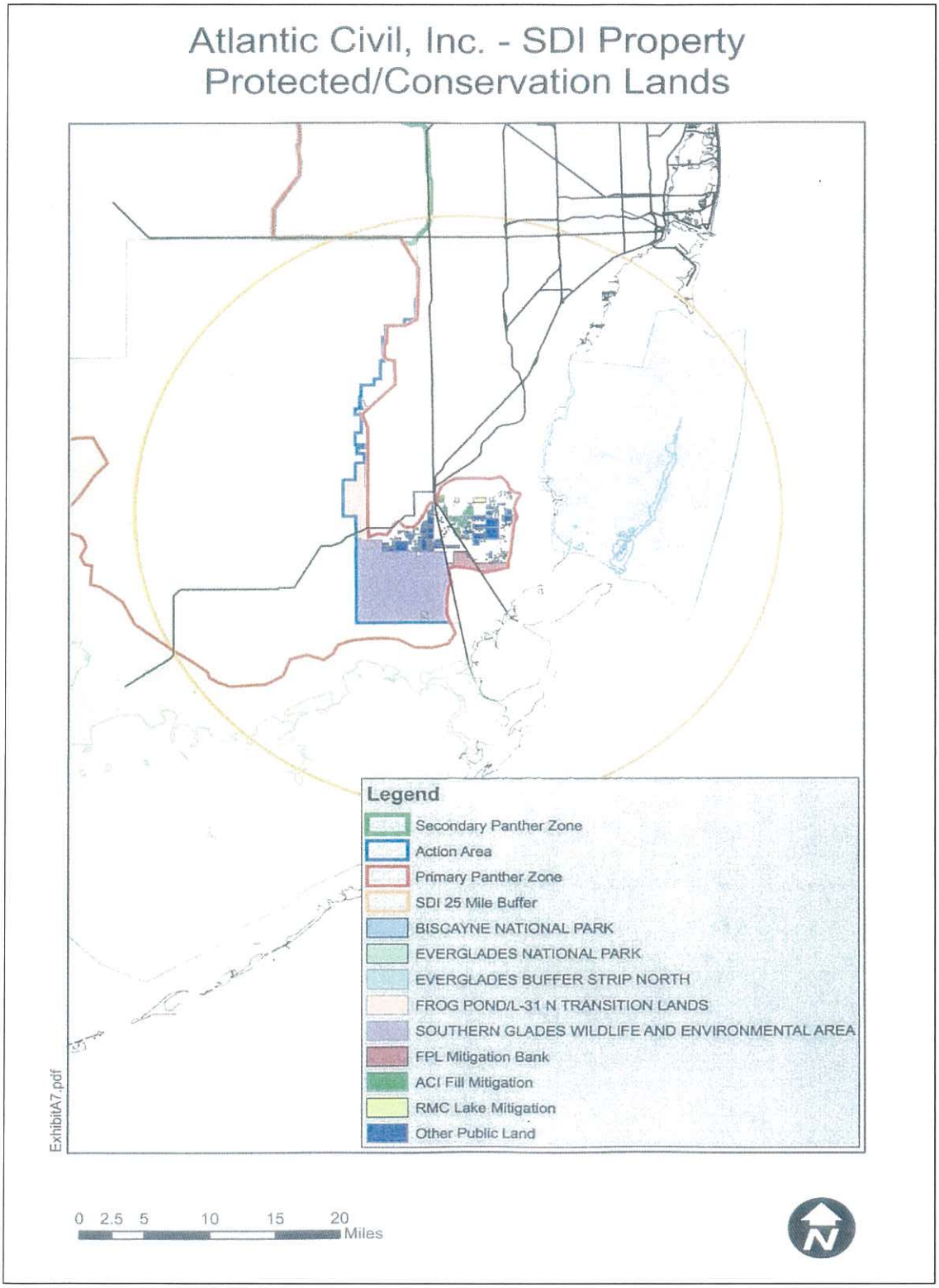

Figure 10. Conservation Lands within 25-Mile Action Area.

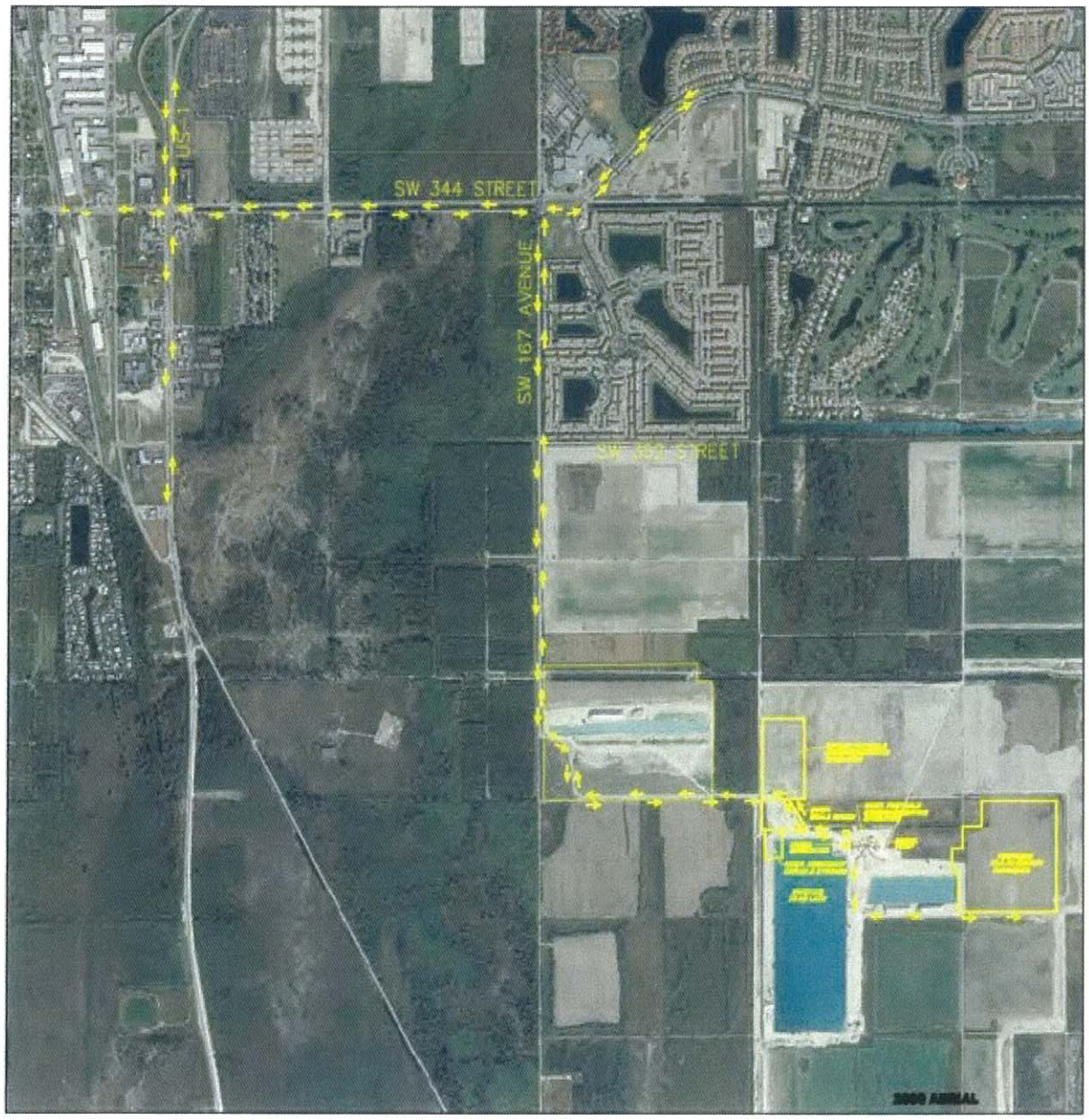

Figure 11. Primary ACI Traffic Routes

Appendix A

Panther Habitat Assessment Methodology

Panther 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 (2006), using a similar concept, assigned likely use values of habitats to dispersing panthers. The FWC's habitats were assigned habitat suitability ranks 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 (2006) with several adjustments to the assigned habitat use values reflecting consolidation of similar types of habitats and the inclusion of Comprehensive Everglades Restoration Plan (CERP) water treatment and retention areas. We used these values (Tables PM1 and PM2) as the basis for habitat evaluations and the recommended compensation values to minimize project effects to the Florida panther, as discussed below.

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

The available primary zone equivalent lands are estimated at 3,276,563 acres (ac) (see Tables PM3 and PM4). Currently 2,073,865 ac of primary zone equivalent, 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. To meet the protected and managed lands threshold 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 ac 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 hectares/year [14,820 ac/ year]). We conservatively assume that we would be aware of half of the development projects that occur within the primary zone and the secondary zone combined. We further assume that 50 percent of these projects would be located in the primary zone and 50 percent would be located in

the secondary zone. Based on these assumptions, we estimated that over a 5-year period about 37,000 ac would be developed without Federal review and adjusted the base value from 1.98 to 2.23.

The Service realizes that habitat losses from individual single-family residential developments will collectively compromise the Service's landscape scale effort to secure sufficient lands for a population of 90 panthers. We believe that, on an individual basis, single-family residential developments by individual lot owners on lots no larger than 5.0 ac will not result in take of panthers on a lot-by-lot basis; however, collectively these losses may affect the panther. Panthers are a wide-ranging species, and individually a 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 or about 0.14 percent of the at risk lands) would be developed through this avenue. This estimate for individual single-family development is based on the yearly average level of development combined in northern Golden Gate Estates (GGE) and Lehigh Acres in Lee and Collier counties. To account for this loss, we further adjusted the base value from 2.23 to 2.48.

There is also 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, which can contribute to panther mortality. For assessment purposes, since our habitat methodology does not provide a mechanism to address this type of effect directly, we are providing a habitat surrogate of 500 ac per year of habitat loss for these types of projects, with a not to exceed value of 2,500 ac over the 5-year period. 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 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 landscape scale effort for the Florida panther.

The Service uses a very conservative density of panthers per area of habitat to calculate the compensation ratio for impacts south of the Caloosahatchee River. Specifically, the Service relied on the low estimate in the range presented in Kautz et al. (2006) to reach its factor of 2.5. This low estimate density value was calculated by dividing the documented number of panthers in 2000, or 62 panthers, by an estimate of the habitat in the primary zone that was most consistently occupied by panthers from 1981 to 2000. As previously mentioned, it is clear the panther population south of the river has increased notably since 2000, in 2001 = 78 panthers; in 2002 = 80; in 2003 = 87; in 2004 = 78; in 2005 = 82; in 2006 = 97; in 2007 = 117; and 2008=104. In 2007 more panthers were documented in south Florida than have been documented since current verified estimates have been collected. Furthermore, none of the panthers recorded south of the Caloosahatchee River lives exclusively outside of the primary zone, although some do venture outside of it on occasion (McBride 2007).

The average population size south of the Caloosahatchee River over the past 7 years is 86. If we were to use this number instead of 62 to calculate the compensation ratio and to use the entire acreage of the primary zone as the denominator, the revised compensation ratio requirement would be 0.32 ac protected for every acre developed. Furthermore, if we excluded the "other zone" altogether from the analysis, the ratio would be 1.01, still lower than the Service's current ratio. We believe this conservative approach is warranted because of the inherent importance of habitat protection to panther conservation.

Landscape multiplier: As stated 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 highest 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 PM5 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 Tables PM1 and PM2. 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.

As of January 2005, the Service has been using a panther habitat suitability ranking system based in part on methods in publications by Swanson et al. (2005) and Kautz et al. (2006) and adjusted by the Service to consolidate similar types of habitats and to include CERP water treatment and retention areas located in the panther's range (Table PM1). Since the implementation of this ranking system, the Service has received two additional, published habitat assessment studies (Cox et al. [2006] and Land et al. [2008]) that further assess habitat usage by the Florida panther. As it is the Service's policy to incorporate the most current peer-reviewed science into our assessment and review of project effects on the Florida panther, we have revised the current habitat suitability ranking system.

To revise these values, the Service, in coordination with FWC, examined the habitat ranking values in the two new papers referenced above and Kautz et al. (2006) publication and developed a spreadsheet. The spreadsheet was developed to: (1) compare the results of each of

these published analyses; and (2) provide a habitat ranking system for each of the assessments. On the first page of the spreadsheet, labeled "panther habitat selection analysis - habitat papers comparison," we summarized the types of analyses performed as to whether it was second order (selection of a home range with a large study area) or third order (selection of habitats within a home range). For each of these analyses, we then listed the habitat types reported in each paper and their order of selection by panthers (Table PM6). We used the cost surface scores and the rank differences from the Kautz et al. (2006) analyses as the selection order and for a measure of statistical differences among the habitat types. Selected habitat types are represented as bold black numbers and avoided habitats are bold red numbers. Habitats that were neither selected nor avoided are shown as normal font black numbers. Ranks with the same letter are not different from each other. Results from the Cox et al. (2006) and Land et al. (2008) papers using Euclidean analyses are shown in a similar fashion.

On the second page of the spreadsheet, labeled "summary of ranking values," we ranked the habitat types on a scale from 0 to 10 according the results from each study and professional judgment (Table PM7). We used our original ranking for the Kautz et al. analyses (with the ranking scale reversed such that the best habitat received a "10" and the lowest quality habitat was "0").

We developed similar rankings for the habitat analyses reported in Cox et al. (2006) and Land et al. (2008). Selected habitats fell in the range of 7 to 10; habitats that were used in proportion to availability were ranked from 4 to 6; and habitats that were avoided by panthers were ranked from 0 to 3. Ranks for habitats within each of the 3 outcomes began at the top of each of the ranges (selected = 10, used in proportion to availability = 6, avoided = 3). Some shifting of the ranks occurred based on the letter-coded statistical ranking. For instance, under *Land GPS Euclidean third order* both upland and wetland forests were selected by panthers and were not statistically different from each other (note the ranking of a and ab for upland and wetland forest, respectively). However, wetland forest and dry prairie also were not significantly different from each other. To show these relationships, we ranked upland forest as a 10, wetland forest as a 9, and we increased dry prairie from a 6 (top of the neither selected nor avoided ranking) to a 7 to reflect the interplay between dry prairie and wetland forest based on professional judgment.

To generate a new ranking of panther habitats for use as a habitat assessment measure, we simply averaged the ranks of the six different analyses presented in the spreadsheet to the first decimal place. Half of these results were second order habitat analyses (Kautz et al. compositional, Kautz et al. Euclidean and Cox et al. Euclidean) and the other half were third order analyses (Cox et al. Euclidean; Land et al. VHF Euclidean; Land et al. GPS Euclidean).

In our assessment, we noted several outlier habitat rankings that, based on our understanding of habitat needs of the Florida panther and our concern for human/panther interactions, appear to provide conflicting values. These habitats and their associated rankings are: (1) barren/disturbed – 5.2; (2) urban – 5.0; (3) open water – 3.3; and (4) coastal wetlands – 1.0. We

believe adjustments are warranted for these four categories and our adjusted values are based on the following:

Barren/disturbed: Barren/disturbed lands may include many temporary changes to land use, such as crop rotation and prescribed fires that likely have little impact on the value to panthers. Areas disturbed by human impact on a longer-term basis (*e.g.*, parking of equipment and material storage areas) have chronic effects on panthers that we judge decrease the value of these lands for panthers. Barren/disturbed lands include disturbed lands (Florida land use and cover classification system [FLUCCS] 740) and spoil areas (FLUCCS 733). Based on the above reasons, we assigned barren/disturbed land a value of 3.

Urban: Panther habitat models typically include urban in the "other" category that was neither avoided nor selected by panthers. Highly urbanized areas are not found in the panther core area that was used in assessing habitat use, as panthers have already selected against these land use types by reducing their range. However, urbanizing areas in more rural settings may appear in the assessment of habitat use. Nevertheless, we believe that potential human/panther interactions are important conflict factors to consider as well. Therefore, we assigned both developed rural and highly urbanized areas a value of 0.

Open water: Open water has been found to be either avoided by panthers or included in the "other" category that was neither avoided nor selected by panthers. We believe open water in any setting provides little to no value to panthers. However, open water edges and berms can be a valuable foraging area or dispersal pathway in more rural settings, although these edges in an urbanized setting could promote human/panther conflicts. Therefore, we assigned open water in an urban setting, with or without emergent vegetation, and surrounding berms a value of 0. However, in rural settings, the littoral edges and berms may provide species benefit and are further addressed under the reservoir discussion below.

Coastal wetlands: There are few strictly coastal wetlands, such as salt marshes and mangrove swamps, within the panther focus area. Where these occur, they are closely interspersed with other upland habitats. In this context, we believe that these areas are of greater value to the panther than the models indicate. These areas may, for the most part, be avoided by panthers; but, they can be of value in the proper landscape context to higher value habitats. Therefore we assigned these areas a value of 3.

We also note that three additional land uses and or habitat types referenced in our original habitat rankings were not components addressed directly in the model. These include: (1) exotic/nuisance plants; (2) stormwater treatment areas (STAs); and (3) reservoirs. We believe these categories are important in our assessment of panther habitat values and warrant consideration in our habitat ranking system.

Exotic/nuisance plants: Although exotic plants can be suitable for providing denning cover and habitat connectivity between other land types for panthers and panther prey, they generally do not provide the preferred foraging base of plants consumed by deer and other herbivores

(Fleming et al. 1994). We believe that prey foraging value, or lack thereof, is an important constraint in our habitat assessments. Therefore, we assigned these habitats a value of 3. Likewise, some native plant species can become so dominant and dense, especially under altered hydrologic and fire suppression regimes, that they no longer provide high habitat value for the panther even though occasional use may occur. The most common example is dense, nearly monotypic cattail stands, which are of reduced value relative to less altered marsh communities. Another example of this type of nuisance species dominance is dense stands of cabbage palm dominated communities. For systems represented by this habitat profile, we also assigned a value of 3.

STAs (Everglades restoration): STAs are generally designed to provide a water quality treatment function for nutrient removal from received upstream discharges and may include multiple berms and adjacent littoral shelves. Depending on the design and mode of operation, they can become vegetated by dense monotypic stands of cattails or can incorporate a diverse mosaic of wetland communities and hydroperiods that support sawgrass and shrub/scrub species. Therefore, they can provide various levels of resource benefit to panthers and panther prey species as discussed below. For this reason, the final value of an STA is determined in a case-by-case basis during project review.

The Service participates in planning efforts that encourage location of STAs at sites with minimal areas of natural habitat, with a preference for sites that are currently in agriculture. Because these facilities by design are located in areas that currently provide a reduced value to panthers and panther prey species, the Service values these systems pre and post project development as a neutral effect on panthers. In these situations, the development of an STA from existing agriculture land uses would be evaluated as if the agriculture land use was present following project development, with no increase or decrease in habitat value to the panther.

However, this neutral effect assessment is only applicable to land conversions from nonnative habitats to STAs. For those projects that remove natural habitats, the Service considers STA functional values to mimic the value of the natural system the STA is designed to achieve. As an example, an STA design that results in a dense monotypic stand of cattails would be appropriately evaluated following the exotic/nuisance species profile. Similarly, a system designed to provide a diverse mosaic of wetland communities and hydroperiods would be evaluated following the wet prairie/marsh profile. Another system design that incorporates internal and external berms could include an edge benefit evaluation identifying the berms and adjacent littoral shelves and their benefit to the Florida panther and panther prey species, and follow the values provided for improved pasture for the berms and or wet prairie/marsh values for the littoral shelves. An individual project assessment of pre and post habitat impacts will identify whether the project as designed results in loss of functional value or provides benefit to the Florida panther and panther prey species.

Reservoirs (Everglades restoration, large water storage area, mines): Reservoirs were originally classified as their own category in our 2003 assessment method. They differ from open-water systems primarily with their location in the landscape. In urban areas, reservoirs have always

been considered open water and given a value of 0. In rural areas, the open water portion of the reservoir provides no habitat value, although the edges and the berms can provide valuable foraging area or dispersal pathways for the panther and panther prey species. Therefore, the 2003 methodology assigned a value of 1.5 to reservoirs to attempt to account for these benefits.

After further consideration, we believe that a more appropriate way to evaluate the value of reservoirs is to evaluate the open water component separately from the reservoir edges and berms. Therefore, we are no longer assigning a value to reservoirs as their own habitat classification. When large-scale reservoir projects are proposed in the rural landscape, all open water areas should be classified as such (value = 0). Berms and edges should be classified as the habitat they will most resemble in the post-project condition. For example: a 1,000-acre reservoir with 50 ac of grassed berms and 50 ac of berms with roads along the top would be evaluated as 900 ac of open water, 50 ac of pasture, and 50 ac of urban.

We also recognized that the habitat matrix (Table PM7) lists four native habitats similar in functional habitat value to panthers as non-native habitats: marsh/wet prairie – 4.7; xeric scrub – 4.5; shrub and brush – 5.5; and dry prairie – 6.3. These habitat ratings, which are between 4 and 6, are classified as being neither selected nor avoided by panthers. The Service's Florida panther draft Recovery Plan's (Service 2008) action 1.1.1.2.3 recommends habitat preservation and restoration within the primary zone be provided in situations where land use intensification cannot be avoided. We view this recommendation as a key parameter in our conservation goal to locate, preserve, and restore 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.

Therefore, for assessment purposes, if a project is proposing restoration of non-native habitats (*e.g.*, pasture, row crops, groves, etc.) to native habitats, we believe that a restoration lift to a value of 7 is appropriate. The functional value of 7 corresponds to that value found in the literature where panthers begin to select for that habitat attribute (Table PM7). We also believe that a full functional lift credit for these restorations is appropriate as the time lag from restoration to full functional value is estimated to be relatively short (less than 5 years) for non-forested systems. However, the calculation of forested restoration values remains the same as in the previous methodology, which is one-half the difference between pre- and post-restoration.

In summary, we believe that appropriate adjustments to our original PHU values are warranted based on the most current peer-reviewed science and our category specific discussions above. Therefore, we have incorporated the above referenced values into our revised habitat assessment matrix and these values are the current basis for habitat evaluations and the recommended compensation values to minimize project effects to the Florida panther (Table PM2).

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 PM2, 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 hydric 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 885 PHUs ((90 ac of pine flatwoods x 9.5 [the habitat suitability value for pine flatwoods] = 855 PHUs) + (10 ac of exotic vegetation x 3 [the habitat suitability value for exotics] = 30 PHUs) = 885 PHUs). The value of 885 PHUs is then multiplied by the 2.5 (the base ratio) and 0.69 (the landscape multiplier) resulting in a value of 1,527 PHUs for the project site. In this example, the acquisition of lands in the primary zone containing at least 1,527 PHUs is recommended to compensate for the loss of habitat to the Florida panther resulting from this project.

Table PM1. Original panther habitat unit 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/nuisance plants	3	Bottomland hardwood	9	Hardwood forest	10
Cropland	4	Bay swamp	9		
Orchards/groves	4	Hardwood swamp	9		

Table PM2. Revised panther habitat unit values for use in assessing habitat value to the Florida panther.

Land Cover Type	Value	Land Cover Type	Value	Land Cover Type	Value
Reservoirs	*	Xeric scrub	4.5	Dry prairie	6.3
STAs	**	Orchards/groves	4.7	Upland Hardwood Forest	9.0
Urban	0	Marsh/ wet prairie	4.7	Cypress swamp	9.2
Water	0	Cropland	4.8	Hardwood swamp	9.2
Barren/Disturbed lands	3	Improved pasture	5.2	Hardwood-Pine	9.3
Coastal wetlands	3	Shrub swamp/brush	5.5	Upland-Hydric Pine forest	9.5
Exotic/nuisance plants	3	Unimproved pasture	5.7		

* PHU values for reservoirs are evaluated based on open water for the main water areas and the appropriate categories for berms and other non-water sections. Refer to pages 5- 7 for the accompanying text for guiding criteria for these systems.

** PHU values for stormwater treatment areas vary depending on design criteria, mode of operation, location in native or non-native habitats, and other landscape features. Refer to page 6 for the accompanying text for guiding criteria for these systems.

Table PM3. 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
TOTAL	2,578,152	TOTAL	2,073,865

Table PM4. 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
TOTAL	1,962,294	TOTAL	1,202,699

* About 819,995 ac are at-risk in the other zone with about 80 percent with resource value. Total ac of at-risk privately owned lands are 1,962,294 ac.

Table PM5. 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 PM6. Panther Habitat Selection Analyses – Habitat Papers Comparison.

Habitats	Kautz compositional second order	rank	Kautz Euclidean second order	rank	Habitats	Cox Euclidean second order	rank	Cox Euclidean third order	rank	Habitats	Land VHF Euclidean third order	rank	Land GPS Euclidean third order	rank
Hardwood swamp	1	A	3	A	Coniferous forest	1	A	1	A	Upland forest	1	A	1	A
Pineland	2	A	2	AB	pineland					pine/hardwood				
Cypress swamp	3	AB	1	BC	Hardwood forest	3	C	2	A	hardwood hammock				
Upland forest	1	B	4	CD	hardwood hammock					pinelands				
Dry prairie	5	B	5	DE	mixed pine/hardwood					tropical hammock				
Shrub and brush	4	C	7	EF	palm/oak					palm/hardwood				
Xeric scrub	3	CD	9	F	tropical hammock					Wetland forest	2	A	2	AB
Marsh	5	CD	9	F	Forested wetland	2	B	3	A	cypress swamp				
Unimproved pasture	7	DE	7	G	cypress swamp					cypress/pine/palm				
Barren	6	E	9	G	mixed forest					mixed swamp				
Improved pasture	9	EF	6	G	shrub swamp					hardwood swamp				
Urban	8	F	8	G	hardwood swamp					Dry prairie/grass	3	B	3	BC
Cropland	9	F	8	H	other wet forest					grassland				
Citrus	10	G	8	H	Dry prairie/grass	4	C	4	B	unimproved pasture				
Coastal wetlands	11	G	8	H	dry prairie					improved pasture				
Open water	10	H	10	I	grassland					Marsh/shrub	6	B	4	C
Exotic plants					Open wetland	7	E	7	C	marsh/wet prairie				
STA					marsh and wet prairie					sawgrass				
Reservoir					sawgrass					cattail				
					cattail					shrub swamp				
					Agricultural	5	D	5	B	Other	4	B	5	C
second order - selection of home range with entire study area					improved pasture					open water				
third order - selection of habitats within home range					citrus					shrub/brush				
Bold (black) - habitat used more than availability (selection)					row crop					barren				
Bold (red) - habitat used less than availability (avoidance)					other agriculture					high impact urban				
rank - habitats with same letters did not differ in preference					Urban/barren	6	E	6	B	low impact urban				
					bare soil					extractive				
					high-impact urban					Agriculture	5	B	6	C
					low-impact urban					citrus				
					extractive					row crop				
										other agriculture				

Table PM7. Summary of Ranking Values

Habitats	Kautz compositional second order	Kautz Euclidean second order	Cox Euclidean second order	Cox Euclidean third order	Land VHF Euclidean third order	Land GPS Euclidean third order	Average
Hardwood swamp	10	7	9	10	10	9	9.2
Pineland	9	8	10	10	10	10	9.5
Cypress swamp	8	9	9	10	10	9	9.2
Upland forest	10	6	8	10	10	10	9.0
Dry prairie	6	5	8	6	6	7	6.3
Shrub and brush	7	3	no data	no data	6	6	5.5
Xeric scrub	8	1	no data	no data	no data	no data	4.5
Marsh	6	1	6	3	6	6	4.7
Unimproved pasture	4	3	8	6	6	7	5.7
Barren	5	1	7	6	6	6	5.2
Improved pasture	2	4	7	6	6	6	5.2
Urban	3	2	7	6	6	6	5.0
Cropland	2	2	7	6	6	6	4.8
Citrus	1	2	7	6	6	6	4.7
Coastal wetlands	0	2	no data	no data	no data	no data	1.0
Open water	1	0	no data	no data	6	6	3.3
Exotic plants							
STA							
Reservoir							

habitat selection	7,8,9,10
neither selected nor avoided	4,5,6
habitat avoidance	0,1,2,3