United States Department of the Interior

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

June 29, 2005

Colonel Robert M. Carpenter
District Engineer
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Service Log No.:	4-1-04-PL-6866-R3
Corps Application No.:	SAJ-2003-09416 (NW-MAE)
Date Received:	March 24, 2004
Biological Opinion Date:	February 22, 2005
Biological Opinion Revision Date:	March 16, 2005
Project:	Ave Maria University DRI
Applicant:	Barron Collier Investments
County:	Collier

Dear Colonel Carpenter:

This document transmits the Fish and Wildlife Service's (Service) revised biological opinion for the above referenced project and its effects on the endangered Florida panther (*Puma concolor coryi*) and threatened Audubon's crested caracara (*Polyborus plancus audubonii*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et. seq.*). The original biological opinion was issued on February 22, 2005. A revised biological opinion was issued on March 16, 2005, which corrected errors and omissions in literature cited in the text, clarified references cited in the document, and corrected errors in some of the tables referenced in the text. This revision, which is the result of a reinitiation of consultation, provides the Service's assessment of additional information received from the applicant and the Florida Fish and Wildlife Conservation Commission (FWC) (In Review) on the status of Camp Keais Strand as an important, documented panther movement corridor between resident and dispersing panthers in the Florida Panther National Wildlife Refuge and resident and dispersing panthers in the Corkscrew Regional Ecosystem Watershed (CREW) conservation lands. This revision also addresses a minor (32.0-acre) addition of cropland to the Ave Maria Development of Regional Impact (DRI) project boundary and a deletion of 656.0 acres of panther compensation lands from Stewardship Sending Areas (SSA) 3 and a corresponding increase of 656 acres of panther compensation lands in SSA6. The revisions also clarify some of the biology of the Audubon's crested caracara. The Service's biological opinion addresses the maximum potential footprint of the Ave Maria University DRI, which is approximately 5,027.0 acres and exceeds the Corps permit application footprint, which is approximately 683.4 acres affecting less than 0.5 acre of federally regulated wetlands.

In addition to this latest information, this revised biological opinion is based on information provided in a March 23, 2004, U.S. Army Corps of Engineers' (Corps) notification letter, information provided by WilsonMiller on June 29, 2004, July 13, 2004, August 17, 2004, and August 18, 2004, the Corps' August 18, 2004, letter to the Service which transmitted project information prepared by WilsonMiller, meetings, telephone conversations, emails, and other sources of information. A complete administrative record of this consultation is on file at the South Florida Ecological Services Office, Vero Beach, Florida.

The purpose of the project, as defined in the Corps' notification letter, is to construct six storm water outfall structures in association with the development of Ave Maria University and an associated town center. Construction of these structures will impact less than 0.5 acre of herbaceous wetlands. The project is located on a 683.4-acre parcel that consists of 28.4 acres of wetlands and open water and 655.0 acres of uplands. This parcel is located south of Immokalee Road, west of Camp Keais Road, north of Oil Well Road, and east of Camp Keais Strand in Sections 31, 32, and 33, Township 47 South, Range 29 East, and in Sections 4, 5, 8, 16, and 17, Township 48 South, Range 29 East, Collier County, Florida. In addition, and for the purposes of addressing additional direct and indirect effects that this project will generate, the Service considers the proposed action to also include those lands surrounding the 683.4-acre project currently being reviewed for potential development under the State of Florida's DRI review process. The proposed Town of Ave Maria DRI will include the Ave Maria University and the Town of Ave Maria with a town center, residential components, and mixed-use commercial development. The proposed Town of Ave Maria DRI, including the 683.4-acre parcel, totals 5,027.0 acres and is located in Sections 1, 12, 13, Township 48 South, Range 28 East; Sections 6, 7, 16, and 18, Township 48 South, Range 29 East; Sections 27, 29, 30, and 31, Township 47 South, Range 29 East; and Section 36, Township 47 South, Range 28 East, Collier County, Florida.

Information provided by the applicant for the total Ave Maria DRI project site indicates a maximum of 5,027 acres of wetlands and uplands may be adversely affected under a build-out scenario. Detailed and specific information for all parts of the Ave Maria DRI project are not yet available; therefore, the analysis and conclusions of this biological opinion are valid for the Ave Maria DRI provided the maximum acreage of impacts to wetlands or uplands, beyond those proposed under the current DRI plan, is not significantly exceeded. Under the Clean Water Act, section 404, future permitting through the Corps is anticipated, at which time confirmation of the acreage of wetland and upland impacts (habitat loss) assumed under this biological opinion will occur. For the purposes of this biological opinion, the entire Ave Maria DRI project site (5,027 acres) is assumed to be impacted, in terms of loss of panther habitat.

Traffic studies provided by the applicants show increases in traffic on Oil Well Road, Camp Keais Road, Everglades Boulevard, and portions of Immokalee Road. To meet the traffic needs expected from the proposed action, the applicant is, in a cooperative agreement with Collier County, proposing funding of portions of the widening and expansion of each of these roads from two-lane rural roadways to four-lane urban roadways. Since Collier County and not Ave Maria University (AMU) is proposing the actual road-widening expansions, this biological opinion addresses only those traffic increases generated by the Ave Maria DRI project.

The Ave Maria DRI project site is comprised primarily of agricultural lands within a larger setting of agricultural lands (Figures 1A and 1B). The primary wetland system in the project vicinity is Camp Keais Strand, a regional north-to-south flowway/wetland system to the immediate west of the project. Clearing for agricultural conversion occurred in the 1960s and 1970s on lands on both sides of Camp Keais Strand, including the project site, with essentially all of the upland lands in the region having been converted to intensive row crop production by the early 1980s. The Ave Maria DRI project site is within both the Secondary Zone (2,902 acres) and the Primary Zone (2,125 acres) (Figure 2) (Kautz et al. In Review). The Primary Zone lands, which are adjacent to Camp Keais Strand, extend out from the native vegetation communities of the Strand (Figures 3A, 3B, and 3C). The maximum acreage of wetland impacts anticipated to occur under the Ave Maria DRI build-out may involve discharge of fill and excavation in approximately 30 acres of federally jurisdictional wetlands and 15 acres of ditches and other surface waters (waters of the United States) and preservation of the balance of 66 acres of federally jurisdictional wetlands. The vast majority of development impacts are proposed for areas that have been previously cleared and are currently being utilized for intensive agriculture activities. As mitigation for wetland impacts, the applicant proposes to enhance and preserve 66 acres of onsite wetlands under Federal wetland jurisdiction and accomplish further wetland mitigation, if necessary, within wetlands that are part of the adjacent Camp Keais Strand system. The specific justification and quantification of wetland mitigation will occur during future Corps 404 permit application reviews.

The applicant is proposing as compensation for adverse effects to habitat loss in the Primary and Secondary Zones of lands important to the Florida panther, the preservation of 7,285 acres of lands in the Primary Zone through perpetual conservation easements granted to Collier County and the State of Florida on the preservation parcels. Two of the compensation parcels (identified as Stewardship Sending Areas [SSA], designated SSA1 and SSA2, totaling approximately 850 acres) are comprised of a mix of native vegetated habitats. Three compensation parcels (identified as SSA3, SSA4, and SSA6, totaling approximately 6,935 acres) are comprised of a mosaic of agricultural fields, hydric and mesic pine (*Pinus elliottii*) flatwoods, and cypress (*Taxodium distichum*) domes and sloughs, with various levels of infestation of the invasive exotic Brazilian pepper (*Schinus terebinthifolius*). SSA3 and SSA4 compensation lands are situated in a regionally significant wildlife corridor and are part of the Okaloacoochee Slough System. These compensation lands are bisected by County Road (CR) 846, which leads east out of the town of Immokalee. The portion of CR 846 adjacent to SSA3 and SSA4 has been the site of five panther deaths due to motor vehicle collisions over the past decade. Placement of the compensation lands under conservation easement is anticipated to facilitate the construction of one or more wildlife underpasses along this important stretch of CR 846. SSA6 compensation lands are adjacent and contiguous to the Florida Panther National Wildlife Refuge (NWR).

The applicant is also proposing, in cooperation with Collier County, as a component of the proposed road improvements, the construction of a panther/wildlife crossing with associated fencing on Oil Well Road. Collier County, in cooperation with the National Wildlife Federation and the Florida Wildlife Federation, is coordinating a study of Oil Well Road and the segment of CR 846 east of Immokalee by Dr. Reed Noss and Dr. Daniel Smith to determine the optimum

location for wildlife crossing constructions (WilsonMiller 2005). Although traffic projection studies do not show an increase in traffic generated by AMU on the portion of Immokalee Road crossing Camp Keais Strand (see discussion in the Effects of the Action), the applicant has proposed, in cooperation with Collier County, the placement of panther crossing road signs (four signs – two on each direction of traffic flow) on this section of Immokalee Road. No road improvements are proposed as a component of the Ave Maria DRI for this section of Immokalee Road.

In the Nationwide Permit notification letter to the Service dated March 23, 2004, the Corps determined the AMU project "may affect, but is not likely to adversely affect" the endangered wood stork (*Mycteria americana*), the endangered red-cocked woodpecker (*Picoides borealis*), the threatened eastern indigo snake (*Drymarchon corias couperi*), and the threatened Audubon's crested caracara. The Corps provided a "may affect" determination for the endangered Florida panther and requested the Service initiate formal consultation. In a letter to the Corps dated June 23, 2004, the Service indicated further information was needed on the full potential DRI project and the Service would need to consider the entire DRI area as the project area. No statement of concurrence regarding determinations was offered. In a letter to the Service dated August 18, 2004, the Corps transmitted requested information from the applicant regarding the maximum potential DRI project. The Corps provided determinations of "may affect, but is not likely to adversely affect" for the wood stork, red-cockaded woodpecker, and eastern indigo snake. The Corps revised its determination to "may affect" for the Audubon's crested caracara, restated its determination of "may affect" for the Florida panther, and requested initiation of formal consultation. After reviewing information received from the Corps and the applicant's agent, WilsonMiller, the Service concurred with the Corps' determination of "may affect, but is not likely to adversely affect" for the wood stork, red-cockaded woodpecker, and eastern indigo snake, and "may affect" for the Audubon's crested caracara and the Florida panther.

Use of Best Scientific and Commercial Information by the Service

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

Specifically, there is one such document cited in the biological opinion the Service acknowledges has been affected in its cited form by new scientific information. The Service has taken these new sources of information into account when using this document to help guide our analysis and decisions. This document is the Multi-Species Recovery Plan (MSRP) of 1999 (Service 1999). In addition, the Service has examined Kautz et al. (In Review) for its scientific validity, specifically with regards to comments and recommendations by other reviewers as discussed below.

South Florida Multi-Species Recovery Plan

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

Kautz et al. (In Review)

The Florida Panther Subteam was charged with developing a landscape-level strategy for the conservation of the Florida panther population in south Florida. The Subteam produced the draft Landscape Conservation Strategy for the Florida Panther in South Florida in December 2002 and provided it to the Service. Upon receipt, the Service began to use the information in the draft Landscape Conservation Strategy in its decision-making processes and documents since it was part of the best scientific information available to the Service at the time. Since then some portions of the science and findings in the draft Landscape Conservation Strategy have been challenged. Many, but not all, of the Subteam members have refined the methodology, further analyzed the data, and better defined the results of the Landscape Conservation Strategy into a draft article, referred to here as Kautz et al. (In Review), for submission to a professional peer-reviewed journal, Biological Conservation. To date, the authors have responded to two sets of edits on their draft article and are awaiting response from the journal editor regarding acceptance of the manuscript for publication. In addition, the authors have considered the comments provided by Beier (2003) on the Landscape Conservation Strategy and the recommendations provided by the Scientific Review Team (SRT) (Beier et al. 2003) as discussed below.
Dr. Jane Comiskey, one of the co-authors of Kautz et al. (In Review), has expressed some concerns about the manuscript and we have addressed her concerns below as well. We have also addressed issues relating to the ESA and Information Quality Act.

Beier (2003) Comments on the Draft Landscape Conservation Strategy

Beier provided 37 comments on the Subteam's Landscape Conservation Strategy. Kautz et al. (In Review) addressed all of Beier's comments except those discussed below.

1. Include a statement that when analyses using nighttime data are available, this picture probably will change.

This statement is not in the manuscript, but in this and other biological opinions, the Service acknowledges that nighttime and 24-hour data are generally not readily available at this time. Data from GPS collars will be considered when found to be reliable and available. Availability of nighttime or 24-hour data may possibly change some conclusions about panther habitat in the future. In analyses of puma habitat in California, Beier (2003) found that puma show markedly broader habitat use and selection at night compared to daytime. We expect that when GPS-

collar data becomes more available, there will likely be a better understanding of habitat use at night. However, the Service does not solely rely on daytime telemetry in making its decisions regarding panther habitat. The Service considers panther habitat to include all areas required for the panther to live out its full life-cycle, including areas providing food and shelter and supporting characteristic movement such as hunting, breeding, dispersal, and territorial behavior.

2. Explain the witch's finger jutting eastward from the Primary Zone. No panther is going to have a home range 10 miles long and 400 meters wide. Buffer this so that it is at least 1 mile wide at its narrowest points, and 4 to 5 miles wide in most areas. I support the idea of making this primary habitat, but strongly feel that it does not make sense to make it so narrow.

This was not addressed. This comment relates to the slender portion of the Primary Zone that protrudes eastward at the border of Palm Beach and Broward Counties and the recommendation by Beier that it be buffered to be more inclusive. While Kautz et al. (In Review) did not make this requested modification; the Service will address this omission in biological opinions, as appropriate. The Service is careful to consider Primary, Dispersal, and Secondary Zones and other panther habitat, along with additional high-quality scientific and commercial data, in our analyses and evaluations.

3. Secondary Zone: Overall, the approach is *reasonable*, but not *rigorous*. We will probably never have data to make this a rigorous analysis, so it would be unreasonable to demand it. However, if you ran a cursory sensitivity analysis, you can determine how the map varies under different assumptions about cutoff points and relative weights.

*According to Kautz et al. (In Review), the Secondary Zone is defined as natural and disturbed lands adjacent to the Primary Zone that may have potential to support an expanding panther population, especially if habitat restoration were possible. A preliminary boundary of a Secondary Zone was originally drawn on a hard copy map by the Multi-species Ecosystem Recovery Implementation Team (MERIT) Panther Subteam. The landscape context of the draft Secondary Zone was evaluated by combining a set of 30-meter (m) pixel grids created to measure three habitat-related variables (*i.e., *proximity to Primary Zone, proximity to a forest plus buffer patch, forest plus buffer patch size) and three land-use variables (*i.e., *proximity to urban lands, intensity of land use, and road type and density). Pixels in the six data layers were assigned scores of 1 to 10, with 10 representing the best case for panthers. Equal interval or progressively increasing or decreasing increment functions were applied to each data layer as deemed appropriate. The Secondary Zone boundary was finalized by adjusting the preliminary boundary to conform to results of the landscape context analysis and to land use changes as indicated by recent satellite imagery. To our knowledge, a cursory sensitivity analysis varying the scores assigned to the different variables within each data layer was not run. Therefore, we do not know how a map of the Secondary Zone would vary under different assumptions about cutoff points and relative weights. However, as a group, the Subteam reviewed the draft Secondary Zone boundaries in relation to the results of the context analyses and recent satellite imagery, and achieved consensus on the adjusted boundaries that best met the definition of the Secondary Zone. Therefore, the Service does not believe the lack of this cursory sensitivity*

analysis affects the scientific validity of a Secondary Zone nor the Service's ability to use it in biological opinions.

4. A density of 1 panther per 11,000 hectare (ha) is a strange inference from this simple descriptive statistic. The 11,000 ha is simply total area divided by the number of panther home ranges in the area. This is not a sound approach toward estimating minimum forest area for use by panthers.

In the Landscape Conservation Strategy, the MERIT Panther Subteam attempted to identify lands north of the Caloosahatchee River for their capacity to support one or more groups of reproducing panthers. In that process, they assumed that large forest patches, at least 11,000 ha in size, would be needed. This assumption was based on an estimate of population density in optimal habitat given by Maehr et al. (1991a).

In conducting a compositional analysis, Kautz et al. (In Review) determined that panther use of forest patches within fixed kernel home ranges south of the Caloosahatchee River differed significantly from random. The smallest forest patch size classes occurred within home ranges in higher proportions relative to their availability than larger forest patch sizes. With this new knowledge, Kautz et al. (In Review) did not repeat the erroneous assumption that forest patches at least 11,000 ha in size are required by panthers. Kautz et al. (In Review) did use 1 panther per 11,000 ha as a rough density estimate along with a density estimate derived from their own analysis (1 panther per 12,919 ha) to provide estimated ranges for the potential number of panthers that could be accommodated by the current configuration of the Primary, Dispersal, and Secondary Zones.

5. Habitat Capacity, "defined as areas with pixel values >3." This definition, it seems, would result in a region with Swiss-cheese holes and outlier bubbles of habitat. Was there a step that involved smoothing to create a "smooth" map? If so, describe that step. If not, acknowledge and describe the nature of the resulting map.

For the purposes of their study, the Subteam developed an estimate of panther population density. Minimum convex polygons of panther home ranges were generated for all Florida panthers by year based on telemetry records through early in 2000 (n=49,889 telemetry locations, 1981 to 2000). Each polygon was converted to a 100 m pixel grid, and the resulting grids were summed. The region of most consistent panther occupancy for the period of record was defined as areas with pixel values ≥3. This step excluded areas used only once or twice by transient animals. To estimate population density, the total land area within the resulting region of panther occupancy was divided by 62, the estimated size of the panther population in 2000 (McBride 2000). Using this method, the region of most consistent panther occupancy from 1981 through early 2000 covered 800,951 ha. Based on the estimated panther population of 62 individuals, population density was one panther per 12,919 ha in 2000. Kautz et al. (In Review) did not address the shape or character of the resulting map, nor whether its creation involved "smoothing." However, the resulting size of area of occupancy and population density they report are consistent with other published information and are considered the most current and up-to-date scientific information available to the Service.

6. "Region of panther occupancy was divided by 62, the estimated size of the panther population in 2000." Need to be specific about whether this refers to resident adults, resident breeding adults, adults plus independent juveniles, or total panthers, including kittens. McBride's estimate, I believe, was "adults plus independent juveniles" and is thus analogous to the estimated density provided by Maehr et al. (1991a).

This was partially addressed. Kautz et al. (In Review) states that "...estimates place the population at 80-100 adults and subadults (Land and Lacy 2000; McBride 2001, 2002, 2003)." Later, where Kautz et al. (In Review) use the estimate of 62 panthers, McBride is cited. According to Kautz et al. (In Review), "To estimate population density, the total land area within the resulting region of panther occupancy was divided by 62, the estimated size of the panther population in 2000 (McBride 2000)." McBride (2000) clearly indicates that 62 panthers "...includes collared and uncollared, adult and subadult, part-Texas and pure Florida panthers. It does not include kittens at the den site, nor does it include extrapolations." The Service understands that the panther population of 62 in 2000 included adults plus subadults and not kittens at the den.

7. "A population of this size would have N_e of ~ 50 breeding adults." This statement needs explanation based on published data, otherwise delete it. N_e is a notoriously difficult parameter to estimate.

No similar statement is in Kautz et al. (In Review) and N_e is not mentioned in the text. However, N_e is in Table 5 of Kautz et al. (In Review). The presence of N_e in Table 5 does not affect the scientific validity of the document nor the Service's ability to use it. The effective population size (N_e) is the number of adults in a population contributing to offspring in the next generation. Although we understand that N_e is difficult to estimate, we believe use of it is helpful in the population guidelines given in Kautz et al. (In Review). The Service realizes that the effective population size is generally smaller than the census size and is often much smaller than the census size. Although not specifically discussed in our biological opinions, we factor this into our analyses.

8. It is hard to believe that we cannot "rank agricultural lands as panther habitat" with data already in hand. Don't we already know that unimproved pasture > improved pasture > citrus > row crops?

This has been addressed to some degree. Table 1 of Kautz et al. (In Review) does rank some agriculture lands but not to the level of detail in the comments. The Service has factored the relative value of cover types/habitat types into our analyses and decision-making process during project evaluations and reviews.

9. Please change "long-term survival of the Florida panther" to "long-term survival of the existing population of the Florida panther."

This was not addressed in Kautz et al. (In Review). However, the Service realizes that a single Florida panther population exists in south Florida. Our decisions in this biological opinion and others are based upon ensuring the survival of the panther population in south Florida while working toward what is needed for recovery throughout the panther's historic range.

Scientific Review Team Report

1. Beier et al. (2003) states that "Telemetry data have been collected for Florida panthers over a long time period (since 1981), but in some analyses of habitat use, the vegetation maps may not have been updated and ground-truthed to stay current with analyses of telemetry data. The SRT has insufficient information to know to what degree this may be a problem, but recommends attention to this potential problem in future analyses."

Kautz et al. (In Review) states that "While researchers have continued to collect telemetry data for radio-collared panthers through the date of this writing, we are reporting the results of the only telemetry data that were available at the time of our collaborative work, and the telemetry data we used were closer in time to the date of the land cover data sets used for habitat analysis." In relation to how this point was addressed in the Kautz et al. (In Review) manuscript, Randy Kautz (Florida Fish and Wildlife Conservation Commission [FWC], personal communication, 2004) stated that he "spent several hours at one point zooming in on panther telemetry against a backdrop of recent land cover data, and...found very few obvious examples of this being a problem. My own take was that the volume of telemetry data of over 55,000 records was so huge that any currency problems comprised a very small error factor." The Service concurs with Randy Kautz's conclusion and believes that currency errors in such a large sample size would not be significant.

2. Beier et al. (2003) strongly recommends the use of compositional analyses (Aebischer et al. 1993) or another statistically appropriate method to compare the distributions of forest patch sizes available to panthers to those used by panthers.

Kautz et al. (In Review) used compositional analysis to assess the effect of forest patch size on panther habitat use within the study area south of the Caloosahatchee River. This was accomplished by reclassifying upland and wetland forest types into one forest class, determining patch size, and assigning individual forest patches to size classes according to an equal area increment function. Differences in proportions of forest patches within each home range relative to the entire study area were then tested. Kautz et al. (In Review) found that forest patches of all sizes are important to panthers and that the smallest classes of forest patches are especially important.

3. Beier et al. (2003) states "The estimate of 84% to 87% kitten survival (Maehr and Caddick 1995) is indefensible for several reasons."

Randy Kautz (FWC, personal communication, 2004) stated "Our Population Viability Analysis (PVA) models used more recent and realistic survival rates of 0.62." This rate was developed by the use of data collected by FWC researchers and constitutes the best available data at this time.

This issue is further addressed below under Questions 2 and 6 within in the section addressing comments from Dr. Jane Comiskey.

4. Beier et al. (2003) states "The SRT recommends that any future PVA models should be built from scratch and explicitly consider parameter uncertainty, variation (demographic, environmental) in parameters, and uncertainty in key functional relationships such as density dependence and the effects of inbreeding."

Randy Kautz (FWC, personal communication, 2004) stated that "We used Risk Assessment, Management, and Audit Systems (RAMAS), and I believe we are happy with the results. Our use of RAMAS preceded the SRT report. I personally think that enough PVAs have been done to give us a pretty good picture of the survival potential of the population, but no doubt the next generation of PVA modelers will improve on past work." The Service concurs with this statement and believes that Kautz et al. (In Review) should be considered among the most current and up-to-date scientific and commercial information available and will use this analysis and other relevant information in our biological opinions until new, scientifically peer reviewed and verified data are present.

Dr. Jane Comiskey's February 2005 Comments on Kautz et al. (In Review)

Taken as a whole, Dr. Comiskey's concerns dealt primarily with the addition of text and explanation to Kautz et al. (In Review) if it was to be used as a substitute for the Landscape Conservation Strategy. The Service agrees that Kautz et al. (In Review) is not a stand alone document and must be used in conjunction with the body of scientific literature regarding the panther, including the work of the Panther Subteam.

1. Kautz et al. (In Review) lacks the needed ecological and environmental context to replace the full Landscape Conservation Strategy.

This may be correct in some instances. However, where the Service has cited this document in place of the Landscape Conservation Strategy we have ensured that the information is indeed included in Kautz et al. (In Review) and not part of the larger, more detailed Landscape Conservation Strategy. We believe that Kautz et al. (In Review) captures the major findings of the Landscape Conservation Strategy. Additional ecological and environmental context that is specific to an individual proposed project and proposed project site is included in biological opinions.

2. "The best we know given the current science at hand" indicates that some model assumptions are violated in the existing population and that parameter value estimates for reproductive rates and kitten survival are likely too optimistic. We need to acknowledge that in using model results.

*Some parameter value estimates for reproductive rates and kitten survival may be too optimistic. Some estimates of kitten survival have been too high (*e.g., *0.80) while others may be too low. It would have been our preference to see a range of kitten survival rates used in the model between*

the Conservative, Moderate, and Optimistic scenarios as was done with other reproductive parameters used in Kautz et al. (In Review). To our knowledge and that of the authors, the kitten survival rate of 0.62 is the most recent and, as far as we know, most reliable; we do not have a more reliable rate for kitten survival to use.

Sensitivity analyses conducted by Karen Root of the Panther Subteam showed that juvenile survival was the most important variable of those used within the PVA (K. Root, Bowling Green State University, personal communication, 2003). Therefore, we are aware that uncertainty within this parameter may have the greatest consequences on the projected population performance or trajectory. We acknowledge that uncertainties exist, and that we are aware of them, however, we consider the 0.62 kitten survival rate the best available at this time. 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.

We recognize that model parameters such as this can have effects on model outcomes. The Service is mindful of the limitations that exist, and when making decisions, we focus on the well being of the species.

3. Kautz et al. (In Review) does not include a definition of habitat.

We agree that specifically stating what constitutes panther habitat would be beneficial, however, we do not agree that lack of a definition should prevent use of Kautz et al. (In Review). Most biologists have an understanding of what habitat means. We believe that the Service and our counterparts understand what constitutes panther habitat. However, the Service considers panther habitat to be all areas required for the panther to live out its full life-cycle, including areas providing food and shelter and supporting characteristic movement such as hunting, breeding, dispersal, and territorial behavior.

4. We agreed on the Florida Panther Subteam on the importance of ranking land use categories on a scale of adverse to beneficial effects on panthers and evaluating proposed land use changes in the context of this scale. Randy Kautz felt that it would be redundant to include an explicit statement about this approach toward evaluating the impact to panthers of intensification of disturbance within zones.

The Service believes that ranking land use categories on a scale of adverse to beneficial effects on panthers and evaluating proposed land use changes in the context of this scale would be helpful, but is not necessarily needed to be part of Kautz et al. (In Review).

5. RAMAS PVA Assumptions: we need more discussion of the assumptions associated with the PVA and the degree to which we know these assumptions to be violated in the existing landscape and population.

We are aware of the assumptions used in the PVA analyses and consider these in our decisions. We will acknowledge the degree to which we believe any assumptions are being violated in our documents.

According to Kautz et al. (In Review), "All models assumed a 1:1 sex ratio, a stable age distribution, 50 percent of females breeding in any year, and an initial population of 41 females (82 individuals including males), the approximate population size in 2001-2002 (McBride 2001, 2002). The basic version 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 45 females (90 individuals) based on estimated population sizes likely to be supported by the Primary and Secondary Zones (see Sections 4.1 and 4.3)."

*The Service acknowledges that some of these assumptions are violated and tries to factor the degrees to which assumptions may be violated into our decisions. For example, the Service is aware that the Panther Subteam had attempted to address the effects of habitat loss by assuming a 25 percent loss of panther habitat over the first 25 years (*i.e., *one percent per year) of the 100-year model simulation during their analyses. Although the probability of extinction only increases approximately one percent under this scenario, the mean final abundance of panthers was reduced by 26 percent to 31 to 38 females. The actual likelihood of population declines and extinction can be much higher than the guidelines suggest, depending upon the number of and severity of assumptions violated. The Service realizes that habitat loss is occurring at an estimated 0.8 percent loss of habitat per year (R. Kautz, personal communication, 2003). The Service has tried to account for habitat loss and changes in habitat quality within its regulatory program and specifically through its habitat assessment methodology. 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 appropriate.*

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. However, 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.

6. All three of the RAMAS PVA model scenarios (conservative, moderate, and optimistic) estimate the first year kitten survival rate at 62 percent, based on the Land/Linda kitten survival analysis from FWC annual panther reports (FWC 2001, repeated in 2002, 2003, 2004). However, the selective Land/Linda analysis omits without explanation many failed litters documented in denning tables in these same annual reports, resulting in estimates of survival rates that are too optimistic, especially for the purebred Florida component of the population where most failed litters occurred. Even when reliable rates are computed, PVA scenarios should incorporate a range of survival rates, since the high survival rate among introgressed litters in part reflects expansion into unoccupied areas of the range where there is less

competition for space and prey. As such, rates could decrease as the range becomes saturated and as inbreeding effects may reappear in the population.

Per Tim O'Meara (FWC, personal communication, 2005), this does include litters that failed. The FWC annual report does include all litters for which FWC was able to get into the den and determine outcome of litters 6 months later; if litters were not included it was because they did not meet those criteria (T. O'Meara, personal communication, 2005). We agree that incorporating a range of kitten survivals into various PVA models would be beneficial in the future. To our knowledge, the kitten survival rate of 0.62 is the most recent and most reliable estimate to use at this time. We will continue to use this estimate until a more reliable estimate is available.

7. We should include a statement acknowledging that the SRT has found serious errors in panther science and has recommended reanalysis of baseline data for the population. We should acknowledge that, as a result of errors, PVA parameter values may have been overestimated, leading to PVA results that may be too optimistic. In the meantime, decisions should err on the side of the panther.

The Service agrees that the SRT has found serious errors in the scientific literature related to the panther and that reanalysis of baseline demographic data for the population should be done. The SRT has made numerous recommendations and the FWC and the Service are in the process of prioritizing these based upon need and importance to panther recovery. We realize that PVAs, like any model or analyses, are only as good as the assumptions, parameters, and data used. We believe that Kautz et al. (In Review) used the best available estimates for the parameters within the PVA. We realize that there is a possibility that the PVA results may be too optimistic. We agree that our decisions should err on the side of the panther.

Endangered Species Act/Information Quality Act

1. The ESA states that the Service "shall use the best scientific and commercial data available." However, the vegetation data and land use/land cover maps, as well as the panther telemetry points are several years old.

Most information must be analyzed before it is of use to us. Due to the time for analysis and the extensive and lengthy peer review and publication process, it is not possible for an article to be published in a professional journal before the data becomes several months to a few years old as is the case in this instance. We believe that Kautz et al. (In Review) is an appropriate and valid addition to the body of science and it adds to the "best scientific and commercial data available," however, part of the base data and maps are not necessarily the most current.

2. The Information Quality Act Challenge states "The estimate of an 80% pre-introgression kitten survival rate in Maehr et al. (1999, 2002b) was based on an indefensible estimate Maehr and Caddick (1995) that was unsupported by data (Beier et al. 2003:47, 49, 143-144)."

Kautz et al. (In Review) used the more current and realistic survival rate of 0.62. This issue is also addressed above in Question 3 within the Scientific Review Team section, and in Questions 2 and 6 within the Dr. Jane Comiskey section.

Summary

After carefully reviewing Kautz et al. (In Review) and considering the above recommendations and standards, we believe that Kautz et al. (In Review) should be considered among the best scientific and commercial data available. Therefore, Kautz et al. (In Review) and the analyses contained therein, along with all other best scientific and commercial data available, is referred to in this document and will be used in our decision making process until or unless new information suggests revisions are necessary.

Consultation History

On March 23, 2004, the Corps issued a Nationwide Permit notification letter to the Service consistent with the Florida panther final interim Standard Local Operating Procedures for Endangered Species (SLOPES) (Service 2000) and the Corps' Florida Panther Effects Determination Key, dated July 1, 2003 (Corps 2003). The proposed project, as identified in the Corps' notification letter, involves the construction of six stormwater outfall structures as part of the construction of AMU and an associated town center. The project site was identified as being on a 683.4-acre parcel comprised of 27.8 acres of wetlands and open water and 655.6 acres of uplands. The Corps also transmitted a biological assessment, prepared by WilsonMiller, to the Service. The Corps provided an initial determination of "may effect, but not likely to adversely affect" for the wood stork, red-cockaded woodpecker, eastern indigo snake, and caracara. The Corps also provided a "may affect" determination for the Florida panther and requested initiation of formal consultation.

In a June 23, 2004, letter to the Corps, the Service indicated further information was needed on the full potential DRI project and the Service would consider the entire DRI area as the project area. The Service requested habitat characterizations, impact analysis for wetlands and other fish and wildlife resources, and effect determinations for threatened and endangered species in and surrounding the total potential planned development.

In a letter to the Service dated August 18, 2004, the Corps transmitted requested information from the applicant regarding the maximum potential DRI project including habitat characterizations and analysis for wetland and other fish and wildlife resources. The Corps provided determinations of "may affect, but not likely to adversely affect" for the wood stork, red-cockaded woodpecker, and eastern indigo snake. The Corps revised their determination to "may affect" for the Audubon's crested caracara, restated their determination of "may affect" for the Florida panther, and requested initiation of formal consultation.

In August 2004, the Service received a copy of a DRI Application for Development Approval for The Town of Ave Maria (the DRI application).

On August 18, 2004, Tom Jones, the applicant's representative, along with Bruce Johnson and Tim Durham of WilsonMiller, as the applicant's consultant, met with the Service at the South Florida Ecological Services Office in Vero Beach to review and present the information previously forwarded to the Service by the Corps.

On September 1, 2004, Service staff conducted a site evaluation to review existing field conditions at the DRI site and the SSA sites.

On February, 22, 2005, the Service issued the Biological Opinion for the AMU project.

On March 16, 2005, the Service issued a revised Biological Opinion which corrected errors and omissions in literature cited in the text, clarified references cited in the document, and corrected errors in some of the tables referenced in the text.

On April 25, 2005, and April 28, 2005, the Service received letter correspondences from the CREW Land and Water Trust and The Conservancy of Southwest Florida providing reference to a report by the FWC that documents Camp Keais Strand as a Florida panther movement and dispersal corridor between CREW conservation lands and the Florida Panther NWR whose significance may increase over time. The FWC report *Use of Least Cost Pathways to Identify Key Highway Segments for Panther Conservation* (FWC In Review) is considered by the Service as new information on Florida panther movement and dispersal corridors that results in a re-evaluation of our assessment of the Ave Maria DRI project effects to the Florida panther.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The applicant proposes to construct six stormwater outfall structures in association with the construction of AMU. The structures have been identified by the Corps as occurring on a 683.4-acre parcel involving the construction of the core of a new university and town center. This 683.4-acre parcel, as well as the entire DRI parcel as discussed below, is proposed to occur within a portion of Collier County covered by a Rural Lands Stewardship Area (RLSA) overlay under the county's Comprehensive Plan.

The RLSA provides requirements whereby new development activity must declare the maximum potential size of a given project as part of the initial local approval process. The RLSA program also requires that: (1) environmentally sensitive/valuable lands (SSAs) be placed under appropriate conservation easements in order to generate sufficient "credits" to entitle other lands, and (2) development may only occur on lands with low environmental resource value (Stewardship Receiving Areas). The enabling mechanism for the entire project will be the DRI review process involving the State of Florida Department of Community Affairs, the Southwest Florida Regional Planning Council (RPC), and local government. An application for a stand-alone subset of the DRI was submitted to the State/RPC/county and is currently referred to as the Preliminary Development Agreement (PDA) under the DRI process. The PDA process allows a project that may ultimately become a DRI to begin with the understanding that a full DRI

application will be submitted within a specified timeframe and that the applicant has no assurances approval will be given for anything beyond the PDA area. The proposed PDA is 960 acres in size and the balance of the potential project acreage (beyond the PDA area) is 4,067 acres for a combined maximum total acreage of 5,027 acres.

The PDA boundaries and acreage of 960 acres were primarily based on zoning/entitlement considerations rather than permit considerations and were declared relatively early as part of the DRI/PDA process. The actual engineering design of the PDA components has resulted in permit boundaries that differ from, but are contained within, the PDA boundaries. Therefore, the construction phase of the PDA and corresponding State Environmental Resource Permit is for a 683.4-acre area within the PDA. The outfall structures, for which authorization is sought under Corps Nationwide Permit 12, are contained within the same 683.4-acre area.

On July 23, 2004, the DRI Application for Development Approval for The Town of Ave Maria was filed with the State/RPC/county. The DRI project land uses will be comprised of 995 acres of university/schools, 2,953 acres of residential, 328 acres of mixed-use, 211 acres of community facilities, 62 acres of wetland preserves, 61 acres of parks, 175 acres of lake parks, and 242 acres of internal roadway.

For the purposes of this biological opinion, the Service has determined the entire potential DRI area be considered as the project area in order to evaluate both the currently proposed 683.4-acre project and the potential future DRI area impacts and associated compensation. The 5,027-acre project site is comprised of 111 acres of jurisdictional wetlands, 15 acres of other surface waters, and 4,916 acres of uplands with isolated wetland inclusions. Out of the 5,027 total acres within the DRI, only 301 acres (6 percent) of the project site possess native land cover, all of which have been historically disturbed, degraded, and fragmented by decades of standard agricultural operations. Current land use and habitat cover types include 588 acres of pasture, 3,389 acres of cropland, 327 acres of sod farm, 162 acres of fallow/open rural lands, 25 acres of agricultural canals/ditches, 173 acres of disturbed native uplands, 201 acres of disturbed native wetlands, 128 acres of exotic vegetation (Brazilian pepper monoculture), and 34 acres of roads.

The DRI project will involve impacts to approximately 30 acres of wetlands and 15 acres of ditches (other waters of the United States), while approximately 66 acres of wetlands will be enhanced and preserved onsite. The project will also impact an additional 4,916 acres of uplands and isolated wetlands, for a total of 5,027 acres of low quality habitat marginally suitable for utilization by the Florida panther. Wetlands consist primarily of remnant cypress and pine/cypress vegetation with significant levels of infestation by Brazilian pepper. Uplands consist primarily of intensively cultivated, raised-bed agricultural fields and sod farming areas. A 588-acre area of improved pasture exists at the northwest corner of the project site. Portions of this pasture area are utilized for foraging by a pair of Audubon's crested caracaras, currently nesting adjacent to the northwest project boundary. As discussed below, conservation measures in the form of off-site compensation for loss of caracara habitat is proposed by the project.

The Town of Ave Maria site is located south of Immokalee Road, west of Camp Keais Road, north of Oil Well Road, and east of Camp Keais Strand in Sections 1, 12, 13, Township 48 South, Range 28 East; Sections 6, 7, 16, and 18, Township 48 South, Range 29 East; Sections 27, 29, 30, and 31, Township 47 South, Range 29 East; and Section 36, Township 47 South, Range 28 East, Collier County, Florida. The Ave Maria DRI project site is within both the Secondary Zone (2,902 acres) and the Primary Zone (2,125 acres) (Kautz et al. In Review). The AMU project site Primary Zone lands, which are adjacent to Camp Keais Strand, which is also in the Primary Zone, extend out from the native vegetation communities of the Strand (Figures 3A, 3B, and 3C).

The applicant is proposing conservation measures to minimize the direct and indirect effects of the project to the Florida panther, the caracara, and the wood stork. To compensate for impacts to ditches, other surface waters, and agricultural fields periodically utilized by wood storks, the applicant proposes to enhance and preserve 66 acres of onsite wetlands.

To compensate for adverse effects to habitat loss in the Primary and Secondary Zones of lands important to the Florida panther, the applicant is proposing the preservation of 7,285 acres of lands in the Primary Zone through perpetual conservation easements granted to Collier County and the State of Florida on the preservation parcels. These preservation parcels are SSA1, SSA2, SSA3, SSA4, and SSA6. SSA1 is located in Section 1, Township 48 South, Range 28 East; and Section 6, Township 48 South, Range 29 East, Collier County. SSA2 is located in Section 36, Township 47 South, Range 28 East; and Section 31, Township 47 South, Range 29 East, Collier County. SSA3 is located in Sections 33, 34, 35, and 36, Township 46 South, Range 30 East; and Sections 1, 2, 3, and 4, Township 47 South, Range 30 East, Collier County. SSA4 is located in Sections 1, 2, 3, and 4, Township 47 South, Range 30 East, Collier County. SSA6 is located in Sections 2 and 3, Township 49 South, Range 29 East, Collier County.

SSA1 and SSA2 (850 acres combined) are adjacent to the eastern border of Camp Keais Strand, are part of this important wildlife movement corridor (FWC In Review), and are comprised of a mosaic of habitats, primarily freshwater marsh (38 percent) and cypress swamp (42 percent), with minor amounts of upland habitats interspersed in the preservation lands.

SSA3 and SSA4 (3,786 acres combined) are part of an important wildlife movement corridor (FWC In Review) and are comprised of a mosaic of pasture (25 percent), crop lands (16 percent), freshwater marsh (29 percent), cypress swamp (16 percent), and a mixture of minor acreages of other wetland and upland habitats. The pasture lands include a mixture of cabbage palms (*Sabal palmetto*) that are potential habitat restoration/enhancement areas for the benefit of caracara.

SSA6 (2,649 acres) is comprised of a matrix of habitats including: cypress swamp (50 percent), hardwood swamp (26 percent), and pine forest (20 percent). SSA6 borders the Florida Panther NWR.

Panther telemetry data, as well as panther/motor vehicle collision data, indicate significant historic and current use of the SSA3, SSA4, and SSA6 areas as home range and movement corridors.

Action Area – Florida panther

The consultation area (see consultation area definition and consultation area map under the sub-section Southwest Florida Panther Conservation Goal) for the Florida panther includes lands in Charlotte, Glades, Hendry, Lee, Collier, Palm Beach, Broward, Miami-Dade, and Monroe Counties, as well as the southern portion of Highlands County (Figure 4). Developed urban coastal areas in eastern Palm Beach, Broward, and Miami-Dade Counties, and in western Charlotte, Lee, and Collier Counties were excluded because they contain little or no panther habitat, and it is unlikely that panthers would use such areas.

For the purposes of this consultation, the action area includes the Corps' project area, the balance of the Ave Maria DRI lands, and surrounding lands used by panthers with home ranges near the Ave Maria DRI project area (Figure 5). Movements of Florida panthers are much larger than the project site and, therefore, the action area is larger than the proposed action identified by the Corps' public notice. The action area, which is a subset of the current panther range, includes those lands the Service believes may experience direct and indirect effects from the proposed development. Maehr et al. (1990a) monitored five solitary panthers continuously for 130-hour periods seasonally from 1986 to 1989, rarely observing measurable shifts in location during the day, but nocturnal shifts in location exceeding 20 kilometers (km) (12.4 miles) were not unusual. Maehr et al. (2002b) in a later report documents a "mean maximum dispersal distance" of 42.3 miles (68.4 km) for subadult males and 12.6 miles (20.3 km) for sub-adult females. In the same report, Maehr et al. (2002b) documents a "mean dispersal distance" of 37.3 km (23.1 miles) for subadult males. Dispersal patterns tend to be circular and of insufficient length to ameliorate inbreeding. Comiskey et al. (2002) documents a "mean dispersal distance" for subadult male panthers as an average distance of 40.1 km (24.8 miles) from their natal range, which is similar to the dispersal distance referenced by Maehr et al. (2002b) and is the basis of the Service's action area determination.

Therefore, for both direct and indirect effects, the action area is defined as all lands within a 25-mile radius of the Ave Maria DRI project. This action area does not include urban lands, lands west of Interstate 75 (I-75), and lands outside the Service's panther consultation area. This action area includes those areas anticipated to sustain direct and indirect effects such as roadways experiencing increased traffic (Oil Well Road, Camp Keais Road, Everglades Boulevard, and portions of Immokalee Road), areas with increased human disturbance (project area and periphery of project), and areas in which habitat fragmentation and intraspecific aggression may be felt.

Action Area – Audubon's crested caracara

For the purposes of this consultation, the action area for caracara encompasses the project area included in the DRI and surrounding lands within the 196,000-acre Collier County RLSA (Figure 1B). The action area is effectively an extension of the caracara's documented current geographic range and includes those lands the Service believes may experience direct and indirect effects from the proposed development. This action area does not include urban lands,

lands outside of the RLSA, or publicly owned lands (*e.g.,* Florida Panther NWR, Big Cypress National Park [BCNP]) adjacent to the RLSA.

This action area definition is supported by several objective facts: (1) the confirmed and probable caracara breeding activity in Collier County occurs within this area; (2) the proposed action occurs near the center of this area; (3) most of the suitable caracara habitat within eastern Collier County occurs within this action area; and (4) the RLSA program provides a mechanism for protecting the agricultural land uses (*e.g.,* cattle ranches, pastures) that serve as the major habitat for caracara.

STATUS OF THE SPECIES/CRITICAL HABITAT RANGEWIDE – Florida panther

The State of Florida declared the panther a game species in 1950, gave it complete protection in 1958, although not an official designation, and closed the hunting season. The Federal government listed the panther as endangered in 1967 (32 FR 4001). Heavy hunting and trapping, an inability to adapt to changes in the environment, and land development were cited as reasons for the species decline. Critical habitat has not been designated for the Florida panther, therefore, none will be affected.

Species Description

The Florida panther was first described by Charles B. Cory in 1896 as *Felis concolor floridana* based on a specimen he collected in Sebastian, Florida (Hall and Kelson 1959). Bangs (1899), however, noted *Felis floridana* had previously been used for a bobcat and, believing the panther was restricted to peninsular Florida and could not breed with any other form, assigned it full specific status as *Felis coryi*. The taxonomic classification of the *Felis concolor* group was revised by Nelson and Goldman (1929), and the panther was assigned subspecific status as *Felis concolor coryi*. This designation also incorporated *Felis arundivaga*, which had been classified by Hollister (1911) from specimens collected in Louisiana. Detailed descriptions of each of the subspecies are provided in Young and Goldman (1946) (30 subspecies) and Hall (1981) (27 subspecies). The genus *Felis* was recently revised so all mountain lions, including the Florida panther, were placed in the genus *Puma* (Nowell and Jackson 1996).

The Florida panther is a medium-sized mammal described as dark tawny in color, with short, stiff hair (Bangs 1899), and having longer legs and smaller feet (Cory 1896) than other puma subspecies. Adult males reach a length of 2.15 m (7 feet) from their nose to the tip of their tail and may reach or exceed 68 kilograms (kg) (150 pounds) in weight, but typically average around 54.5 kg (120 pounds). They stand approximately 60 to 70 centimeters (23 to 27 inches) at the shoulder. Adult females are smaller, with an average weight of 34 kg (75 pounds) and length of 1.85 m (6 feet). The skull of the Florida panther has been described as having a broad, flat, frontal region, and broad, high-arched or upward-expanded nasals (Young and Goldman 1946).

The coat of an adult Florida panther is unspotted and typically rusty reddish-brown on the back, tawny on the sides, and pale gray underneath. The long cylindrical tail is slender compared to some of the other subspecies of *Puma concolor* (Belden 1989). Florida panther kittens are gray

with dark brown or blackish spots and five bands around the tail. The spots 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 turn to the light-brown straw color of the adult (Belden 1989).

Three external characteristics are often observed in Florida panthers that are not found in combination with other subspecies of *Puma concolor*. These characteristics are 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, light flecking on the head, nape, and shoulders (Belden 1986). The light flecking may be a result of scarring from tick bites (Maehr 1992a; Wilkins 1994). The kinked tail and cowlicks are considered manifestations of inbreeding (Seal et al. 1994).

Life History

Panthers are essentially solitary. Interactions between adult females and their kittens are most frequent. Interactions between adult male and female panthers are second in frequency, last from 1 to 7 days, and usually result in pregnancy. Conflicts between males are common and often result in serious injury or death to some individuals. Between October 1984 and June 2004, there were 36 known deaths attributed to intraspecific aggression (FWC 2004). While most of those were between males, one-third occurred between male and female panthers resulting in 12 deaths of females (FWC 2004). Overall, the amount of mortality from intraspecific aggression appears to be increasing with a total of 13 mortalities during the first 10 years of study and nearly double that in the second 10 years (FWC 2004). In addition, the extant of mortality in female panthers from intraspecific aggression appears to be increasing. Since 1995, 10 of the 23 known deaths from intraspecific aggression were female panthers, whereas in previous years only 2 of 13 such deaths were females (FWC 2004). Densities of Florida panthers have increased in the last decade. Higher densities may lead to increases in panther interactions and aggressive conflicts between male panthers, and male and female panthers. However, aggressive encounters between females have not been documented (Maehr et al. 1991a).

Panther activity levels peak around sunrise and sunset. The lowest activity levels occur during the middle of the day. Females at natal dens follow a similar pattern with less difference between high and low activity periods. Although some travel occurs during the day, panthers are mostly crepuscular (Maehr et al. 2004). There are no known differences in seasonal movements, wet and dry season habitat use, seasonal variation in diet, or effects of season on road crossings. Responses to fluctuations in water levels are believed to be not significant (Maehr 1989; Maehr et al. 1990b, 1991a).

Habitat

Human persecution over a 100-year period, along with bounty hunting, land clearing, lumbering, and market hunting of deer, resulted in a range-wide decline of the panther, and as a result, panthers now occupy just 5 percent of their former range. The remaining breeding population is in south Florida, south of the Caloosahatchee River. Maehr (1990a) estimated the occupied range of the panther in 1990 to be 2.2 million acres (880,000 ha) in south Florida. Logan et al.

(1993) estimated the range to be 3.1 million acres (1,254,500 ha). The area of most consistent panther occupancy from 1981 through early 2000 was estimated by Kautz et al. (In Review) to be 2 million acres (800,951 ha). Native landscapes within the Big Cypress Swamp region of south Florida, within occupied panther range, are dominated by slash pine, cypress, and freshwater marshes, interspersed with mixed-swamp forests, hammock forests, and prairies. Private lands represent about 25 percent of the Primary, Secondary, and Dispersal Zones in south Florida (Kautz et al. In Review). The largest contiguous tract of panther habitat is the Big Cypress/Everglades ecosystem in Collier, Monroe, and Miami-Dade Counties. Suitable habitat also extends into Lee, Hendry, Charlotte, Glades, Broward, Palm Beach, Highlands, Sarasota, Polk, Osceola, Hardee, and Desoto Counties. Some researchers are of the belief the low nutrient, frequently saturated soils prevalent south of I-75 in south Florida do not produce the quality or quantity of forage required to support large herds of white-tailed deer (*Odocoileus virginianus*), a dominant prey species for panthers (see below), and believe it is unlikely habitat in Big Cypress National Park (BCNP) and Everglades National Park (ENP) is as productive as habitat on private lands in northern and western Collier County in terms of panther health, reproduction, and density (Maehr 1992a). However, more recent reports provide contradictory information (McBride 2002, 2003). In addition, according to Beier et al. (2003), the conclusion that ENP and BCNP are poor habitats for panthers is not scientifically supported.

Forests provide important diurnal habitat for panthers. Belden et al. (1988) reported Florida panthers use hardwood forests and mixed swamps more than would be expected based on their occurrence in the landscape. While panthers may seek upland forests for daytime uses, as indicated by telemetry data, Kautz et al.'s (In Review) compositional analysis also confirmed that panther home ranges also included non-forest cover types interspersed in landscapes of forest patches, including freshwater marsh, prairie and shrub lands, agricultural lands, and pasture lands.

Telemetry data are the best available information about daytime panther habitat use. However, there are limitations and assumptions that should be stated about any conclusions based on telemetry data. Beier et al. (2003) points out several biases in research by Maehr and Cox (1995) in relating the importance of forests as panther habitat. These biases are stated to result from the use of daytime telemetry locations to describe habitat use, the selective use of telemetry data, and using location of telemetry versus panthers as a sampling unit. First, the panther telemetry data is collected in the morning, which creates a disjuncture between the time of data collection (beginning shortly after 7:00 am) and the times of peak panther activity (dawn and dusk). Habitat selection by panthers may be considerably broader at dawn and dusk (Beyer and Haufler 1994; Rettie and McLoughlin 1999). Second, the majority of panthers that have been radio-collared were on public lands. Telemetry research began in the Fakahatchee Strand State Preserve in 1981 (Belden et al. 1988) and gradually expanded to include BCNP, ENP, Florida Panther NWR, Picayune Strand State Forest, Okaloacoochee Slough State Forest, and CREW. It also expanded to include some telemetry data research on private lands in Collier, Hendry, Glades, and Lee Counties. Lastly, tests of the accuracy of some of the telemetry locations revealed the difference between the actual location of the transmitter and the recorded location averaged 77 m (Dees et al. 2001) and can be as large as 230 m (Belden et al. 1988). These results were obtained by placing test transmitters in known locations in the field, plotting

transmitter locations from the air, and then determining the error of actual versus observed locations.

A more recent analysis (Maehr et al. 2004) suggests some likelihood daytime telemetry locations are not dissimilar to areas used by panthers at night. However, 24-hour telemetry has not returned enough data to fully address this question. Maehr et al. (1990b) found panthers were very active around sunrise, a time of day well represented by aerial telemetry data, but that Comiskey et al. (2002) claims is missing from previous analyses of panther habitat use. Although it is not known exactly what behavior each animal was engaged in at the time these data were collected, it likely included a variety of activities, *e.g.*, walking, hunting, feeding, grooming, and resting. Maehr et al. (2004) believes daytime telemetry data include periods during which panthers are quite active. However, Maehr et al. (2002b) did not compare habitats recorded by observers during periods of activity (as indicated by mercury tip switches or radio-collars) to habitats available to the panther.

The Service and the FWC commissioned a scientific review team to do an independent critical review of literature related to ecology and management of the panther. The team (referred to as the Scientific Review Team [SRT]) published their findings in Beier et al. (2003). Included in these findings, the SRT: (1) encourages the acquisition and analysis of nighttime telemetry data to provide a more complete picture of Florida panther habitat use; (2) urges researchers to fully disclose and explain reasoning for selective use of data; (3) believes panthers rather than individual panther locations should be the sampling unit for determining habitat use; (4) believes vegetation maps used in habitat analysis be current with the data being analyzed; and (5) recommends to cease using a 90-m distance from forest cover, minimum sizes of forest patches, and the Panther Habitat Evaluation Model in making decisions about habitat mitigation and acquisition. Following release of these critical review findings, revised analyses of panther telemetry data and habitat use data were undertaken by Kautz et al. (In Review) to address issues associated with the use of individual panther telemetry data, vegetation maps, and the use of the 90-m distance from forest cover. Furthermore, the Service does not use or rely on habitat assessments that incorporate the Panther Habitat Evaluation Model (Maehr and Cox 1995) in site evaluations.

Maehr and Cox (1995) studied 10 female and 13 male panthers and found the home ranges included 6 percent freshwater marsh, 5 percent grass and agriculture, 3 percent dry prairie, 3 percent shrub swamp, and 1 percent barren land; and concluded panthers can remain part of the native fauna in areas where agricultural activities exist. The above cover types, which represent open habitat, totaled 18 percent of the panther's home range. Maehr et al. (1991a) states panthers may travel through agricultural areas at night. Panthers currently in ENP have home ranges less than 10 percent forest cover (Comiskey et al. 2002). Maehr et al. (2002b) found three panthers that crossed the Caloosahatchee River all went through areas with limited forest cover, and dispersing males wander widely through unforested and disturbed areas (Maehr 1992a). Beier et al. (2003) reported Comiskey et al. (2002) made a credible case that no significant relationship exists between home range size and forest cover.

Reproduction and Demography

Male panthers are polygynous and maintain large home ranges that may overlap home ranges of others males, although not to the extent overlapping that of several females. Breeding peaks in fall and winter (Maehr 1992b). Gestation lasts 90 to 96 days. Parturition is distributed throughout the year with the majority of births occurring between March and July. Prenatal litters range from three to four. Postnatal litters range from one to four kittens (FWC 2001). Litters surviving to 6 months of age average 2.2 kittens. Female panthers losing their litters generally produce replacement litters within the same breeding season. Intervals between litters range from 19 to 22 months (FWC 2004). Den sites are usually located in dense, understory vegetation, typically saw palmetto (Maehr 1990a). Den sites are used for up to 2 months and may be used again in subsequent years.

Historical records of den sites and birth rates for the past 5 years for the Florida panther, based on data provided by the FWC (2004), were: 7 dens, 18 kittens in 2003/2004; 6 dens, 17 kittens in 2002/2003; 12 dens, 26 kittens in 2001/2002; 8 dens, 21 kittens in 2000/2001; and 6 dens, 17 kittens in 1999/2000, averaging 8 dens/reproductive females per year ($n = 5$) with an average productivity of 20 kittens per year providing an average birth rate of 2.5 kittens per female ($n = 8$). Based on the premise that a female panther will generally produce kittens every other year and the average number of dens for the 5-year period is 8, the estimated reproductive female population per year ($n = 5$) is16 females with 8 females producing 20 kittens per year.

Early estimates of infant mortality varied and were in conflict. For example, Roelke et al. (1993) characterized infant mortality as relatively high with fewer than half of all births resulting in offspring that survive beyond 6 months of age. Land (1994) estimated the kitten survival rate between age 6 months and 1 year at 0.895, based on a sample of 15 radio-instrumented kittens. More recently, however, the FWC has been visiting den sites of female Florida panthers and Texas puma females since 1992 and has documented the number of kittens that survived to 6 months of age for 38 of these litters (FWC 2004). Florida panther and Texas puma kitten survival to 6 months-of-age were estimated to be 52 and 72 , respectively, but were not significantly different (P=0.2776) (FWC 2004). Average kitten survival, therefore, was 62 from birth to 6 months of age (FWC 2004). The FWC (2004) determined the survival of kittens greater than 6 months of age by following the fates of 55 radio-collared dependent-aged kittens, including 17 Texas puma descendants from 1985 to 2004. They found only 1 of these 55 kittens died before reaching independence (a 98.2 percent survival rate) (FWC 2004). Twenty-three of 24 female panthers, first captured as kittens, became residents and 18 (78.3 percent) produced litters. One female was too young to determine residency status (FWC 2004). Female panthers were considered as adult residents if they were older than 18 months of age, established home ranges, and bred or if they were older than 3 years of age and established a home range (Maehr et al. 1991b). Twenty-eight of the 31 male panthers became residents; three males were too young to determine residency status (FWC 2004). Male panthers were considered residents if they were older than 3 years of age and established a home range that overlapped with females (FWC 2004).

Females are readily recruited into the population as soon as they are able to breed (Maehr et al. 1991a). Age at first reproduction has been documented as early as 18 months for females (Maehr et al. 1989). However, 50 percent of known panther dens were initiated by females aged 2 to 4 years. Females aged 5 to 11 years initiated the remaining 50 percent.

The first sexual encounters for males have occurred at about 3 years of age (Maehr et al. 1991a). Dispersing females are quickly assimilated into the resident population, typically establishing home ranges less than 1 home range width from their natal ranges (Maehr et al. 2002b), while males usually go through a period as transient (non-resident) subadults, moving through the fringes of the resident population and often occupying suboptimal habitat until an established range becomes vacant (Maehr 1997). Maehr (1990a) believes there is a lack of unoccupied suitable habitat for dispersing subadult Florida panthers, which may increase fighting among males, and successful male recruitment appears to depend on the death or home range shift of a resident adult male (Maehr et al. 1991a). Turnover in the breeding population is low and documented mortality in radio-collared panthers is greatest in subadult and non-resident males (Maehr et al. 1991b).

Natural genetic exchange with other panther populations ceased when the Florida panther became geographically isolated over a century ago (Seal et al. 1994). Isolation, reduced population size, and inbreeding resulted in loss of genetic variability and diminished health. Data on polymorphism and heterozygosity, along with records of multiple physiological abnormalities, suggest the panther population has experienced inbreeding depression (Roelke et al. 1993; Barone et al. 1994). Inbreeding depression has been related to decreased semen quality, lowered fertility, reduced neonatal survival, and congenital heart defects in a variety of domesticated and wild species (Lasley 1978; Ralls and Ballou 1982; Wildt et al. 1982; O'Brien et al. 1985; Roelke 1991). Congenital heart defects have been shown to be related to diminished panther survival and reproduction (Roelke 1991; Dunbar 1993; Barone et al. 1994). The Florida panther exhibits diminished male reproductive characteristics compared to other populations of *Puma concolor* in North and Latin America (Barone et al. 1994). In a comparison of 16 male Florida panthers and 51 males from *Puma concolor* populations in Texas, Colorado, Latin America, and North American zoos, Wildt (1994) found a much higher rate of unilateral cryptorchidism (43.8 versus 3.9 percent), lower testicular and semen volumes, diminished sperm motility, and a greater age of morphologically abnormal sperm in the Florida panther samples.

Measured heterozygosity levels indicate the Florida panther has lost 60 to 90 percent of its genetic diversity (Culver et al. 2000). Measured levels of mitochondrial DNA variation are the lowest reported for any similarly studied feline population, including leopards, cheetahs, and other *Puma concolor* subspecies. Electrophoretic analyses also indicated the Florida panther has less genetic variation than any other *Puma concolor* subspecies. Panther DNA fingerprint variation is nearly as low as in the small, isolated population of Asiatic lions of the Gir Forest Sanctuary in India (Roelke et al. 1993).

A genetic restoration program was initiated for the Florida panther in 1995. FWC (2001, 2003, 2004) indicated representation of Texas cougar genes in the south Florida population is probably close to the goal of 20 percent (Seal et al. 1994), although two of the eight Texas females are

over-represented. The occurrence of kinked tails and cowlicks has been reduced in intercross progeny. Information on other morphological traits associated with genetic isolation and inbreeding such as cryptorchidism sperm deformities, atrial septal heart defects, and skull morphology cannot be collected until the intercross progeny mature or pass away. However, the fecundity of the intercross progeny would seem to indicate sperm deformities have been reduced. For example, one first-generation male captured and examined in the field by Smithsonian Theriogenologist, Dr. Jo Gayle Howard, had a sperm count 3 times that of a Florida panther, a sperm motility rate twice as high, a age of normal sperm 4 times greater, and a sperm concentration 10 times higher (McBride 2001). Since the genetic restoration program was initiated in 1995, the number of panthers monitored annually has increased, highway mortality has increased, and panthers have moved into formerly unoccupied niches on public land in south Florida (McBride 2002). This may indicate a more robust population that varies dramatically from population parameters prior to 1995. However, Maehr and Lacy (2002) recommended caution in claiming success through genetic management. They state it is likely local prey populations cannot support the increased number of panthers over the long term, and as long as the panthers are restricted to south Florida, the problems of inbreeding and genetic variation that led to the genetic restoration program will return. Still, McBride (2002) states panther recovery continues to benefit from genetic restoration and an existing State land acquisition program (for large tracts of land) north of BCNP will provide additional benefits.

Food Habits

Florida panther food habit studies indicate commonly consumed prey include feral hog (*Sus scrofa*), white-tailed deer, raccoon (*Procyon lotor*), nine-banded armadillo (*Dasypus novemcinctus)*, and alligator (*Alligator mississippiensis*) (Maehr et al. 1990a; Dalrymple and Bass 1996). Adult panthers generally consume one deer or hog per-week, supplemented by opportunistic kills of smaller prey (Maehr 1997). A female with kittens may need the equivalent of two such kills per-week. The high caloric intake needed to sustain successful reproduction and rearing of kittens is best achieved when a dependable supply of large prey is available (Roelke 1990). Deer and hogs accounted for 85.7 percent of consumed biomass north of I-75 and 66.1 percent south of I-75 (Maehr et al. 1990a). Differences in prey abundance and availability were indicated by an eight-fold greater deer abundance north of I-75 versus south of I-75, although the estimated number of deer consumed did not differ between the north and south portions of the study area. Hog numbers were lower south of I-75. Hogs dominated the diet of panthers in the north in terms of both estimated biomass and numbers. In the south, deer accounted for the greatest estimated biomass consumed, whereas raccoons were the highest estimated number of prey items consumed. Domestic livestock were found infrequently in scats or kills, although cattle were readily available north of I-75 (Maehr et al. 1990a). However, the number of deer consumed did not differ between the north and south portions of the study. There appears to be a consensus among land managers and Federal biologists that white-tailed deer and wild hogs are the dominant prey for panther, while rabbits, raccoon, and armadillos are of secondary importance (Beier et al. 2003).

Movements and Dispersal

Adult Florida panthers occupy available habitat in a pattern similar to western cougars (Land 1994). More than 7,000 telemetry locations on 26 radio-collared panthers between 1985 and 1990 indicated home range size varied from 21 to 461 square miles (53 to 1,194 square km), averaging 200 square miles (519 square km) for resident males and 75 square miles (193 square km) for resident females. Beier et al. (2003) found estimates of panther home ranges varying from 74 to 153 square miles (193 to 396 square km or 47,359 to 97,920 acres) for females and 168 to 251 square miles (435 to 650 square km or 107,520 to 160,639 acres) for males to be reliable. The most current estimate of home-range sizes (minimum convex polygon method) for established, non-dispersing adult panthers, based on radio-collared panthers monitored during the 2003-2004 genetic restoration and management annual monitoring report ($n = 37$), averaged 60.3 square miles (156.1 square km or 38,572 acres) for females ($n = 22$) and 160.6 square miles (416 square km or 102,794 acres) for males ($n = 10$) (FWC 2004). Home ranges of resident adults were stable unless influenced by the death of other residents and home range overlap was extensive among resident females and limited among resident males (Maehr et al. 1991a).

Maehr et al. (1990a) monitored five solitary panthers continuously for 130-hour periods seasonally from 1986 to 1989, rarely observing measurable shifts in location during the day, but nocturnal shifts in location exceeding 20 km (12.4 miles) were not unusual. Maehr et al. (2002) in a later report documents a "mean maximum dispersal distance" of 42.3 miles (68.1 km) for subadult males and 12.6 miles (20.3 km) for subadult females. In the same report Maehr et al. (2002) documents a "mean dispersal distance" of 37.3 km for subadult males. Dispersal patterns tend to be circular and of insufficient length to ameliorate inbreeding. Comiskey et al. (2002) documents a "mean dispersal distance" for subadult male panthers as an average distance of 40.1 km (24.9 miles) from their natal range, which is similar to the dispersal distance reference by Maehr et al. (2002b). Subadult dispersal typically occurs around 1.5 to 2 years of age, but may occur as early as 1 year of age. Dispersing males wander widely through unforested and disturbed areas (Maehr 1992a).

Status

Of the 27 recognized subspecies of *P. concolor* described by Hall (1981), the Florida panther is the sole remaining subspecies in the eastern United States. Historically, the panther was distributed from eastern Texas or western Louisiana and the lower Mississippi River Valley east through the southeastern states in general, intergrading to the north with *P. c. cougar*, and to the west and northwest with *P. c. stanleyana* and *P. c. hippolestes* (Young and Goldman 1946). The Florida panther had been eliminated from most of the historic range by 1950. Occasional sightings and signs were reported throughout the rural southeast between 1950 and 1980 (Anderson 1983). The only confirmed panther population was found in south Florida (Anderson 1983).

Distribution

A variety of human activities contributed to the decline of the Florida panther. The first bounty on Florida panthers was passed in 1831. An 1887 Florida law authorized a payment of $5 for scalps (Tinsley 1970). Panthers were also shot on sight, hunted, poisoned, and trapped. Agricultural land clearing in the southeastern United States between 1850 and 1909 totaled 31.6 million acres (12.8 million ha). Lumbering reduced the original southern forest nearly 40 percent from 300 million acres (121.4 million ha) to 178 million acres (72.0 million ha) by 1919 (Williams 1990). Meanwhile the white-tailed deer, primary prey of the panther, was reduced from a range-wide population of about 13 million in 1850, to under 1 million by 1900 (Halls 1984). Over a 100-year period, bounty hunting, land clearing, lumbering, and market hunting of deer contributed to the range-wide decline of the panther.

At the beginning of the 20th century, the Florida panther population may have numbered as many as 500 (Seal et al. 1989). The State of Florida declared the panther a game species in 1950 and in 1958 totally protected the animal. In the 1970s, the FWC established a Florida Panther Record Clearinghouse to ascertain the status of the panther. The first field searches were made in 1972. The Florida Panther Act, a State law enacted in 1978, made killing the panther a felony. Telemetry investigations began in 1981, primarily on public lands in southwest Florida. Maehr et al. (1991a) estimated the average density of panthers in southwest Florida between February and July 1990 to be one panther per 42.95 square miles (110 square km or 27,456 acres). When extrapolated over a 1,945.9-square-mile (5,040-square-km or 1,257,979-acre) area thought to be occupied by radio-collared panthers in southwest Florida, the estimated population of the area was 46 adults (9 resident males, 28 resident females, and 9 transient males) between December 1985 and October 1990. This estimate assumed homogeneous density and similar age and sex composition over time and space. Maehr et al. (1991a) considered the actual population to be higher because the estimation technique excluded panthers in ENP, eastern BCNP, and areas north of the Caloosahatchee River. The Florida Panther Interagency Committee, comprised of the Service, National Park Service, Florida Department of Environmental Protection, and the FWC, estimated the population in 1993 at 30 to 50 adults (Logan et al. 1993). More recent estimates show a panther population (adults and subadults) of 62 in 2000 (McBride 2000), 78 in 2001 (McBride 2001), 80 in 2002 (McBride 2002), and 87 in 2003 (69 adults and 18 yearlings) (FWC 2003). No documented population number has been provided by FWC for 2004 to date. However, D. Land (FWC, personal communication, November 2004) estimates the population to be between 70 and 100 panthers.

Human persecution over a 100-year period, along with bounty hunting, land clearing, lumbering, and market hunting of deer, resulted in a range-wide decline of the panther, and as a result panthers now occupy just 5 percent of their former range. The remaining breeding population is in south Florida, south of the Caloosahatchee River. Dispersing males occasionally cross the Caloosahatchee River and have been observed in rural habitats of south-central Florida.

In the south Florida breeding population, habitat loss, habitat fragmentation, habitat degradation, and increased human disturbance resulting from agricultural and residential development are now considered among the primary threats to long-term panther persistence. Continued

development associated with the expansion of Florida's urbanized east coast, urban development on the west coast, and the spread of agricultural development in the south Florida interior, have placed increasing pressure on panthers and panther habitat (Maehr 1990b, 1992b; Maehr et al. 1991a). Past land use activity, hydrologic alterations, road construction, and lack of fire management (Dees et al. 1999) have also affected the quality and quantity of panther habitat.

In southwest Florida, agriculture development between 1986 and 1990 resulted in a row crop acreage increase of 8,990 acres (3,640 ha) or 21 percent; a sugarcane increase of 16,000 acres (6,475 ha) or 21 percent; and a citrus increase of 54,000 acres (21,850 ha) or 75 percent. Rangeland, much of it suitable for panther occupation, decreased by 160,000 acres (64,750 ha) or 10 percent. In a more current analysis, (B. Stys, FWC, unpublished data, 2002) performed a change detection analysis for Collier, Lee, Hendry, Charlotte, and Glades Counties, and found the area of disturbed lands in these five counties increased 31 percent between 1986 and 1996. Most (66 percent) of the land use change over the 10-year period was due to conversion to agricultural. Forest cover types accounted for 42 percent of land use conversions, dry prairies accounted for 37 percent, freshwater marsh accounted for 9 percent, and shrub/brush lands accounted for 8 percent.

Residential, commercial, and industrial development projects may have an adverse direct effect on the Florida panther through: (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 foraging, breeding, and dispersing panthers; and (4) a reduction in the geographic distribution of the species. Indirect effects may include: (1) an increased risk of roadway mortality to panthers traversing the area due to the increase in vehicular traffic; (2) increased disturbance to panthers in the project vicinity due to human activities; (3) the reduction in panther prey; (4) the reduction in value of panther habitat adjacent to the project due to habitat fragmentation; and (5) a potential increase in intraspecific aggression between panthers (and an increase in mortality of subadult male panthers) due to reduction of the geographic range of the panther.

Prey Densities

Panther prey density, especially deer, is an important factor in evaluating panther habitat. The type and number of prey available affects the health and distribution of panthers, as well as their ability to breed and support young. Environmental factors, specifically the availability of high quality forage, affect the prey density and influence the carrying capacity and population dynamics of the prey species, especially deer herds (Fleming et al. 1993). In the Everglades region, deer inhabit a variety of landscape types, including pinelands, high ridges, and adjacent periphery wetlands, which include the mosaic of sawgrass and wet prairie savannahs and sloughs that comprise the interior freshwater marshes and coastal mangrove forest.

Deer are ruminants, with small stomach capacities, and are selective for high quality forage to meet their nutritional needs. To meet these high quality forage needs, deer selectively move through the mosaic of habitat types taking advantage of the seasonal forage that provide the most benefit to the deer. Water management practices have reduced habitat heterogeneity and the

sequence of seasonal and successional patterns of plant growth and appear to have affected deer abundance (Fleming et al. 1993).

Other adverse changes in habitat characteristics that affect deer density include the invasion of exotics into native uplands, over drainage of marshes, and the establishment of monotypic stands of unpalatable plant species, generally resulting from nutrient enrichment related to agricultural and urban runoff. The replacement of these native plant communities reduces important habitat heterogeneity and the ability of deer to meet their critical dietary needs. For example, deer densities on over-drained, exotic species infested private lands being developed in northwest Lee County averaged one deer-per 591 acres (Turrell 2001) to one deer-per 534 acres (Passarella 2004). As another example, in monotypic stands of cattail (*Typha* spp.) communities in the Everglades Wildlife Management Areas, historical deer densities in the mid-to-late 1950s averaged one deer per 100 acres (40 ha) when the vegetative community was a mosaic of native species, whereas more recent surveys (1993) showed a 67 to 76 percent decrease (one deer per 300 to one deer per 475 acres) of the 1959 population estimate (Fleming et al. 1993).

As a comparison to higher quality habitat communities, deer densities in wildlife management areas in the BCNP's Corn Dance Unit were predicted to be between one deer per 165 acres and one deer per 250 acres (Steelman et al. 1999). However, deer densities in these units may also have been affected by off road vehicle use. Predictions of deer density in Fakahatchee Strand were estimated to be higher than one deer per 18.2 acres (McCown 1991). Deer densities in the Mullet Slough area of BCNP yielded an estimated density range of one deer per 93 acres and one deer per 250 acres. The Stairsteps Unit of BCNP support densities of one deer per 190 acres to one deer per 218 acres from track count estimates. Aerial surveys for the same units used after 1982 estimated deer densities between one deer per 60 acres and one deer per 2,643 acres (Steelman et al. 1999). Harlow (1959) predicted deer density in wet prairie habitat in Florida to be one deer per 115 acres.

To counteract the threat of exotic species invasion and monotypic stands of unpalatable plant species, all public land and most private land managers pursue exotic and invasive species management and habitat improvement through fire management and eradication programs. However, these actions are restricted by available funds to implement these programs.

Panthers, because of their wide-ranging movements and extensive spatial requirements, are also particularly sensitive to habitat fragmentation (Harris 1985). Habitat fragmentation can result from road construction, urban development, and agricultural land conversions within migratory patterns of panther prey species and affect the ability of panthers to move freely throughout their home ranges. Construction of highways in wildlife habitat typically results in loss and fragmentation of habitat, traffic related mortality, and avoidance of associated human development. Roads can also result in habitat fragmentation, especially for females who are less likely to cross them.

Kautz et al. (In Review) estimated approximately 25 percent of panther habitat within Primary, Secondary, and Dispersal Zones, is on private land. Maehr (1990a) indicated development of private lands may limit panther habitat to landscapes under public stewardship. From March

1984 through June 2005, the Service concluded formal consultation on 53 projects involving the panther. The minimum expected result of these projects is impacts to 87,290 acres of panther habitat and the preservation of 27,854 acres (Table 1). Of the 87,290 acres of impacts, 39,918 are due to agricultural conversion and 47,372 acres to development and mining. Portions (10,370 acres) of the largest agricultural conversion project, the 28,700 acres by U.S. Sugar Corporation, were re-acquired by the Federal Government as a component of the Talisman Land Acquisition (Section 390 of the Federal Agricultural Improvement and Reform Act of 1996 [P.L. 104-127] Farm Bill Cooperative Agreement, FB4) for use in the Comprehensive Everglades Restoration Project. The non-agriculture impacts are permanent land losses, whereas the agricultural conversions may continue to provide some habitat functional value to panthers, depending on the type of conversion. However, these land conversions provide less functional value than native habitats. The 47,372 acres of expected impacts from development and mining included a mixture of agricultural fields consisting of row crops and citrus groves and natural lands with varying degrees of exotic vegetation. Management actions on some of the lands preserved include exotic species removal, fire management, wetland hydrology improvement, improved forest management practices, and recreational benefit improvements.

Habitat Management

Prescribed burning is probably the single most important habitat management tool available to public land stewards. Dees et al. (1999, 2001) examined panther use of habitat in response to prescribed burning at Florida Panther NWR and BCNP between 1989 and 1998. The greatest temporal response by panthers to burning in pine was within 1 year followed by a decline in subsequent years and is likely due to the rapid regrowth of vegetation, which attracted prey (Dees et al. 2001). Temporal analysis demonstrated notable selection only for pine stands that had been burned within 1 year relative to older burns. Compositional analysis showed that panthers were more likely to position their home ranges in areas that contained pine. Dees et al. (2001) suggest that panthers were attracted to less than 1-year-old burns because of white-tailed deer and other prey responses to vegetation and structural changes caused by prescribed fire. According to Dees et al. (2001), it was the effect of burning in pine, rather than the pine per se, which most influenced habitat selection by panthers. However, they caution that the effects of shorter burning intervals on vegetation composition and landscape-level changes be determined before burning rotations are reduced.

Land Conservation Trends

The 1.4-million-acre ENP was established in 1947, more than 2 decades before the Florida panther was listed as endangered. The 577,000-acre BCNP was established in 1974, just 1 year after passage of the ESA. Additional State and Federal acquisitions since the establishment of ENP and BCNP include Fakahatchee Strand Preserve State Park (58,373 acres), Florida Panther NWR (26,400 acres), Picayune Strand State Forest (55,200 acres), Collier-Seminole State Park (7,271 acres), Okaloacoochee Slough State Forest (34,962 acres), and CREW (24,028 acres). As of April 2001, non-profit organizations, local governments, State and Federal agencies, and Tribes have protected approximately 2.21 million acres of panther habitat south of the Caloosahatchee River within the Primary, Secondary, and Dispersal Zones (Kautz et al.

In Review). These protected lands are the cornerstones for the Service's continuing effort to work in tandem with the private sector and State and county government, to preserve and manage panther habitat. These lands are protected by conservation easements or transferred by title to public entities to manage.

Mortality, Trauma, and Disturbance

Records of mortality on uncollared panthers have been kept since February 13, 1972, and records of mortality on radio-collared panthers have been kept since February 10, 1981. A total of 143 panther mortalities have been documented through June 2004, with 59 (41 percent) known deaths occurring in the past 4 years (FWC 2001, 2002, 2003, 2004). Overall, documented mortality (n = 99) of radio-collared and uncollared panthers averaged 3.4 per-year through June 2001. However, from July 2001 through June 2004, documented mortality (n = 48) increased with an average of 16.0 per-year during these years (FWC 2002, 2003, 2004). Eighty-four free roaming, radio-collared panthers have died since 1981, and intraspecific aggression was the leading cause accounting for 41 percent of these mortalities (FWC 2004).

Unknown causes and collisions with vehicles accounted for 24 percent and 19 percent of mortalities, respectively. Other factors (7 percent), infections (5 percent), and diseases (4 percent) caused the remaining mortalities (FWC 2004). The causes of mortality were found to be independent of gender (FWC 2004). It is likely some causes, such as road mortality, are more likely to be found and, therefore, are over represented in the above total.

Between February 13, 1972, and June 30, 2004, Florida panther vehicular trauma (n = 73), averaged 2.3 panthers per year (FWC 2004). Thirty-four incidents of trauma (47 percent) have occurred in the past 5 years (average 6.8 panthers per year during 2001 to 2004). From June 30, 2003, through October 2004, we are aware of seven additional vehicular mortalities, including several near CREW, one on Interstate 4 near Tampa, one just east of the intersection of I-75 and Alligator Alley, one on I-75 at mile marker 93, one on I-75 near mile marker 98, and one several miles north of CR 858 on SR 29. Although the relative significance of vehicular trauma to other sources of mortality is not entirely known, it has been the most often documented source of mortality (Maehr 1989; Maehr et al. 1991b) because the death of uncollared panthers, due to other causes (*e.g.*, intraspecific aggression, old age, disease, etc.) often goes undetected.

There are presently 28 wildlife underpasses with associated fencing suitable for panther use along I-75 (Figure 6) and, to date, no panthers have been killed by vehicles in areas protected with wildlife underpasses (FWC 2003). There are four underpasses suitable for panther use currently existing, and two additional underpasses presently proposed by the Florida Department of Transportation (FDOT) along U.S. Highway 29 (US 29) (Department of the Army Public Notice SAJ-2004-778) (Figure 6). Several additional panther/wildlife crossings are proposed along roadways in rural Lee and Collier Counties in addition to the proposals along US 29 (FWC 2001). In addition, Collier County, in cooperation with the National Wildlife Federation and the Florida Wildlife Federation, is coordinating a study of the segment of CR 846 east of Immokalee and the section of Oil Well Road where the road crosses Camp Keais Strand by Dr. Reed Noss and Dr. Daniel Smith to determine the optimum location for wildlife crossing construction

(WilsonMiller 2005). However, vehicular trauma still occurs on outlying rural roads and the FWC is conducting a study to determine the impacts of vehicular collisions to panthers and studying ways to minimize panther vehicle collisions (FWC In Review).

In an examination of the location of panther-suitable wildlife crossings and locations of vehicular collisions (Figure 6), we note that after crossing installation, no collisions have been recorded in the immediate vicinity of those crossings. There have been no collisions on east-west I-75 in the vicinity of crossings since installation in 1991. Prior to 1991, there were five recorded deaths from collisions. The FDOT has also identified the location of, proposed the construction of, and constructed several wildlife crossing on SR 29. Proposed crossings A and B (Figure 6) will be in an area of 10 documented collisions from 1980 to 2004. Existing crossings C and D, north of I-75, were installed in 1995. There were two recorded collisions in the vicinity of crossing D from 1979 to 1990, but none at either C or D since crossing installation. Existing crossing E was installed in 1997. There has been one collision approximately 1 mile to the north in 2002. Existing crossing F was installed in 1999. There was one documented collision in the immediate vicinity in 1981, but none since installation. However, there have been two collisions approximately 1.5 miles to the north since crossing installation.

Florida panthers were hunted for bounty during the 1800s and for sport up until the 1950s (Tinsley 1970). Seven panther shootings, six fatal and one non-fatal, were documented between 1978 and 1986. A female Texas puma introduced for genetic restoration was shot in 1998 (FWC 1999). Education, self-policing among hunters, and regulation are the tools by which shootings are minimized. All free-ranging pumas in Florida are protected by a "similarity of appearance" provision in the ESA (56 FR 40265-40267; August 14, 1991).

Janis and Clark (1999) compared the behavior of panthers before, during, and after the recreational deer and hog-hunting season (October through December) in areas opened (BCNP) and closed (Florida Panther NWR, Fakahatchee Strand State Preserve) to hunting. The variables examined were: (1) morning activity rates; (2) movement rates; (3) predation success; (4) home range size; (5) home range shifts; (6) habitat selection; (7) distance from panther locations to trails; and (8) frequency of panther use in the Bear Island Unit of BCNP. The authors failed to detect any relationship between hunting and the first six variables. Of the last two variables, they determined the distance of panther locations from trails increased an average of 0.31 mile (0.57 km) and the frequency of panther use in the Bear Island Unit decreased from 30 up to 40 percent during the hunting season. An analysis of movement rates, a measure of energy expenditure, predation success, and energy intake do not indicate any direct, negative energetic responses to increased human activity during the hunting season. However, the increase in average distance from trails and decrease in panther use of the Bear Island Unit are indicative of a behavioral change. Janis and Clark (1999) surmise the increase in the distance of panther locations from trails is "biologically minor" and probably related to prey behavior (*i.e.*, white-tailed deer moving deeper into the forest to avoid hunters). The decrease in panther use of the Bear Island Unit is balanced by an increase in use of private lands north of BCNP as "refugia." However, Beier et al. (2003) finds this and other studies of hunting impacts to panthers to be inconclusive.

Verified Panther Population

In September 2003, the documented south Florida panther population was 87 adults and subadults, not including kittens at the den (FWC 2003). The south Florida panther population has shown an increase in the survivability of young and juveniles (McBride 2003) and an increase in the population estimates from 62 in 2000 (McBride 2000) to 78 in 2001 (McBride 2001) to 80 in 2002 (FWC 2002) to 87 in 2003 (FWC 2003). No documented population number has been provided by FWC for 2004; however, D. Land (FWC, personal communication, November 2004) estimates the population to be between 70 and 100 panthers. McBride (Livestock Protection Company, personal communication, November 2004) plans to provide a verified population count in 2005 and expects, due to the extent of mortalities this year, the population estimate may be lower than last year.

Population Dynamics

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

As originally defined by Shaffer (1981), "a minimum viable population for any given species in any given habitat is the smallest isolated population having a 99 percent chance of remaining extant for 1,000 years despite the foreseeable effects of demographic, environmental and genetic stochasticity, and natural catastrophes." However, the goal of 95 percent probability of persistence for 100 years is the standard recommended by population biologists and is used in management strategies and conservation planning, particularly for situations where it is difficult to accurately predict long-term effects.

A total of 108 Florida panthers since 1981 have been radio-collared and monitored on public and private lands throughout south Florida (Maehr et al. 2002a; Shindler et al. 2001). These data were used by researchers to estimate survival rates and fecundity and were incorporated into PVA models previously developed for the Florida panther (Cox et al. 1994; Kautz and Cox 2001; Seal et al. 1989, 1992; Maehr et al. 2002a). These models incorporated a range of different model parameters such as general sex ratios, juvenile survival rates, age distributions, and various levels of habitat losses, density dependence, and intermittent catastrophes or epidemics. The outputs of these models predicted a variety of survival scenarios for the Florida panther and predicted population levels needed to ensure the survival of the species.

The Service, in February 2000, in order to develop an updated landscape-level strategy for the conservation of the Florida panther population in south Florida, appointed the Florida Panther Subteam. This Subteam is part of the overarching MERIT. MERIT includes more than 30 members representing Federal, State, and local governmental agencies, the Seminole Tribe of Florida, the Miccosukee Tribe of Indians of Florida, academia, industry, and the private sector, and was created with the purpose of overseeing the implementation of the recovery and restoration tasks identified in the MSRP. One of the actions the Subteam evaluated was the current status of the Florida panther and the various PVA models developed. Based on this assessment, members of the Subteam requested the development of an updated set of PVA models for the Florida panther. These models, developed and presented by Root (2004), were based on RAMAS GIS software (Akçakaya 1998). 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. (2002a). A conservative model was based on Ballou et al. (1989); a moderate model was based on the 1992 optimistic model of Maehr et al. (2002a); and an optimistic model was based on the 1999 consensus model of Maehr et al. (2002a). In each model, first-year juvenile survival was set at 62 percent based on recent information from routine panther population monitoring (Shindle et al. 2001). All models assumed a 1:1 sex ratio, a stable age distribution, 50 percent of females breeding in any year, and an initial population of 41 females (82 individuals including males), the approximate population size in 2001-2002 (McBride 2001, 2002).

Basic Versions: The basic versions of each model incorporated no catastrophes or epidemics, no change in habitat quality or amount, and a ceiling type of density dependence. The basic versions of the models incorporated a carrying capacity of 53 females (106 panthers - 50/50 sex ratio). Variants of the models were run with differing values for density dependence, various levels of habitat loss, and intermittent catastrophes or epidemics. Each simulation was run with 10,000 replications for a100-year period. The minimum number of panthers needed to ensure a 95 percent probability of persistence for 100 years was estimated in a series of simulations in which initial abundance was increased until probability of extinction at 100 years was no greater than 5 percent. More detailed information concerning the PVA model parameters appears in Root (2004).

The results of these model runs predicted a probability of extinction for the conservative model of 78.5 percent in 100 years with a mean final total abundance of 3.48 females. Also, the probability of a large decline in abundance (50 percent) was 94.1 percent. The moderate model resulted in a 5 percent probability of extinction and mean final abundance of 42.3 females in 100 years. The probability of panther abundance declining by half the initial amount was 19.9 percent in 100 years under the moderate model. The optimistic model resulted in a 2 percent probability of extinction and mean final abundance of 51.15 females in 100 years. The probability of panther abundance declining by half the initial amount was only 9.1 percent in 100 years under the optimistic model. These models also provide a probability of persistence (100 percent minus probability of extension) over a 100-year period of 95 percent for the moderate model and 98 percent for the optimistic model.

Kautz et al. (In Review) also provided PVA model runs, following Root's (2004) parameters, with the basic versions of their models incorporating a carrying capacity of 45 females (90 individuals) versus Root's 53 females (106 individuals). Kautz et al.'s carrying capacity is the estimated population size likely to be supported by the Primary and Secondary Zones under current habitat conditions (see zone discussions below). Kautz et al.'s results parallel Root's predictions with the exception of the mean final abundance of panthers. The mean final abundances of females in Kautz et al.'s results are 3 for the conservative model, 33 for the moderate model, and 45 for the optimistic model versus 3.50, 42.30 and 51.15, respectively for Root's models.

One Percent Habitat Loss: Model results were also provided by Root (2004) and Kautz et al. (In Review) for probability of extinctions for 1 percent loss of habitat, within the first 25 years of the model run. The 1 percent loss of habitat equates to essentially all remaining non-urban privately owned lands in the Primary Zone and corresponds to the estimated rate of habitat loss (Root 2004) from 1986 to 1996 for the five southwest counties based on land use changes. For the moderate model (for both authors), the model runs predict a probability of extinction increase of approximately one percent, from a probability of extinction of 4.8 percent with no loss of habitat to 5.8 percent with 1.0 percent habitat loss per year, for the first 25 years. For the optimistic model (for both authors), probability of extinction increased from 1.6 percent with no loss of habitat to 2.6 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 females, a 24.3 percent reduction for the moderate model and from 41 to 38 females, a 7.3 percent reduction for the optimistic model.

The model runs also predict a probability of persistence (100 percent minus the probability of extension) over a 100-year period of 94.2 percent for the moderate model and 97.4 percent for the optimistic model. Both model runs, predict a mean final abundance of 62 individuals (31 females and 31 males) for the moderate model and 76 individuals (38 females and 38 males) for the optimistic model.

Population Guidelines: Kautz et al. (In Review), following review of the output of their PVA models, Root's PVA models, and those of other previous PVAs for the Florida panther, suggested a set of population guidelines for use in management and recovery of the Florida panther. These guidelines are: (1) populations of less than 50 individuals are likely to become extinct in less than 100 years; (2) populations of 60 to 70 are barely viable and expected to decline by 25 percent over 100 years; (3) populations of 80 to 100 are likely stable but would still be subject to genetic problems (*i.e.,* heterozygosity would slowly decline); and (4) populations greater than 240 have a high probability of persistence for 100 years and are demographically stable and large enough to retain 90 percent of original genetic diversity.

These guidelines are based on the basic model assumptions of a 1:1 sex ratio, a stable age distribution, 50 percent of females breeding in any year, and an initial population of 41 females (82 individuals including males), the approximate population size in 2001-2002 (McBride 2001, 2002). These guidelines also assume no catastrophes or epidemics, no change in habitat quality

or amount, and a ceiling type of density dependence. The basic versions of Kautz et al.'s models incorporated a carrying capacity of 45 females (90 individuals), which is based on the estimated population sizes likely to be supported by the Primary and Secondary Zones.

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. (In Review). However, the Service views the guidelines in Kautz et al. (In Review) 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. (In Review), these assume no habitat loss or catastrophes.

PVA Summaries and Population Guidelines: Kautz et al.'s (In Review) moderate model runs, which are the more conservative of the two recent PVA model sets (Root 2004; Kautz et al. In Review), show a final populations of 33 females (66 total) and 31females (62 total), with extinction rates of 5 percent and 6 percent, respectively for the basic and 1 percent habitat loss scenarios.

Root's (2004) moderate model runs, which have a larger carrying capacity than the Kautz et al.'s moderate model runs, 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 extinction rates for both moderate model sets (for both authors) are similar with the predicted final populations in Kautz et al.'s (In Review) to be 66 and 62 panthers for no loss of habitat and 1 percent loss of habitat, respectively. 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 population guidelines applied to Kautz et al.'s moderate model (In Review) for a population of 62 to 66 panthers, with or with/out habitat loss, respectively, describe the population as barely viable and expected to decline by 25 percent over 100 years. Kautz et al.'s population guidelines applied to the Root (2004) moderate models for a population of 62 to 84 panthers, with or with/out habitat loss, respectively, describe the "with habitat loss" population as barely viable and expected to decline by 25 percent over a 100-year period. The "without habitat loss" is likely stable but would still be subject to genetic problems.

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

Model Violations: The actual likelihood of population declines and extinctions may be different than the guidelines and models suggest, depending upon the number of and severity of assumptions violated. The Service realizes that habitat loss is occurring at an estimated 0.8 percent loss of habitat per year (R. Kautz, FWC, personal communication, 2003). The Service has accounted for some habitat loss and changes in habitat quality within its regulatory program, and specifically through its habitat assessment methodology (discussed in the Effects of the Action). 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. However, 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 that uncertainties exist, assumptions can be violated, and catastrophes can occur. However, 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.

Panther Habitat Conservation Plans: In the early 1990s, two plans for the protection of Florida panther habitat in south Florida were developed (Logan et al. 1993; Cox et al. 1994). Both of these plans identified privately owned lands that contained habitats important to the long-term conservation of the Florida panther. Logan et al. (1993) identified specific parcels of land by section, township, and range as Priority 1 and 2 preservation areas. However, this plan has been criticized as being too general (*i.e.*, targeted lands perceived as including too many areas not truly panther habitat [active rock and sand mines]) and for not having been available for public review and comment prior to publication. Cox et al.'s (1994) plan identified specific lands based on their habitat features and the likelihood they could support a minimally viable population of panthers for the next 200 years.

The lands identified in each of these planning studies, although referred to in the studies as essential to the survival and recovery of the Florida panther, were intended to be guides for land acquisition planning purposes, because of their inclusion of lands containing urban developments and other lands not considered truly panther habitat (*i.e.*, active rock and sand mines). These land preservation recommendations have been used by Federal, State, and county resource agencies as guides for public land acquisition programs, local land-use planning, and, in a few cases, compensation for land-use conversion projects proposed for lands identified in the plans.

An example of use of these planning studies is shown in Figure 7. This figure provides a representative view of the existing and proposed public land acquisition and preservation efforts within the southwest Florida landscape that not only benefits the Florida panther, but also provides benefits to the mosaic of other species important to the south Florida ecosystem.

Table 2 provides a summary of the targeted and acquired acreages of conservation lands in southwest Florida. Based on the table, total lands targeted for acquisition to date are 3,588,749 acres.

Panther Recovery Goal: Both the 1995 and 1999 recovery objectives for the panther were to achieve three viable, self-sustaining populations within the historic range of the Florida panther. In 2001, a new Florida Panther Recovery Team was appointed to revise the recovery plan. Although preliminary, the revised recovery objectives established in 2004 continue to be to achieve at least three self-sustaining, viable populations of panthers within the historic range.

A high priority for recovery and conservation of the Florida panther is to ensure the survival of the existing breeding population south of the Caloosahatchee River. The Service's southwest Florida panther recovery goal is to achieve this priority and to identify lands north of the Caloosahatchee River that can be the recipient area for the expansion of the South Florida panther breeding population from south of the Caloosahatchee River to other parts of its historic range. We believe sufficient lands may be found north of the Caloosahatchee River and possibly elsewhere throughout the southeast (Thacher et al. 2003), in conjunction with the lands conserved south of the river, to support a population of greater than 240 individuals.

The PVA models discussed in the previous section, and in detail in Root (2004) predict a population of 80 to 100 individuals is needed for stability over a 100-year period, although subject to genetic problems and a population greater than 240 is needed to retain 90 percent of original genetic diversity. The Service also believes a population of 80 to 100 panthers in southwest Florida will serve as the founder population for the recovery of the Florida panther throughout its historic range and the panthers in south Florida will be used to further overall recovery goals.

Land Preservation Needs: To further refine the land preservation needs of the Florida panther and to specifically develop a landscape-level program for the conservation of the Florida panther population in south Florida, the Service as previously discussed, in February 2000, appointed a Florida Panther Subteam. The Subteam in addition to the assignments discussed previously, was also charged with developing a landscape-level strategy for the conservation of the Florida panther population in south Florida. The results of this collaborative effort are partially presented in Kautz et al. (In Review). One of the primary goals of this effort was to identify a strategically located set of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of the southwest population of the Florida panther (Figure 8). Kautz et al. (In Review) focused their efforts on the area south of the Caloosahatchee River, where the reproducing panther population currently exists.

Kautz et al. (In Review) created an updated Florida panther potential habitat model based on the following criteria: (1) forest patches greater than 4.95 acres (2 ha); (2) non-urban cover types within 656 feet (200 m) of forest patches; and (3) exclusion of lands within 984 feet (300 m) of urban areas. The potential habitat map was reviewed in relation to telemetry data, recent satellite imagery (where available), and panther home range polygons. Boundaries were drawn around lands defined as the Primary Zone (Figure 8), defined as the most important area needed to

support a self-sustaining panther population. Kautz et al. (In Review) referred to these lands as essential, however, as observed in the two previous plans (Logan et al. 1993; Cox et al. 1994), lands within the boundaries of the Primary Zone included some urban areas and other lands not considered to be truly panther habitat (*i.e.*, active rock and sand mines).

The landscape context of areas surrounding the Primary Zone was modeled and results were used to draw boundaries of the Secondary Zone (Figure 8), defined as the area capable of supporting the panther population in the Primary Zone, but where habitat restoration may be needed (Kautz et al. In Review).

Kautz et al. (In Review) also identified, through a least cost path model, the route most likely to be used by panthers dispersing out of south Florida, crossing the Caloosahatchee River, and dispersing into south-central Florida. Kautz et al. (In Review) used ArcView GIS© version 3.3 and ArcView Spatial Analyst© version 2 (Environmental Systems Research, Incorporated, Redlands, California) to construct the least-cost path models and identify optimum panther dispersal corridor(s). The least-cost path models operated on a cost surface that ranked suitability of the landscape for use by dispersing panthers with lower scores indicating higher likelihood of use by dispersing panthers. The lands within the boundaries of the least cost model prediction were defined as the Dispersal Zone (Figure 8). The preservation of lands within this zone is important for the survival and recovery of the Florida panther, as these lands are the dispersal pathways for expansion of the south Florida panther population. The Primary Zone covers 2,270,590 acres (918,895 ha); the Secondary Zone covers 812,104 acres (328,654 ha); and the Dispersal Zone covers 27,883 acres (11,284 ha); providing a total of 3,110,578 acres (1,258,833 ha) (Kautz et al. In Review). The combined acreage of lands within the Primary, Dispersal, and Secondary Zones is 3,110,577 acres (1,258,833 ha) (Kautz et al. In Review).

As part of their evaluation of occupied panther habitat, in addition to the average density estimate of one panther per 11,000 ha (27,181 acres) developed by Maehr et al. (1991a), Kautz et al. (In Review) estimated the present average density during the timeframe of the study, based on telemetry and other occurrence data, to average 1 panther per 12,919 ha (31,923 acres). In the following discussions of the number of panthers that a particular zone may support, the lower number is based on the 12,919 ha value (Kautz et al. In Review) and the higher number is based on the 11,000 ha value (Maehr et al. 1991a).

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

Kautz et al.'s (In Review) 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. (In Review) 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).

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

The principle regulatory mechanisms that allow the Service to work directly with private land owners during review of development and land alteration projects are through section 7 and section 10 consultations under ESA. Section 7 consultations, which are the more common consultations, are primarily with the Corps. In August 2000, the Service, to assist the Corps in assessing project effects to the Florida panther, developed the Florida panther final interim SLOPES (Service 2000). The Florida panther SLOPES provide guidance to the Corps for assessing project effects to the Florida panther and recommends actions to minimize these effects. The Florida panther SLOPES also includes a consultation area map (Figure 4) that identifies an action area where the Service believes land alteration projects may affect the Florida panther and is used by the Corps project managers in evaluating consultation needs with the Service.

Compensation Recommendations: To achieve our goal to locate and preserve sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of a population of Florida panthers south of the Caloosahatchee River, the Service chose the mid point in Kautz et al.'s (In Review) population guidelines that a population of 80 to 100 panthers is likely to be stable, although subject to genetic problems, through 100 years. 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 of habitat that we believe is necessary to support a population of 90 panthers in southwest Florida. The Service, based on Kautz et al.'s (In Review) average panther population density of 31,923 acres per panther, determined 2,873,070 acres of Primary Zone equivalent lands (see discussion of Primary Zone equivalent lands in the Effects of the Action) need to be protected and managed. The combined acreage of lands within the Primary, Dispersal, and Secondary Zones is 3,110,577 acres (1,258,833 ha) (Kautz et al. In Review).

The SLOPES consultation area map, as previously discussed, included lands north of the Caloosahatchee River and "Other" Zone lands. Since the Service's southwest Florida panther conservation goal is to focus on habitat conservation in the Primary, Secondary, and Dispersal Zones, which are south of the Caloosahatchee River, conservation recommendations for projects south of the Caloosahatchee River are restricted to south of and conservation recommendations

for projects north of the Caloosahatchee River are restricted to north of the Caloosahatchee River, respectively.

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. (In Review) 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 (In Review), using a similar concept, assigned likely use values of habitats to dispersing panthers. FWC's habitat were assigned habitat suitability rank between 0 to 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. (In Review) and FWC (In Review) with several adjustments to the assigned habitat use values reflecting consolidation of similar types of habitats and the inclusion of Everglades Restoration water treatment and retention areas. We used these values as the basis for habitat evaluations and the recommended compensation values to minimize project effects to the Florida panther (Table 3) (see the detailed discussion of the application of the habitat assessment methodology in the Environmental Baseline).

The Service, based on Kautz et al.'s (In Review) average panther population density of 31,923 acres per panther, determined 2,873,070 acres of Primary Zone equivalent lands (see discussion of Primary Zone equivalent lands in the Effects of the Action) need to be protected and managed for a population of 90 panthers. Currently, 2,094,988 acres of Primary Zone equivalent lands are preserved, so 778,082 additional acres need to be preserved to support a population of 90 panthers in south Florida (2,873,070 minus 2,094,988 equals 778,082).

STATUS OF SPECIES/CRITICAL HABITAT RANGEWIDE – Audubon's crested caracara

The Audubon's crested caracara is a large, boldly patterned raptor in the Falconidae family (Dove and Banks 1999). Dove and Banks (1999) conducted a taxonomic analysis of museum specimens of caracaras based on plumage and morphological characteristics, and concluded that there are three caracara species with no subspecific groupings. They refer to the North American caracara as *Caracara cheriway*, and this name was subsequently accepted by the American Ornithologists' Union. The list of threatened and endangered animals (50 CFR 17.11) continues to refer to the old scientific name, but it is referred to in the remainder of this document as the northern caracara. It is a resident, diurnal, and non-migratory species that occurs in Florida as well as the southwestern United States and Central America. Florida's population of the crested caracara is found in the prairie area of the south-central region of the State.

Only the Florida population, which is isolated from other populations of the species in the southwestern United States and Central America, is listed under the ESA. Although limited management activities have been undertaken for the United States population of this species,

draft habitat management guidelines have been developed (subject to revision) that should aid in the caracara's recovery (Service 2002).

The following sections draw heavily from the species account provided in the MSRP (Service 1999), augmented with more recent updates from Morrison (1999, 2001, 2003), Morrison and Humphrey (2001), and Nemeth and Morrison (2002).

Species Description

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

Juveniles have a similar color pattern but are brownish and buffy with the breast and upper back streaked instead of barred. Subadults resemble adults but are more brownish in color. Adults have yellow-orange facial skin and yellow legs. Facial skin of juveniles is pinkish in color, and the legs are gray (Layne 1978). Full adult plumage is obtained sometime after 2 years of age (J. Morrison, University of Florida, personal communication, 1997). There is no evidence of sexual dimorphism, the sexes being similar in color and size; however, gender can be determined surgically or through genetic analysis (Morrison and Maltbie 1999).

A caracara's feet and flight behavior are also notable. Their feet are clearly those of a raptor; however, their talons are flatter, enabling caracaras to run and walk more easily than other raptors. Caracaras are terrestrial and often forage by walking for extended periods on the ground (Morrison and Humphrey 2001). Bent (1938) noted the caracara's flight pattern resembles that of a northern harrier (*Circus cyaneus*), but caracaras fly faster and more gracefully. Caracaras are strong fliers and may reach speeds of 40 miles per hour. They have also been observed soaring in large circles at great heights (Howell 1932).

The crested caracara is a member of the Class Aves, Order Falconiformes, Family Falconidae. It was originally described by John James Audubon (1834), who discovered the caracara on November 21, 1831, and published an account under the name *Polyborus vulgaris*. John Cassin renamed it in 1865 to *Polyborus audubonii*. In 1999, Dove and Banks definitively renamed the species *Caracara cheriway* and eliminated all subspecies classifications.

Life History

Caracaras are resident, diurnal, and non-migratory. Adult caracaras may be found in their home range year-round. Home ranges average approximately 1,200 ha (approximately 3,000 acres), corresponding to a radius of 2 to 3 km (1.2 to 1.9 miles) surrounding the nest site (Morrison and

Humphrey 2001). Foraging typically occurs throughout the home range during nesting and non-nesting seasons.

Habitat

The Florida caracara population historically inhabited native dry or wet prairie areas containing scattered cabbage palms, their preferred nesting tree. Scattered saw palmetto, scrub oaks (*Quercus geminata, Q. minima, Q. pumila*), and cypress also occur within these native communities. Morrison and Humphrey (2001) hypothesize the vegetation structure of open grasslands (short-stature vegetation, scattered shrub cover, and nest trees) may be preferred by caracara, due to its tendency to walk on the ground during foraging activities. The short vegetation structure may directly facilitate foraging by caracara and provide less cover for predators.

Over the last century, many of the native prairie vegetation communities in central and south Florida have been converted to agricultural land uses, and frequently replaced by improved and unimproved pasture dominated by short-stature non-native sod-forming grasses. Morrison and Humphrey (2001) characterized caracara distribution, reproductive activity, and land use patterns within a 21,000-km^2 area in south-central Florida. Comparisons of randomly selected areas and available habitat within the study area revealed caracara home ranges contained higher proportions of improved pasture and lower proportions of forest, woodland, oak scrub, and marsh. Home range size was inversely related to the proportion of improved pasture within the home range. In addition, breeding-area occupancy rate, breeding rates, and nesting success were consistently higher on private ranch lands during the study. Although it is unclear exactly which management activities best promote habitat utilization by caracara, the mowing, burning, and grazing activities associated with improved pastures serve to maintain the short vegetation structure they appear to favor. The scattered cabbage palms that are often present within improved pastures to serve as shade for cattle provide nesting substrate for caracaras.

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

Reproduction

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

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

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

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

Food Habits

Caracaras are highly opportunistic in their feeding habits, eating carrion and capturing live prey. Their diets include insects and other invertebrates, fish, snakes, turtles, birds, and mammals (Layne 1978). Live prey also include rabbits, young opossums (*Didelphis marsupialis*), rats (*Rattus* spp.), mice, squirrels, frogs, lizards, young alligators, crabs, crayfish, fish, young birds, cattle egrets (*Bubulcus ibis*), beetles, grasshoppers, maggots, and worms (Bent 1961; Layne et al. 1977; Morrison 2001). Scavenging at urban dumps has also been observed (Morrison 2001).

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

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

Localized Movements

Although adult caracaras are generally territorial and primarily occupy home ranges, large groups of individual caracaras are occasionally encountered (Layne 1978). Oberholser (1974) attributes this to the birds' carrion-feeding habit, although Morrison (University of Florida,

personal communication, 1996a) has noted that juvenile caracaras are nomadic. Subadult caracaras also use pasture and grassland habitats and gathering areas where relatively large numbers can regularly be seen and are comprised of similar habitats to those found in the natal territory.

Relationship to Other Species

There appears to be no migration or genetic exchange between the Florida population and other populations of the northern caracara. Detailed studies on natural predators are lacking; however, crows (*Corvus* spp.) and raccoons have been documented as nest predators (J. Layne, Archbold Biological Station, personal communication, 1996a; J. Morrison, University of Florida, personal communication, 1996b).

Status and Distribution

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

Habitat Threats

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

The only known Federal property that supports caracaras is Avon Park Air Force Range (AFR) in Polk and Highlands Counties. In recent years, nesting on Avon Park AFR has been limited to only one nesting pair (J. Morrison, University of Florida, personal communication, 1996a). As emphasized by Morrison and Humphrey (2001), private lands dedicated to cattle ranching possess high conservation value for caracara in Florida.

Habitat Management

To date, management activities are lacking throughout the species' range in Florida. Avon Park AFR has conducted caracara surveys in the past. This contract allowed a biologist to perform research activities both on the AFR and in the surrounding region. In biological opinions and informal consultations over the last decade, the Service has endeavored to better address effects to the caracara through recommendations to: set aside home ranges, allow research and monitoring, perform surveys, avoid work during the nesting season, and formulate a management plan for protection of the resident pair. Projects evaluated by the Service for their effect on the caracara have included the conversion of pasture to citrus, several FDOT road improvement projects, the construction of a juvenile detention center, rock mines, military activities, hydrologic restoration projects, and other similar activities.

Caracaras appear to benefit from management actions such as prescribed burning that maintain habitat in a low stature and structurally simple condition. These activities reduce available cover and may facilitate the observation and capture of prey. Within agricultural lands, regular mowing, burning, and high-density grazing may maintain low vegetative structure, an important habitat characteristic of the caracara's nest stand area (Morrison and Humphrey 2001). Regular prescribed burning maintains habitat in a favorable condition in native dry prairies. These field observations are consistent with the home range compositional analyses that indicate non-random selection of improved and semi-improved pasture land use. Draft habitat management guidelines similar to those in place for the bald eagle (*Haliaeetus leucocephalus*) have been developed by State and Federal agencies (Morrison 2001; Service 2002). The *Habitat Management Guidelines for the Bald Eagle in the Southeastern Region* (Service 1987) has been useful in providing guidance for preserving bald eagle nest sites in areas subject to development pressure.

Mortality, Trauma, and Disturbance

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

The Florida population of caracaras is isolated and habitat-specific. Therefore, it may be susceptible to environmental catastrophes and potentially reduced reproductive rates because of demographic accidents such as skewed sex ratios or disproportionate age-related mortality. Low numbers may also reduce the genetic viability through loss of heterozygosity, thereby increasing vulnerability to environmental stresses. The location of many of the occupied territories on private land, and the inaccessibility of these territories to surveyors, makes it difficult to census the caracara and detect changes in its population size and distribution. This difficulty increases the possibility of not detecting a population decline that could result in extinction.

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

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

Recovery Plan Objectives

Several recovery plan objectives outlined for the crested caracara in the MSRP (Service 1999) can be addressed in part by activities related to the proposed action. The action occurs within the Collier County RLSA, an innovative comprehensive planning program whereby lands are scored on natural resource factors such as land cover, listed species occurrences, major flow-ways, etc. Lands scoring above a specified threshold value cannot be developed, while lands scoring below that specified threshold may be potentially utilized for future development. Development activities can be entitled only by the voluntary surrender of specified land use rights on any lands within the RLSA ("SSA") and such lands tend to be areas where the natural resource scores are higher than average. Large contiguous areas of eastern Collier County have been designated as Flowway Stewardship Areas and Habitat Stewardship Areas to protect hydrologic and biological resources.

The net effect of the Collier County RLSA program is that development occurs where the natural resource scores are below a certain threshold, and environmental protection tends to occur in areas with overall natural resource scores that are above the threshold value. These SSA typically contain a variety of resources, thereby benefiting a variety of species. Because landowners receive development credits for finding listed species on lands that they dedicate for protection, the program has already resulted in the identification of several confirmed and probable caracara home ranges in eastern Collier County. Notably, the program creates incentives for the retention of agricultural land uses, which are often overlooked in other planning and conservation programs. Incentives to retain agricultural land uses (especially cattle

ranching) facilitate the major element in caracara conservation, which is habitat preservation (Morrison and Humphrey 2001).

Under the heading "Species-Level Recovery Actions" (MSRP, page 4-229), item S.1 describes the determination of caracara distribution, status, and abundance. Item S.1.2 describes Collier County as a "formerly inhabited area" for caracara. The Breeding Bird Atlas maintained by the FWC reported one confirmed instance of caracara breeding on the eastern Collier County boundary, one probable breeding, and one possible breeding in the period 1986 to 1991. No other data had been available since 1991. However, the recent confirmation of two breeding pairs in Collier County and other scattered sightings may simply indicate that better distributional information is now becoming available.

The applicant thoroughly surveyed for caracara in and around the proposed action area, and in February 2004 identified a caracara nest tree, an adult pair, and two caracara fledglings just east of the project boundary. Since that time, the applicant has sought verifiable information on caracaras from other landowners and land managers within the Collier County RLSA. To date, another confirmed breeding pair and two juveniles have been identified 1 to 2 miles northwest of Lake Trafford, one or more caracaras have been observed at SR 29 just north of BCNP, and caracaras have been observed west of the Florida Panther NWR. More efforts are needed to determine if the latter two observations constitute breeding pairs or if they represent nomadic individuals.

The confirmed breeding observations extend the known caracara breeding range over 10 miles in eastern Collier County, and individual caracara observations suggest that the extent of occupied areas may be larger. These observations also confirm the promise of the RLSA program, where landowners are actively reporting the presence of listed species like caracara because it enhances, not diminishes their land value for being good stewards. The RLSA specifically facilitates species-level recovery action 2.1.2 (MSRP page 4-230), encouraging landowners to protect caracara nest sites by providing incentives in the form of development credits that can be applied elsewhere within the RLSA. Other action items regarding caracara colonization and reintroduction in eastern Collier County may or may not be necessary depending upon territory occupancy and available habitats.

Under the MSRP habitat-level recovery actions, the RLSA program facilitates action item 1.1.2, which encourages "use of conservation easements and other non fee-title ownership options to maintain habitat" (MSRP page 4-233). The RLSA program requires legally binding Stewardship Easements that permanently restrict specified land uses on the subject property. Perpetual maintenance of suitable pasture, dry prairie, and/or wet prairie habitats can be added as special conditions that qualify the landowners for additional program credits, addressing recovery action item H.1.1.4 for maintaining and enhancing caracara habitats (MSRP page 4-233). The potential also exists within the RLSA program to advance recovery action item H2, the creation, restoration, or expansion of occupied habitat wherever possible (MSRP page 4-234). The program provides strong incentives (in the form of development credits) for landowners to consider habitat creation and/or restoration activities in support of listed species conservation, while directing development to more environmentally suitable areas within the RLSA.

ENVIRONMENTAL BASELINE – Florida panther

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

Status of the Species within the Action Area

As stated previously, for the purposes of this consultation, the action area includes the Corps' project area, the maximum potential DRI footprint, and surrounding lands frequently visited by panthers. The action area is a subset of the current geographic range of the panther and includes those lands the Service believes may experience direct and indirect effects from the proposed DRI development. Based on the "mean dispersal distance" for sub-adult males of 37.3 km (23.1 miles) (Maehr et al. 2002b) and 40.1 km (24.9 miles) (Comiskey et al. 2002), the action area is defined as all lands within a 25-mile radius of the project. This action area does not include urban lands, lands west of I-75, and lands outside of the Service's panther consultation area. The proposed action may have direct and indirect effects on the ability of panthers to breed, feed, find shelter, and 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. 1999a; Beier 1995) and are typically at rest in dense groundcover during daytime monitoring flights (Land 1994). Therefore, telemetry locations may present an incomplete picture of panther activity patterns and habitat use (Comiskey et al. 2002). In addition, telemetry data alone may be misleading since less than half the panther population is currently monitored.

Although telemetry data may not provide a complete picture of panther activity patterns, telemetry locations are a good indicator, due to the extensive data set, of the approximate boundaries of home ranges, panther travel corridors, and the range of Florida panthers south of the Caloosahatchee River. The FWC also uses observational data collected during telemetry flights to assess the yearly breeding activity of radio-collared panthers. Female panthers accompanied by kittens or male panthers within close proximity of an adult female were assumed to have engaged in breeding activity during that year. Documentation by McBride (FWC 2003) shows between July 2002 and June 2003 12 collared panthers, 4 uncollared females, and 3 uncollared males had home ranges in or home ranges that overlapped the same survey unit as the Ave Maria DRI project. In addition, eight other panthers that used this survey unit previously died during this time period (FWC 2003). This unit, designated as Unit 5, includes the Florida Panther NWR, Corkscrew Swamp Sanctuary, and CREW.

Within the action area, the 25-mile radius, 16 radio-collared panthers have overlapping known home ranges (Figure 9). These panthers are FP 59 (male), FP 60 (male), FP 64 (male), FP 65 (male), FP 71 (female), FP 75 (female), FP 79 (male), FP 70 (female), FP 83 (female), FP 93 (female), FP 100 (male), FP 101 (female), FP 117 (male), FP 127 (male), FP 132 (male), and FP 131 (male). In addition, McBride (2003) notes previous use of the action area by other panthers prior to their mortality. According to telemetry data, no radio-collared panthers have been recorded on the site within the past 12 years. The occurrence of uncollared panthers onsite is unknown.

Within the Camp Keais Strand corridor, which is adjacent and west of the site, based on telemetry data, 8 panthers either entered the Strand, traveled though the Strand, or were evidenced near the Strand. Panther FP 96 traveled through the Strand (south to north) between 12/01 and 1/02 as evidenced by panther telemetry points within the Strand. Panther FP 99 generated a telemetry point southeast of the Strand on 11/16/01 and then northeast of the Strand on 11/21/01, presumably after traveling through the Strand. Panther FP 64 generated a telemetry point south of the Strand and east of SR 29 on 3/06/98 and then north of the Strand on 3/11/98, possibly having traveled through the Strand. Panther FP 12 traveled through the strand (86-94). Panther FP 34 entered and exited the south portion of the Strand (90-93), panther FP 28 entered and exited the Strand from the north (89-92), and panther FP 31 entered and exited the Strand from the south (89-94). In addition, FP 65 was in the general vicinity of the Strand (approximately 2 miles to the east) generating a single telemetry point in 4/98. Prior to and following the single telemetry point in 4/98, panther FP 65 consistently remained east of SR 29, well to the east of the Strand and project area.

The project site is located within the geographic range of the panther in Florida. There have been numerous panthers recorded within 5 miles of the project site from 1989 through 2004. The large number of panthers is primarily attributable to lands with native habitats south of the project site and south of Oil Well Road that are contiguous with the Florida Panther NWR. The Service believes the project site may occasionally be used by panthers because it contains habitat types deemed capable of use by panthers and their prey and the project vicinity has been used historically by panthers as indicated by telemetry locations over a 14-year period.

Past and ongoing Federal and State actions affecting panther habitat in the action area include the issuance of Corps permits and State of Florida Environmental Resource Permits authorizing the filling of wetlands for development projects and other purposes. Since 1982, the Corps and the State have had a joint wetland permit application process, where all permit applications submitted to the State are copied to the Corps and vice versa. Within the 25-mile action area, the Service, since January 14, 1992, has formally consulted on 26 projects regarding the panther that were a result of Federal actions (database entries for formal consultations prior to 1992 are incomplete for projects in the action area). These projects have impacted or are expected to impact approximately 25,575 acres of panther habitat. These projects have also incorporated a total of 15,249 acres of preservation and restoration of panther habitat. The impacted lands generally are: (1) on the western fringe of occupied panther habitat; (2) vegetated with dense stands of exotic species, which may adversely affect the density of the panther prey base; and/or (3) support agricultural enterprises, *i.e.*, row crops, citrus, etc., which provide a lower quality

habitat value to the Florida panther. The preserved lands, which are generally proximate to larger tracts of Federal, State, and other preserves, provide a higher quality habitat value for the Florida panther. The Service has determined in the biological opinions issued for these Federal actions, that individually and cumulatively these projects do not jeopardize the survival and recovery of the Florida panther.

From July 2000 through April 11, 2005, the Service also engaged in informal consultation within the Florida panther consultation area with the Corps for approximately 467 projects affecting approximately 517.5 acres in Collier County (primarily Northern Golden Gate Estates) and 45.0 acres in Lee County (primarily Lehigh Acres) (database entries for informal consultations prior to 2000 are incomplete for projects in the consultation area). Almost all of these projects involved the construction of single-family residences in partially developed areas, each in most cases involving less than an acre of direct impact. Although panthers have been known to cross these areas to other parts of their range, prey base and denning utilization of these areas have been affected by the level of development and the additions of these residences is not expected to significantly further impact these habitat functions. For these actions, the Service concurred with the Corps' determination of "may affect, but is not likely to adversely affect" for these individual projects. These projects have been incorporated into the Service's environmental baseline for the Florida panther and the Service has determined that individually and cumulatively these projects do not jeopardize the survival and recovery of the Florida panther.

We have received information that within the action area, the Corps has, between April 1, 2004, and September 30, 2004, issued non-jurisdictional wetland determinations (isolated wetlands) for three projects, totaling 1,039.6 acres in Collier County, and for four projects, totaling 226 acres in Lee County. These additional determinations were issued per jurisdictional guidance provided recently in the Supreme Court decision, Solid Waste Agency of Northern Cook County vs. U.S. Army Corps of Engineers, 531 U.S. 159 (2001) and, therefore, they will require no Federal Clean Water Act 404 wetland permit. These projects have been incorporated into the Service's environmental baseline for the Florida panther in this biological opinion and the Service has determined, based on the location of these projects (generally in the western fringe of the panther's geographic range), the quality of the habitat present on these project sites, and the overall status of the Florida panther that these projects individually and cumulatively do not jeopardize the survival and recovery of the Florida panther. However, since loss of panther foraging habitat may occur from construction of these projects and no Corps wetland permit is required, the Service is requesting the applicant pursue Habitat Conservation Plans in cooperation with the Service.

Panther mortality related to traffic within the 25-mile action area from 1979 through August 2004 totals 38 documented panther-vehicle mortalities (see Table 4 and Figure 10). Two recent road mortalities are east of the project area on CR 846, the location of which is being evaluated for construction of a panther crossing (FWC 2003) and proposed as SSA3/SSA4 compensation lands by this project. In addition, Collier County, in cooperation with the National Wildlife Federation and the Florida Wildlife Federation, is coordinating a study of Oil Well Road and the segment of CR 846 east of Immokalee by Dr. Reed Noss and Dr. Daniel Smith to determine the optimum location for wildlife crossing construction (WilsonMiller 2005).

Within the Camp Keais Strand corridor, no mortalities have been recorded on Oil Well Road; however, two mortalities have occurred on Immokalee Boulevard, (FP 50 [1-26-2003] and FP 8 [6-30-2003]), both east of Everglades Boulevard and west of the Ave Maria DRI project. A wildlife crossing of Oil Well Road is being proposed as a component of this action through a joint coordination being undertaken by the applicant and Collier County. In addition to the crossing on Oil Well Road, panther crossing warning signs are being proposed for the portion of Immokalee Road, which crosses Camp Keais Strand.

Activities within the action area have also benefited panthers. The issuance of Corps and State of Florida Environmental Resource Permits has preserved 15,141 acres of higher quality panther habitat within the core area (see definition of core panther area in Effects of the Action – Primary Equivalent Lands) for permitted impacts to 25,575 acres of generally lower quality panther habitat on the fringe of the core area. Additional benefits have resulted from the acquisition of high quality habitat through acquisition programs by the other Federal, State, and county resource agencies. Table 5 provides a summary of the State and county acquisitions within the last 5 years.

Moreover, the management of public lands, including prescribed fire and eradication of exotic vegetation in the Picayune Strand State Forest, Fakahatchee Strand State Preserve, Florida Panther NWR, ENP, and other conservation areas, is intended to improve habitat for panther prey species, which benefits panthers within these areas. Installation of several wildlife crossings under SR 29 within the action area has also benefited the panther by improving habitat connectivity and eliminating panther-vehicle collision mortalities.

Factors Affecting Species Environment within the Action Area

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

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

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

ENVIRONMENTAL BASELINE – Audubon's crested caracara

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

consultation, and the impact of State or private actions, which occur simultaneously with the consultation in progress.

Status of the Species within the Action Area

Until early 2004, the status of the crested caracara within Collier County was exemplified by the MSRP species account (Service 1999), which considered Collier County to be formerly occupied range. Published maps of the caracara breeding range (Figure 11) depicted the southern terminus of the range at the county boundary (*e.g.*, Morrison 2001). However, as a direct result of implementing of the RLSA program, caracara breeding has been confirmed at two distinct sites within the county, and reliable anecdotal reports of sustained caracara presence within the RLSA have been noted.

For the purposes of this consultation, the action area for caracara encompasses the project area included in the DRI and surrounding lands within the 196,000-acre Collier County (RLSA) (Figure 1B). The action area is effectively an extension of the caracara's documented current geographic range, and includes those lands the Service believes may experience direct and indirect effects from the proposed development. This action area does not include urban lands, lands outside the RLSA, or publicly owned lands (*e.g.,* Florida Panther NWR, BCNP, etc.) adjacent to the RLSA.

This action area definition is supported by several objective facts: (1) the confirmed and probable caracara breeding activity in Collier County occurs within this area; (2) the proposed action occurs near the center of this area; (3) most of the suitable caracara habitat within eastern Collier County occurs within this area; and (4) the RLSA program provides a mechanism for protecting the agricultural land uses (cattle ranches, pastures) that serve as the major habitat for caracara.

Data on the current status of caracara in Collier County are limited. As noted previously, a nest tree was documented adjacent to the project site during the 2003-2004 nesting season, and an adult pair and one juvenile were still observed there as of November 2004. The adult pair moved to a new nest tree just within the project boundary as of January 2005 and displayed breeding behaviors, while the juvenile has apparently left the adults. Another breeding pair and two juveniles have been documented 1 to 2 miles northwest of Lake Trafford. At least one caracara has been observed repeatedly at SR 29 just north of BCNP, and caracaras have been observed west of the Florida Panther NWR. Although sightings of additional individual caracaras are not proof of breeding or inhabited territory, they are encouraging for caracara recovery and warrant further study.

Factors Affecting Species Environment within the Action Area

Past and ongoing Federal and State actions potentially affecting caracara in the action area include the limited issuance of Corps 404 Individual Permits, the use of Corps Nationwide Permits, and State of Florida Environmental Resource Permits authorizing the filling of wetlands for agricultural projects and other purposes. Historically, most of the environmental changes

within the action area resulted from the conversion of native vegetation to agricultural land uses from the 1940s through the 1980s. Since the mid-1980s, activities authorized through State and Federal permitting have predominantly been associated with the construction and modification of agricultural infrastructure such as canals, berms, farm roads, agricultural stormwater retention areas, etc.

EFFECTS OF THE ACTION – Florida panther

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

Factors to be Considered

Residential, commercial, and industrial development projects may have a number of direct and indirect effects on the Florida panther and panther habitat. Direct impacts which are primarily habitat based may include: (1) the permanent loss and fragmentation of panther habitat; (2) the permanent loss and fragmentation of habitat that supports panther prey; (3) the loss of available habitat for foraging, breeding, and dispersing panthers; and (4) a reduction in the geographic distribution of the species. Indirect effects may include: (1) an increased risk of roadway mortality to panthers traversing the area due to the increase in vehicular traffic; (2) increased disturbance to panthers in the project vicinity due to human activities; (3) the reduction in panther prey; (4) the reduction in value of panther habitat adjacent to the project due to habitat fragmentation; and (5) a potential increase in intraspecific aggression between panthers (and an increase in mortality of subadult male panthers) due to reduction of the geographic range of the panther. These indirect effects are habitat based, with the exception of vehicular mortality, which could result in lethal "take." Intraspecific aggression, though habitat based, could also result in lethal "take." However, based on our analysis (see below), neither vehicular mortality nor mortality through intraspecific aggression are likely to occur as a result of this project.

This project site is adjacent to vegetated panther habitat along its western perimeter (Camp Keais Strand system) and is located within the geographic range of the Florida panther. The vegetation of Camp Keais Strand is comprised mainly of forested wetlands with limited natively vegetated uplands within or adjacent to the project site. Marginal panther habitat, primarily in the form of large-scale agricultural fields and sod farm areas, comprises the majority of the DRI project site. Panthers may be found on and adjacent to the proposed construction footprint year-round. The project will be constructed in a series of potentially disruptive events, and result in permanent loss and alteration of agricultural field and sod farm habitats on the project site. The project site is currently in active agricultural use and only minor additional land clearing is proposed by the project. The time required to complete construction of the project is not specifically known, but is anticipated to occur over a several-year period. The disturbance associated with the project will be permanent and result in loss of low quality habitat currently available to the panther.

Analyses for Effects of the Action

Approximately 2,125 acres of the Town of Ave Maria DRI project are agricultural lands located within the Primary Zone (Kautz et al. In Review) and is located inside the panther consultation area as defined by the Service (2000). The Primary Zone designation in this area captures the native vegetation of Camp Keais Strand plus a generally prescribed offset of 200 m from forested patches > 2 ha. The 200-m offset was used in deriving the Primary Zone principally based in recognition of spatial errors of up to 200 m between recorded and tested telemetry data. The balance, or 2,902 acres, of the project site is generally included within the Secondary Zone (Kautz et al. In Review).

The onsite native vegetation areas are currently permitted and utilized as water retention areas by the existing agricultural operations. The project may result in a maximum conversion of approximately 234 acres (5 percent of the project site) of native vegetation and approximately 1,891 acres of agricultural lands in the Primary Zone onsite into development and university use. The project will result in the conversion of approximately 2,759 acres of agricultural areas and approximately 143 acres (3 percent of the project site) of native vegetation in the Secondary Zone into development and university use. Compensation for the loss of 5,027 acres of this lower quality panther habitat will be through the preservation of 7,285 acres (SSA1, SSA2, SSA3, SSA4, and SSA6 compensation lands) of higher quality panther habitat in the Primary Zone, within the action area defined by a 25-mile radius from the project. The SSA1 and SSA2 compensation lands are part of the Camp Keais Strand system that could be restored as an improved regional wildlife corridor. The SSA3 and SSA4 compensation lands are part of the Okaloacoochee Slough system and were part of the home range of two radio-collared panthers during the 2002-2003 reporting period. The SSA6 compensation lands are adjacent and contiguous to the existing Florida Panther NWR and were part of the documented home range of two radio-collared panthers during the same report period. Preservation will be accomplished through a perpetual conservation easement granted to Collier County and the State of Florida.

Habitat Assessment: In this section, we assess habitat compensation recommended to offset project impacts to Florida panther habitat. Through the methodology described below, we assess how to compensate when habitat loss or degradation resulting from a proposed project cannot be avoided and when adverse effects have been minimized, but loss will still occur. The purpose of this assessment is to ensure that adequate compensation will occur to prevent any significant reductions in the likelihood of survival and recovery of the species due to habitat loss. The Service, in coordination with the applicant, agreed to evaluate the project's effects to the Florida panther through a habitat assessment methodology that incorporates many of the habitat importance values referenced in Kautz et al. (In Review) and FWC (In Review). Our analysis evaluates habitats from 0 to 10 with low scores reflecting low habitat value to the Florida panther (Table 3). The habitat suitability scores as developed by the Service incorporate a direct calculation per acre with a base ratio (2.5) multiplier to compensate for unavoidable project effects to the Florida panther.

Our process to determine compensation is based on the amount of habitat that we believe is necessary to support a population of 90 panthers in south Florida, which is the mid-point in Kautz et al.'s (In Review) management guidelines that a population of 80 to 100 panthers is likely to be stable, although subject to genetic problems and assumptions previously stated, through 100 years. The Service, based on Kautz et al.'s (In Review) average panther population density of 31,923 acres per panther, determined 2,873,070 acres of Primary Zone equivalent lands (see discussion of Primary Zone equivalent lands below) need to be protected and managed. Currently, 2,094,988 acres of Primary Zone equivalent lands are preserved, so 778,082 additional acres need to be preserved to support a population of 90 panthers in south Florida (2,873,070 minus 2,094,988 equals 778,082).

Primary Zone Equivalent Lands: Kautz et al. (In Review), through their habitat evaluation of lands important to the Florida panther, identified three sets of lands, *i.e.,* Primary Zone, Secondary Zone, and Dispersal Zone, and documented the relative importance of these lands to the Florida panther. These lands, generally referred to as the core area, include the majority of the home ranges of the current population of the Florida panther. The Service, in our evaluation of habitat needs for the Florida panther expanded the boundaries of the Kautz et al. (In Review) core area to include those lands south of the Calooshatchee River where additional telemetry points historically were recorded. These additional lands, referred to as the "Other" Zone, added to the lands in Kautz et al.'s (In Review) core lands are referred to by the Service as the Core Area (Figure 12). The "Other" Zone lands, as well as the lands within the Secondary Zone, provide less landscape benefit to the Florida panther than the Primary and Dispersal Zones, but are important as a component of our goal to preserve sufficient lands to support a population of 90 panthers in South Florida. To account for the lower landscape importance of these lands in our preservation goals and in our habitat assessment methodology, we assigned lands in the Other Zone a value of 1/3 and lands in the Secondary Zone a value of 2/3 to convert these lands to Primary Zone value, *i.e.,* Primary Zone equivalents (Table 6). Dispersal Zone lands are considered equivalent to Primary Zones lands with a 1/1 value. For example, non-urban at-risk lands in the Other Zone total 819,995 acres, multiply these by 1/3 to determine the acres of Primary Zone equivalent lands the Other Zone can provide (819,995 times 1/3 equals 273,332 acres of Primary Zone equivalent lands). Using this assessment, the 471,466 acres of Secondary Zone lands equate to 314,297 acres of Primary Zone equivalent lands. These equivalent values, 1/3 and 2/3, for Other and Secondary Zones, respectively, and 1/1 for Dispersal Zone, are important components in our assessment of compensation needs for a project in the panther consultation area and are components of our habitat assessment methodology as discussed below.

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 non-urban Primary Zone equivalent lands in the core area (Figure 12) are estimated at 3,272,493 acres (actual acreage is 4,486,364 acres [the "actual acreage" value includes acres of lands in each category in the Secondary and Other Zones as well as the lands in the Primary Zone]) (see Table 6). Currently 2,094,988 acres of Primary Zone equivalent lands

(actual acreage is 2,605,046 acres) of non-urban lands are preserved. The remaining non-urban at-risk private lands are estimated at 1,177,506 acres of Primary Zone equivalent lands (actual acreage is 1,881,318 acres). To meet the protected and managed lands goal for a population of 90 panthers, an additional 778,082 acres of Primary Zone equivalent lands are needed. The base ratio is determined by dividing the acres of at-risk habitat to be secured (778,082 acres) by the result of the acres of at-risk habitat in the Primary Zone (568,549 acres) times the value of the Primary Zone (1); plus the at-risk acres in the Dispersal Zone (21,328 acres) times the value of the Dispersal Zone (1); plus the at-risk acres in the Secondary Zone (471,446 acres) times the value of the Secondary Zone (2/3); plus the at-risk acres in the Other Zone (819,995 acres) times the value of the Other Zone (1/3); minus the at-risk acres of habitat to be protected (778,082 acres). The results of this formula provide a base value of 1.95.

$$778{,}082 / ((568{,}549 \times 1.0) + (21{,}328 \times 1) + (471{,}446 \times 0.667) + (819{,}995 \times 0.333)) - 778{,}082 = 1.95$$

In evaluating habitat losses in the consultation area, we used an estimate of 0.8 percent loss of habitat per year (R. Kautz , FWC, personal communication, 2004) to predict the amount of habitat loss anticipated in south Florida during the next 5 years (*i.e.,* 6,000 ha / year; 14,820 acres / year). We conservatively assumed that we would be aware of half of these projects. We assumed that half of the projects would occur in the Primary Zone and half would occur in the Secondary Zone. We then adjusted the base ratio slightly higher than the 1.95 to 2.25 to account for unexpected increases in habitat loss.

We also realize that collectively habitat losses from individual single-family residential developments will compromise the Service's goal to secure sufficient lands for a population of 90 panthers. We believe that, on an individual basis, single-family residential developments by individual lot owners on lots no larger than 2.0 ha (5.0 acres) will not result in take of panthers on a lot-by-lot basis; however, collectively these losses may impact the panther. 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 adjusted the base value from 2.25 to 2.50, which is our base ratio.

The Service intends to re-evaluate this base ratio periodically and adjust as needed to achieve the Service's conservation goal for the Florida panther.

Landscape Multiplier: As discussed previously in the above section on Primary Zone Equivalent Lands, the location of a project in the landscape of the core area of the Florida panther is important. As we have previously discussed, lands in the Primary and Dispersal Zones are of the most importance in a landscape context to the Florida panther, with lands in the Secondary Zone of less importance, and lands in the Other Zone of lower importance. These zones affect the level of compensation the Service believes is necessary to minimize a project's effects to Florida panther habitat. Table 7 provides the landscape compensation multipliers for various compensation scenarios. As an example, if a project is in the Other Zone and compensation is proposed in the Primary Zone, a Primary Zone equivalent multiplier of 0.33 is applied to the panther habitat units (see discussion of panther habitat units 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 0.67 is applied to the panther habitat units developed for the project.

Panther Habitat Units: 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 onsite a habitat suitability value from the habitats shown in Table 3. The habitat suitability value for each habitat type is then multiplied by the acreage of that habitat type resulting in a number representing panther habitat units (PHU). These PHUs are summed for a site total, which is used as a measurement of the functional value the habitat provides to the Florida panthers. This process is also followed for the compensation sites.

Exotic Species Assessment: Since many habitat types in south Florida are infested with exotic plant species, which affects the functional value a habitat type provides to foraging wildlife species, *i.e.,* primarily deer and hog, we believe the presence of these species and the value these species provide to foraging wildlife needs to be considered in the habitat assessment methodology. As shown in Table 3, we have a habitat type and functional value shown for exotic species. This category includes not only the total acres of pure exotic species habitats present but also the percent-value acreages of the exotic species present in other habitat types.

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

Habitat Assessment Methodology Application: The application of the habitat assessment methodology including the base ratio, landscape multiplier, PHU determinations, and compensation recommendations, are presented below for the Ave Maria 5,027-acre site and the 7,285-acre compensation site.

For the Ave Maria DRI project, which is in both Secondary and Primary Zones, with compensation in the Primary Zone, the habitat functional value for the project site is 22,760 PHUs (14,000 in Secondary and 8,760 in Primary), which is based on the acres of each type of habitat multiplied by the habitat value (Tables 8a, 8b, 6c, and 8d) and assumes all of the 5,027 acres of the project lands are lost. To determine the compensation needs for the project, the habitat value is multiplied by the base ratio of 2.5, then by the landscape multipliers of 0.667 for that area within the Secondary Zone and 1.0 for that area within the Primary Zone. The resulting sum indicates a compensation need of 45,350 PHUs [(14,000 x 2.5 x 0.67) + (8,760 x 2.5 x 1.0)]. The functional value of the compensation site is determined in the same manner, *i.e.,* the acres of each type of habitat multiplied by the habitat value. In this instance, the acres of habitat types for SSA1, SSA2, SSA3, SSA4, and SSA6 compensation lands are multiplied by the existing habitat value (Tables 8b, 8c, and 8d). The resultants are then summed to indicate a total compensation sites value of 57,043 PHUs (7,614 + 25,840 + 23,589) from the 7,285 acres of compensation lands.

Based on these functional comparisons, the Service believes the habitat values lost by the proposed development will be more than offset by the preservation and compensation actions proposed by the applicant. Although the lands proposed for development fall within the Primary and Secondary Zones, these lands: (1) have not had a telemetry point occurrence within 1 mile of the site in 12 years, although use by uncollared panthers is unknown; (2) are primarily comprised of cropland; and (3) are bordered on the north by cropland, on the south by cropland and Oil Well Road, and on the east by Camp Keais Road and extensive citrus lands. The lands proposed for preservation include lands within a regional wetland system (SSA1 and SSA2) identified by the State for special consideration (CREW) and could become part of future efforts to improve the use and value of the Camp Keais Strand system as a wildlife corridor. Proposed compensation lands within the Okaloacoochee Slough system (SSA3 and SSA4) are within a recognized area of existing panther activity and corridor travel. Protection of the SSA3 and SSA4 lands will facilitate the State support of wildlife crossing construction on a portion of SR 846 where panther collisions have been an ongoing problem. In addition, compensation is proposed (SSA6 compensation lands) on lands abutting the existing Florida Panther NWR. Compensation lands proposed for preservation provide higher value habitat for the panther, are in the Primary Zone, and are consistent with the Service's panther conservation goal to strategically locate and preserve sets of lands containing sufficient area and appropriate land cover types to ensure the survival of the Florida panther population south of the Caloosahatchee River.

Wildlife Assessment: As discussed previously in the status of the species and in the environmental baseline, the Service believes the existing habitat conditions present on a site and the foraging value that a site provides to the Florida panther and panther prey species are an important parameter in assessing the importance of the project site to the Florida panther and other wildlife species. In order to assess this importance, the Service requests wildlife surveys and plant species compositions as part of the applicant's biological assessment prepared for the project. To provide the Service with this information, a series of protected species surveys were conducted on the proposed DRI project site by WilsonMiller in 2003 and 2004. Opportunistic foraging by wading birds in various ditches was noted and a nesting pair of caracara was identified approximately 150 linear feet outside the project's northeast boundary. Subsequent observations of the caracara indicate the pair relocated their nesting site approximately 500 feet to the north, along the project sites northeast boundary, at the beginning of the 2004-2005 nesting season. Track surveys provided evidence of occasional use by feral hog or deer in the agricultural areas on the project site.

As discussed previously, white-tailed deer densities and other prey species are influenced by the quality of the foraging habitat present in an area. Monotypic stands of poor quality foraging plant species and the invasion of a site by exotic plants provide lower habitat foraging values and affect the utilization by and density of foraging species. The habitats in the project area have experienced similar vegetation changes. Historical vegetation on the property included a mosaic of upland and wetland habitats that provided a seasonal pattern of plant growth. However, past and current agricultural practices have resulted in loss of quality forage for resident deer populations. The agricultural practices at the project site involve raised-bed agriculture and sod

farming. The climate, soil, and hydrologic conditions at the site allow multiple crops to be planted and harvested through 9 months of the year. The rapid and multiple cycles of leveling fields, adjusting beds, planting and staking plants, and harvesting each year occur over a several square-mile area in the general region of the project site. As a result, quality forage for deer is not available outside the adjacent Camp Keais Strand system. This fact is borne out by the relatively low occurrence of either deer or feral hog sign on the project site. However, the proposed compensation sites, and SSA3, SSA4, and SSA6 in particular, with their existing mosaic of uplands, pastures, and wetlands, provide a diverse combination of plant species capable of supporting deer foraging as well as feral hog use.

Conservation Measures: The beneficial effects of the project include the preservation of 7,285 acres of Primary Zone panther habitat within the action area. Although the project will result in a net loss in the number of acres of habitat, the value of lost habitat is limited for the panther and the habitat quality provided to the Florida panther through preservation of SSA1, SSA2, SSA3, SSA4, and SSA6 compensation lands is superior to that of the areas to be impacted. The preservation of SSA3 and SSA4 lands is anticipated to facilitate the siting and construction of needed wildlife crossings and directional fencing along a portion of SR 846 where numerous panther collisions have been documented. SSA6 compensation lands will effectively extend panther preservation lands northward from the existing Florida Panther NWR by 2,649 acres. The SSA3 and SSA4 compensation lands are part of the documented home range of Florida panthers FP 132 and FP 65. The SSA6 compensation lands are part of the documented home range of Florida panthers FP 59 and FP 131. Lands preserved will be protected by conservation easement granted to the Federal government in perpetuity. The compensation sites, SSA3, SSA4, and SSA6, compensation lands in particular, are valuable areas for breeding, foraging, and dispersal habitat important to panthers. In comparison, no radio-collared panthers have been recorded within 1 mile of the project development site in over 12 years and the project development site data do not indicate use of the project site lands as a movement corridor. However, Camp Keais Strand, which is adjacent to the project site, is a documented travel corridor. The occurrence of uncollared panthers on the project site is unknown.

Direct Effects

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

Permanent Loss of Habitat: The project will result in the loss of 5,027 acres of lower quality panther habitat located within of the Primary and Secondary Zones. The land will be converted to support a university, a defined town center, and residential community. Habitat quality is generally poor, as it is primarily cropland and sod farm. Prey surveys did not document

significant site usage by white-tailed deer or feral hog, primary panther prey species. The project site has not been documented to serve as a panther connection or dispersal corridor. The project site is bordered to the north by Immokalee Road, to the east by Camp Keais Road, to the South by Oil Well Road and to the west by the Camp Keais Strand, which is a Collier County Habitat and Flowway Stewardship Receiving Area. Camp Keais Strand has been identified as an important wildlife corridor (FWC In Review). Surrounding lands to the north, east, and south of the project are intensely utilized for row crops and sods farms, which provide low quality foraging habitat for prey species. Therefore, we believe the loss of the habitat associated with the project is not significant and this action is not expected to result in jeopardy to or a significant reduction in the geographic distribution of the Florida panther.

Fragmentation of Habitat: In our evaluation of fragmentation of habitat, we consider the location of the project in relation to surrounding native habitats, preserved lands, and wildlife corridors. We also consider the habitats present onsite, their importance in providing foraging needs for the Florida panther and panther prey species, and if the site development would further restrict access to surrounding lands important to the Florida panther and panther prey species.

The project site has not been documented to serve as a panther connection or dispersal corridor, most likely due to the extent and intensity of agricultural operations and the significant absence of native upland vegetation in the area. Furthermore, the project site is also bordered on the north, east, and south by intensively utilized agricultural lands, which provide low quality foraging habitat for prey species. Although panthers and panther prey species may occasionally cross the project site, to access higher quality foraging habitat in the CREW conservation lands to the north and to native habitats to the south (Florida Panther NWR), as well as the Camp Keais Strand corridor, the duration and intensity of agricultural operations and the low foraging and vegetative cover for panther and panther prey species on the property adversely affect project land access and use by the Florida panther and panther prey species.

Furthermore, as discussed previously, according to telemetry data, no radio-collared panthers have been recorded on the site within the past 12 years. In addition, prey species surveys further document the low value of these lands as a foraging base for panther prey species. In consideration of the above listed factors, the current land uses, (approximately 78 percent row crop and 12 percent improved pasture), we believe that fragmentation of panther habitat and habitat for panther prey species is not significant and the proposed action is not expected to result in jeopardy to the Florida panther.

Road Way Improvements: Roadway improvements as components of the proposed action include the construction of internal roads within the development, a connection to Oil Well Road, and a connection to Camp Keais Road. No other road improvements are proposed as components of the Ave Maria project. The proposed roadway constructions are located within either lands currently in use as row crops or sod fields. These lands as discussed previously provide marginal quality habitat to the Florida panther and panther prey species, and the Services believes that the construction of the roadway improvements as a component of the proposed action is not significant and is not expected to result in jeopardy to the Florida panther. As discussed above, a wildlife crossing of Oil Well Road directional fencing, and the installation of

panther crossing warning signs are being proposed as a component of this action through a joint coordination being undertaken by the applicant and Collier County, and this crossing and signage are expected to improve survival of Florida panthers utilizing the Camp Keais Strand as a corridor.

Construction: The construction for this project is anticipated to occur in phases and over several years. There are no known den sites within the project boundaries and the quality and quantity of the foraging prey base is low. Therefore, we believe panther usage of the property is limited and we do not believe project construction will result in direct panther mortality.

Compensation: The Service believes the habitat values lost by the development will be offset by the preservation and compensation actions proposed by the applicant. The lands proposed for development are primarily improved cropland and sod farms with significantly reduced opportunity for use by panther for denning, prey support, or stalking. The compensation lands of SSA1 and SSA2 (850 acres) constitutes the majority of land owned by the applicant within Camp Keais Strand while the compensation lands of SSA3 and SSA4 (3,786 acres) will allow the installation of a wildlife crossing for the much-used Okaloacoochee Slough wildlife corridor and the SSA6 compensation lands (2,649 acres) will add significant compensation lands adjacent to the Florida Panther NWR. The 7,285 total acres of lands proposed for preservation are consistent with the Service's panther conservation goal to locate and preserve sets of lands containing sufficient area and appropriate cover types to ensure the long-term survival of the Florida panther south of the Caloosahatchee River.

Interrelated and Interdependent Actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. This biological opinion is based on the maximum potential footprint of the proposed Town of Ave Maria DRI as proposed in the project's July 2004 DRI application to the State/RPC/local government as modified in March 2005 and dictated by the applicable portions of Collier County's Comprehensive Plan for the Rural Lands Stewardship Overlay. This maximum potential footprint, which is approximately 5,027.0 acres, exceeds the Corps permit application footprint, which is approximately 683.4 acres affecting less than 0.5 acre of federally regulated wetland. No further interrelated or interdependent actions are expected to result from the project.

Indirect Effects

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

(5) a potential increase of intraspecific aggression between panthers due to reduction of the geographic range of the panther.

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

In the following sections, the Service has identified the road segments that surround the AMU DRI and provided an assessment of the traffic changes attributed to the AMU project and traffic changes attributed to actions not associated with AMU. The purpose of this assessment is to provide the basis to assess the project's effects to the Florida panther and identify non-project related effects to the Florida panther. Traffic travel routes that surround the project site (Figure 13) include portions of Immokalee Road, which are north and east of the project, Oil Well Road, which is south of the site, and Camp Keais Road, which is east of the site. All of these roads are currently rural two-lane highways.

Baseline Traffic (Without Ave Maria DRI): Traffic projections (Table 9) show that without the proposed Ave Maria DRI, the average vehicle trips per day on the network of roads surrounding the Ave Maria DRI project will increase from current levels of 63,638 trips (2004) to 115,900 trips (2011) to 144,100 trips (2016), an increase of 82 percent and 126 percent, respectively, above current levels.

Oil Well Road: Traffic projections for Oil Well Road show that without AMU, the average-vehicle trips per day will increase from 9,096 trips per day (2004) to between 12,700 and 16,300 trips per day (2011), depending on which section of Oil Well Road is modeled. This increase represent between a 40 and 80 percent increase, respectively, over the current levels of traffic. The portion of the roadway crossing Camp Keais Strand shows a 40 percent projected increase over current levels. A similar increase is shown for the 2016 projections, providing a projected increase of 40 percent (12,700 to 17,800) and 28 percent (16,300 to 20,900) over the 2011 base year.

Immokalee Road: On the section of Immokalee Road between Everglades Boulevard and Camp Keais Road, which represents the portion crossing Camp Keais Strand, traffic projections show that without the proposed Ave Maria DRI, the average vehicle trips per day will increase from current levels of 5,205 trips to 14,800 trips, an increase of 184 percent over existing levels. On the portion of Immokalee Road between the intersection of Camp Keais Road and urban Immokalee, 2011 traffic projections show an increase from the current levels of 8,217 trips to 20,000 trips, an increase of 143 percent over existing levels. Traffic projections for 2016 show an additional increase from 20,000 trips to 23,100 trips, an increase of 3,100 trips per day.

Camp Keais Road: On Camp Keais Road, between its connection with Oil Well Road and Immokalee Road, traffic projections show that without AMU, the average vehicle trips per day will increase from 3,027 to 7,600 trips or 8,900 trips (2011), depending on the section of Camp Keais Road modeled, which represents an increase over existing levels of 151 percent and 194 percent, respectively. The 2016 projections show an increase (400 trips per day) on the southern portions of Camp Keais Road, but no increase on the northern section.

Baseline Traffic (With Ave Maria DRI): Traffic studies (Table 7) by WilsonMiller estimate that the Ave Maria DRI will generate an increase in traffic on the network of roads surrounding Ave Maria DRI project over baseline (without AMU DRI) of 13,000 vehicle trips per day by 2011 (128,900 [with AMU] minus 115,900 [without AMU] equals 13,000) and 29,300 vehicle trips per day by 2016 (173,400 [with AMU] minus 144,100 [without AMU] equals 29,300). These values represent an increase of 11 percent and 20 percent, respectively, above the projected baseline traffic values for 2011 and 2016 for the network of roads surrounding the Ave Maria DRI.

Traffic studies project the largest increase in vehicle trips per day on portions of Oil Well Road between the entrance of AMU and its intersection with Immokalee Road to the west and on Camp Keais Road between the entrance of AMU and its intersection with Immokalee Road to the north.

Oil Well Road: Traffic projections for Oil Well Road from its intersection with Everglades Boulevard and the entrance to AMU, which is the section of Oil Road that crosses Camp Keais Strand, show an increase from the base (without AMU) in 2011 from 12,700 to 17,500 trips, an increase of 4,800 trips per day or a 38 percent increase over base. The projections also show an increase from the base in 2016 from 17,800 to 22,700 trips, an increase of 4,900 trips or a 28 percent increase over base. For the section of Oil Well Road from its intersection with Everglades Boulevard to Immokalee Road (west), 2011 traffic projections show a decrease from 16,300 to 15,600 trips, which represent a 5 percent reduction in vehicle trips per day. Traffic projections for 2016 also show a decrease from base from 20,900 to 18,300, a reduction of 14 percent.

Camp Keais Road: Following the same analysis, 2011 traffic projections for Camp Keais Road from its intersection with Oil Well Road and the entrance to AMU show a decrease from 8,900 to 5,900 trips, which represent a 34 percent reduction in traffic. From the entrance to AMU to its intersection with Immokalee Road, 2011 traffic projections show an increase from 7,600 to 16,800 trips, which represent an increase of 121 percent. The 2016 projections show increases in baseline traffic for both sections, providing a 74 percent and 225 percent increase in traffic, respectively, for the south and north sections of Camp Keais Road.

Immokalee Road: On the portion of Immokalee Road, which is the northern connection of traffic from AMU into Immokalee, 2011 traffic projections show an increase from 20,000 to 24,700 trips, an increase of 24 percent over base (without AMU), and for 2016, an increase from 23,100 to 29,500 trips, an increase of 28 percent. On the portion of Immokalee Road between Everglades Boulevard and Camp Keais Road, which represents the portion crossing Camp Keais

Strand, 2011 traffic projections show a decrease from 14,800 to 12,900, a 13 percent reduction in traffic. The 2016 projections show a similar reduction trend from 19,700 to 18,100, an 8 percent decrease.

Project and Non-Project Related Traffic Generated Effects to the Florida Panther

The Service believes that the two roads crossing Camp Keais Strand and the northward expansion of Immokalee Road from its intersection with Camp Keais Strand Road and urban Immokalee may affect the Florida panther and panther prey species based on traffic increases projected for the AMU project.

Camp Keais Strand Corridor: Camp Keais Strand has been identified as a panther/wildlife corridor between the CREW conservation lands and the native lands north of and adjacent to Florida Panther NWR, including Florida Panther NWR (FWC In Review). For evaluation purposes, the Service considers the Camp Keais Strand corridor as those lands within the Collier County Habitat and Flowway Stewardship Receiving Area, generally bordered by Immokalee Road to the north and Oil Well Road to the south. This corridor is approximately 5 miles in length with its narrowest point approximately 1.2 miles wide, and is estimated at 3,950 acres. Habitats within the strand are primarily a mixture of cypress (38 percent), freshwater marshes and wet prairie (21 percent), hardwood swamp (8 percent) and mixed pine-cypress (19 percent) as natural habitats and row crops (14 percent) as the dominant agricultural land use. Exotic species infestations in the natural communities are limited, generally less than 5 percent, with Brazilian pepper encroaching into the fringing upland communities bordering the Strand and along the perimeter of the Strand.

As discussed previously, AMU is proposing no roadway improvements that may directly affect Camp Keais Strand. However, the expected changes in traffic generated by AMU may indirectly affect the Strand and are the assessment the Service is evaluating. In the previous sections, the 2011 and 2016 traffic projections showed that even without the AMU development a 40 percent increase in average vehicle trips per day is expected for the Oil Well Road portion crossing the strand, which the Service considers as the baseline to evaluate AMU. With the AMU traffic projections, the average vehicle trips per day are expected to increase by approximately 38 and 28 percent above the without AMU projections, respectively, for the 2011 and 2016 model years.

For the Immokalee Road crossing of Camp Keais Strand, traffic projections for without AMU show a 184 percent increase above current levels to the 2011 model year and a 16 percent increase from the 2011 model year to the 2016 model year, which the Service considers the baseline for the AMU assessment,. Model projections for the portion of Immokalee Road crossing Camp Keais Strand with the AMU development shows a decrease of 13 percent and 8 percent from the baseline, respectively for the 2011 and 2016 model years.

Northward Expansion of Immokalee Road: The 2011 traffic projections for this portion of Immokalee Road predict an increase in traffic without AMU from the current levels of 8,217 trips to 20,000 trips (2011), an increase of 143 percent over existing levels. Traffic projections for 2016 show an additional increase of 3,100 trips per day. The 2011 traffic projections with AMU

show an increase from 20,000 to 24,700 trips, an increase of 24 percent over the base; and for 2016, a 28 percent increase above the without-AMU projections. This north-south section of road, which is approximately 3 miles in length, is bordered on the east and west primarily by row crops and sod fields. However, immediately west, approximately 500 feet at its closes point is a Collier County Stewardship Water Retention Area, which has two historical panther telemetry points (FP 12 [1990]) and is connected directly to Camp Keais Strand. Immediately east of this area and east of the road is another existing natural system, although much smaller is size than the water retention area, that also historically had a panther telemetry point (FP 65 [1998]). Approximately a mile north of this telemetry point, FP 81 was document in 2001, approximately 1 mile east of the road. However, no recent use has been documented.

Evaluation

Based on the above, the Service believes that there may be an adverse effect to the Florida panther and panther prey species from the proposed increases in traffic on both Oil Well Road and Immokalee Road where the roads cross Camp Keais Strand and on the north-south portion of Immokalee Road connecting Camp Keais Road to urban Immokalee. Therefore the Service is evaluating the adverse effect of the increase in traffic projected for the AMU DRI.

Non-Project Generated Traffic Increases

The Service is aware that Collier County is proposing and is in the planning phases of improvements to portions of Oil Well Road, Camp Keais Road, and portions of Immokalee Road to meet the projected traffic needs for the AMU project and to address the model predicted increases in non-project related traffic. Since the County's proposed improvements, based on the projected Camp Keais Strand crossings are expected to impact wetland, (wetland filling necessary to expand Oil Well Road from a two-lane road to a four-lane road), which is a future Federal action, the effects of that project to the Florida panther and panther prey species will be evaluated under a future Federal action.

Project Generated Traffic Increases

As previously discussed, the AMU project is expected to generate increases in traffic on portions of Oil Well Road, Camp Keais Road, and Immokalee Road.

Oil Well Road – Camp Keais Strand Crossing: In evaluating project generated actions, the traffic increase on Oil Well Road, where it crosses Camp Keais Strand has been identified as a location of panther/wildlife/vehicle interactions that may result in injury and/or mortality to panthers and panther prey species. Through discussions with the Service, the applicant is proposing, in coordination with Collier County, the installation of a wildlife/panther crossing with associated directional fencing along Oil Well Road to navigate wildlife species to the crossing location. The most appropriate location of the crossing is a component of Collier County's cooperative study of Oil Well Road and the segment of CR 846 east of Immokalee to determine the optimum location for wildlife crossing constructions (WilsonMiller 2005). The Service, based on the above commitment by both AMU and Collier County (see Consultation

History), believes the increase in traffic on Oil Well Road at this location attributed to AMU will not result in direct or indirect mortality or injury of a Florida panther.

Immokalee Road – Camp Keais Strand Crossing: Historical records of vehicle/panther mortality show the occurrence of two panther deaths on this section of Immokalee Road (FP 50 [1-26-2003] and FP 58 [6-30-2003]), both of which are east of Everglades Boulevard and west of the Ave Maria DRI project. As discussed previously, traffic projections with AMU and without AMU show a reduction of traffic on this section of Immokalee Road with AMU, which the Service believes is a beneficial action. However, since panthers are known to cross this rural two-lane road and several road mortalities have historically occurred within the section of Immokalee Road crossing Camp Keais Strand, the Service, through discussion with AMU, believes additional measures can be provided to further reduce the risk of a panther/vehicle encounter. Since traffic speeds and awareness by vehicle drivers of wildlife present on rural roads is the most likely key to minimizing vehicle/wildlife interactions, AMU is proposing, in cooperation with Collier County, the installation of four panther/wildlife crossing warning signs on this portion of Immokalee Road. Therefore, based on the above analysis, the Service believes the traffic projection decrease associated with the AMU project along with the installation of panther/wildlife crossing warning signs proposed by AMU will not result in direct or indirect mortality or injury of a Florida panther.

However, as previously discussed, the increase over existing traffic levels projected to occur from non-project related actions are a component of a future action with Collier County for wetland fill for widening of Oil Well Road and will be addressed during that consultation.

Northward Expansion of Camp Keais Road and Immokalee Road: Traffic projections for the 2011 model year for Immokalee Road north of the AMU DRI, project an increase above current levels of approximately 125 percent, with AMU providing an additional increase of 24 percent. This area and the natural systems adjacent to the road alignment have no recent telemetry points (2 in 1990, 1 in 1998, and 1 in 2001), and based on the current land use, primarily row crops and sod fields, panther and panther prey are not expected to be present. However, since historical telemetry points are present in this rural area, the Service recommends that panther crossing signs also be installed in this location. AMU has proposed to provide six panther/wildlife crossing warning signs for placement on the portion of Immokalee Road crossing Camp Keais Strand. The Service believes that four signs are sufficient and recommends placement of the two remaining signs on this section of Immokalee Road in the general vicinity of the current locations of the native communities and in line with the closest point adjacent to the Collier County Stewardship Water Storage Area. Based on AMU's commitment to incorporate this sign placement, the Service believes the traffic increases resulting from AMU will not result in direct or indirect mortality or injury of a Florida panther.

Immokalee Road East – Traffic Mortality: Although the AMU project is not expected to generate traffic increases on CR 846 east of the community of Immokalee, 11 panther deaths have been attributed to vehicular collisions on this road segment since 1997. As previously discussed, road crossing and accompanying directional fences have been shown to appreciably reduce traffic mortalities. However, the primary obstacle to the siting and construction of

wildlife crossings in the area of CR 846 has been reluctance by the State of Florida to locate crossings where unencumbered private lands exist on either side of a specific crossing location. As part of the AMU compensation package, the applicant is proposing to encumber the lands (SSA3 and SSA4) on both sides of CR 846 as part of the panther compensation for the project. This encumbrance will facilitate the siting of wildlife crossing(s) and directional fencing which the Service considers a beneficial effect to the Florida panther. To facilitate this process, Collier County Transportation Department is currently working with Dr. Reed Noss and Dr. Dan Smith to contract a study of optimum wildlife corridor locations for Collier County. The Eastern Collier County Highway and Greenways Plan study is being supported by Collier County in cooperation with the National Wildlife Federation and the Florida Wildlife Federation through a grant to the National Wildlife Federation through Jane's Trust. The study is intended to identify areas of wildlife crossing at the intersection existing/proposed greenways (SSA lands) and existing roadways. The project's SSA3/SSA4 lands are specifically targeted for study based on the project's commitment to SSA designation and panther compensation commitment. The results of the study will be used to specifically site the wildlife crossing locations.

In summary, based on the above assessments and the commitments proposed by AMU, the Service believes the increases in the projected traffic above base (without AMU) for all roads addressed in this analysis will not result in direct or indirect mortality or injury of a Florida panther and will not jeopardize the existence of the Florida panther.

Habitat Fragmentation: In our analysis of the indirect effects from habitat fragmentation, we consider the same parameters as evaluated for direct effects; specifically, the location of the project in relation to surrounding native habitats, preserved lands, and wildlife corridors. We also consider the habitats present onsite, their importance in providing foraging needs for the Florida panther and panther prey species, and if the site development would further restrict access to surrounding lands important to the Florida panther and panther prey species. The project site has not been documented to serve as a panther connection or dispersal corridor, most likely due to the extent and intensity of agricultural operations and the significant absence of native upland vegetation in the area. Furthermore, the project site is also bordered on the north, east, and south by intensively utilized agricultural lands, which provide marginal quality foraging habitat for prey species. Although, panthers and panther prey species may occasionally cross the project site to access higher quality foraging habitat in the CREW conservation lands to the north and to native habitats to the south (Florida Panther NWR), as well as the Camp Keais Strand corridor, the duration and intensity of agricultural operations and the low foraging and vegetative cover for panther and panther prey species on the property adversely affect project land access by the Florida panther and panther prey species.

Furthermore, as discussed previously, according to telemetry data, no radio-collared panthers have been recorded on the site within the past 12 years. In addition, prey species surveys further document the low value of these lands as a foraging base for panther prey species. In consideration of the above listed factors, the current land uses (approximately 78 percent row crop and 12 percent improved pasture), we believe that fragmentation of panther habitat and habitat for panther prey species is not significant and the proposed action is not expected to result in jeopardy to the Florida panther.

Panther and Prey Disturbance (Panther/Human Interactions) and Intraspecific Aggression: Potential increases in intraspecific aggression and disturbance to the Florida panther were evaluated. As discussed previously in our assessment of fragmentation, we considered habitat quality related factors and occurrence data for the Florida panther and panther prey species. This information is also the basis of our evaluation of disturbance and intraspecific aggression to the Florida panther and to panther prey species. The Service believes, as previously discussed, the habitats on the property provide low quality foraging for prey species, which directly affects the frequency and duration of use of the property by panthers. Therefore, since we do not believe that panther prey species and/or Florida panthers utilize the property on a frequent basis, the loss of the limited use of the site by panthers and panther prey species will not significantly increase the risk of disturbance to panthers in the project action area due to human activities, will not increase mortality from intraspecific aggression between panthers, and will not significantly increase disturbance to panthers and panther prey species in the project action area.

EFFECTS OF THE ACTION – Audubon's crested caracara

This section analyzes the direct and indirect effects of the DRI project on the crested caracara and crested caracara habitat.

Factors to be Considered

Residential, commercial, and industrial development projects may have a number of direct and indirect effects on the caracara and caracara habitat. Direct impacts, which are primarily habitat-based, may include: (1) the permanent loss of foraging habitat; (2) the permanent loss of nest tree availability; and (3) a reduction in the geographic distribution of the species. Indirect effects may include: (1) an increased risk of roadway mortality to fledglings due to the increase in vehicular traffic; and (2) increased disturbance to nesting caracara in the project vicinity due to human activities. These indirect effects are habitat based with the exception of vehicular mortality, which could result in lethal "take."

Analysis for Effects of the Action

As noted previously, an adult pair of caracara occupied a nest tree approximately 150 feet east of the project boundary during the 2003-2004 breeding season. Successful breeding was confirmed, and two juvenile caracaras were observed with the adults throughout 2004. The home range of these birds includes 601± acres of improved pastures within the project area. Approximately 480± acres of the improved pasture areas are dominated by bahia grass (*Paspalum notatum*) groundcover, while 121± acres of the pastures at slightly lower elevations are dominated by knot grass (*Paspalum distichum*).

Direct Effects

The direct effect of the action will be the conversion of the pasture acreage to development, and the associated loss of caracara pasture habitat and nest site. Morrison (2001) and Morrison and Humphrey (2001) have cited habitat loss as the major threat to caracara conservation. The

applicant is currently working with Dr. Joan Morrison, an acknowledged expert on caracara, to develop appropriate compensation plans. The direct impacts are considered as an incidental taking due to the loss of habitat and probable dispersal of the caracaras from the site. However, as detailed below in the section on Conservation Measures, this direct impact to caracara habitat will be offset by an in-kind replacement of habitat via improved pasture restoration or creation on existing agricultural lands within the RLSA.

Indirect Effects

Indirect effects are those effects that result from the proposed action, and are reasonably certain to occur. The indirect effects this project will have on the crested caracara within the action area are discussed below and in the assessment of indirect impacts previously discussed. The project will result in increased vehicular traffic in the project vicinity. Caracara mortality due to vehicular trauma has been documented (*e.g.,* in the MSRP), particularly within the first 6 months of fledging. Based upon habitat considerations, most of the potential habitat for caracara (*i.e.,* improved pasture, dry prairie) outside the project site occurs more than 2 miles from the project site and major roads that serve it. Therefore, the Service believes project-related traffic effects on caracara demographics are not significant.

Indirect effects of the action also include potential disruption of nesting during the 2004-2005 breeding season, and the probable movement of the birds away from the site during and following construction activities. Thus far, the caracaras at the proposed project site display a high tolerance for farm-related vehicular traffic and human activity, even during nesting. The birds have been observed sitting 15 feet from the main internal farm road as trucks, semi-tractor trailers, farmworker buses, and farm equipment pass by without any visual sign of disruption. The birds also come in close contact with humans at the farmworker lunch area onsite, as they scavenge for leftover food. As detailed below in the section on Conservation Measures, these effects will be minimized through monitoring of the adult pair through the 2004-2005 breeding season, adherence to Dr. Morrison's recommendations for Primary and Secondary Zone activities during construction, and radio-tagging of nestlings to follow dispersal events post-construction.

Interrelated and Interdependent Actions

An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. This biological opinion is based on the maximum potential footprint of the proposed Town of Ave Maria DRI as proposed in the project's July 2004 DRI application to the State/RPC/local government and dictated by the applicable portions of Collier County's Comprehensive Plan for the Rural Lands Stewardship Overlay. No further interrelated or interdependent actions are expected to result from the project.

Conservation Measures

The conservation measures, some of which have already begun, consist of four elements: (1) improved pasture habitat creation and/or restoration; (2) monitoring of the adult pair through the 2004-2005 breeding season and radio-tagging of nestlings (if feasible); (3) monitoring of fledglings via radio-telemetry to document any dispersal events and the annual home-range; and (4) gather as much data on caracara occurrence, territorial occupancy, breeding, etc., from other landowners within the RLSA.

Since habitat loss constitutes the major threat to caracara persistence and recovery, the applicant will create and/or restore improved pasture habitat that provides in-kind replacement for habitat converted at the project site. The pasture creation and/or restoration will occur on existing agricultural lands, which may include existing row-crop fields, fallow fields and/or unimproved pastures currently unsuitable for caracara due to the existing vegetation composition or structure (*e.g.,* dense shrub cover, high groundcover, etc.). The total direct impacts to improved pasture at the project site (calculated from GIS acreages) are 601± acres; 480± acres which are upland bahia grass pasture, and 121± acres which are dominated by knot grass transitional to wetland.

The compensation will provide in-kind replacement with pasture and/or native vegetation species, and will be designed in consultation with Dr. Morrison. If cabbage palms are not already present in sufficient number or location to serve as nest trees, they may be planted as deemed necessary. Cattle ponds, ditches, and other enhancements to concentrate fish, amphibians, etc., for caracara foraging may be added. Requirements for habitat management plans and legal agreements for maintaining the compensation will be included as permit conditions. Alternatively, if the Service, in coordination with Dr. Morrison, determines funding for caracara habitat acquisition in another part of the population's range may be more effective for caracara conservation, the applicant could provide acquisition funds or funds to put easements in place on ranchlands in these other areas, in lieu of easements on their land.

Weekly visual monitoring of the adult pair began on November 1, 2004, to establish the onset of breeding behavior, the location of a nest tree, and eventually, a breeding chronology for the 2004-2005 season. Monitoring is performed according to Morrison (2001) and in coordination with Dr. Morrison. If/when egg laying is confirmed, an attempt will be made to have Dr. Morrison radio-tag the nestlings. The relative ease of tagging the nestlings will provide useful data of the adult pair home range, since the fledglings will track with the adults for at least the first year. This effort is also notable as a conservation measure, because no detailed data exist on adult dispersals and establishment of a new home range.

The applicant has already enlisted other landowners within the RLSA to report known caracara occurrences and to be alert for any new sightings. It now appears landowners within the RLSA have been aware of caracara within the general area, but had no cause to report their presence. The RLSA program, which provides incentives to protect environmentally sensitive lands, has resulted in several reports of caracara, including a breeding pair near Lake Trafford. Landowners are now envisioning how the presence of caracara on their property may be an asset rather than a liability. This promising development echoes the main point of Morrison and

Humphrey (2001), which states, "...finding new ways to forge partnerships among private and public landowners and conservation biologists are urgently needed steps toward workable conservation alternatives across both natural and managed landscapes." Since the caracara occur almost exclusively on private lands managed for cattle, these partnerships are essential for caracara recovery.

The overall effects of the action may include positive contributions to caracara conservation that the proposed action has already produced. Prior to the application for the proposed action, the status of caracara within Collier County was unknown. The MSRP (Service 1999) considered Collier County to be formerly occupied range, and the breeding range barely edged into the county (Figure 11). The proposed action, occurring within the RLSA context, has already identified two adult breeding pairs in the vicinity of Immokalee, and credible reports of resident caracara over a 100,000- to 200,000-acre area within the county. These positive effects are consistent with specific caracara recovery actions outlined in the MSRP.

CUMULATIVE EFFECTS – Florida panther

Cumulative effects include the effects of future State, Tribal, local, or private actions reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions unrelated to the proposed action but located in the action area are not considered in this section because they require separate consultations pursuant to section 7 of the ESA. As discussed in the environmental baseline, the Service identified a variety of actions that may have a beneficial and/or an adverse effect on the Florida panther and has developed a mechanism to distinguish between those actions both likely and not likely to be future Federal actions, and thus meet the cumulative effects definition.

Within the action area, past and ongoing State and county actions affecting panther habitat include: (1) the issuance of Development of Regional Impact Orders (2001-2004); (2) Comprehensive Plan Amendments (2003-2004); (3) Zoning Amendments (2003-2004); (4) Planned Unit Developments (2001-2004); and (5) Environmental Resource Permits (2003-2004). To evaluate these effects, the Service incorporated the Florida Land Use, Cover and Forms Classification System (FLUCCS) mapping to determine properties that may be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps. For listing purposes, properties with less than 5 percent wetlands were considered by the Service to be generally exempt from regulatory review as these quantities of wetlands could be avoided by project design.

The Service identified, within the action area, the location of past and ongoing State and county actions (as referenced above) affecting panther habitat and cross-referenced the boundaries and approximate locations of the listed projects on recent aerial photographs. For those projects that included less than 5 percent wetlands, which the Services considers as project likely to be exempt from Federal review, Table 10 provides a list of identified projects, acres, year approved, and designation if wetlands are present. According to FLUCCS mapping, approximately 2,627.3 acres could be expected to be subject to development in the action area without Federal permit involvement through the Clean Water Act section 404. According to the most current

home range estimates of the Florida panther (FWC 2004), this level of development represents 9.8 percent of a female panther home range and 2.7 percent of a male panther home range.

State and county land alteration permits not part of those actions listed above, generally included single-family residential developments within Northern Golden Gate Estates and Lehigh Acres. Vacant lands within the area of Northern Golden Gate Estates (north of I-75) total approximately 34,028 acres as of September 2004 (Figure 9). To evaluate these effects, the Service has overlain the plat boundaries on 2004 aerials, noted lots with developments, compared those to 2003 aerials, and noted the changes. Vacant lands within the area of Northern Golden Gate Estates (north of I-75) total approximately 35,768 acres as of August 2003. The breakdown of acres for August 2003 is: (1) wetlands, approximately 17,572 acres; (2) uplands, approximately 17,990 acres; and (3) water, approximately 210 acres. These changes were overlain on the National Wetlands Inventory (NWI) maps for presence of wetlands. This evaluation was used to estimate the percentage of properties that may be exempt from Federal Clean Water Act section 404 wetland regulatory reviews by the Corps (Figure 14). A comparison of the 2003 and 2004 data for Northern Golden Gate Estates indicates approximately 1,740 acres of land were converted from vacant to developed with the breakdown as: (1) wetlands, approximately 696 acres and (2) uplands, approximately 1,044 acres. Therefore, using NWI mapping, approximately 1,050 acres could be expected to be subject to development each year in this area without Federal permit involvement.

Vacant lands within the area of Lehigh Acres total approximately 34,852 acres as of April 2003 (Figure 15). The breakdown of acres is: (1) wetlands, approximately 1,057 acres; (2) uplands, approximately 33,592 acres; and (3) water, approximately 202 acres. A review of aerial photography and Lee County building permit data for Lehigh Acres from the 1-year period prior to April 2003 indicates approximately 441 acres of land was converted from vacant to developed during the 1-year period. The breakdown of converted acres is estimated as: (1) wetlands, 66 acres; (2) uplands, 375 acres; and (3) water, 0 acre. For the non-exempt projects, where permits were required by the Corps, the Service concurred with the Corps' determination of "may affect, but is not likely to adversely affect" for these individual projects. Therefore, using NWI mapping, approximately 375 acres could be expected to be subject to development each year in this area without Federal permit involvement.

The evaluation process discussed previously for both these subdivisions provided an estimate of 417 lots, totaling 1,044 acres for Northern Golden Gate Estates and 1,764 lots, totaling 375 acres for Lehigh Acres. Therefore, using NWI mapping for the Northern Golden Gate Estates and Lehigh Acres areas, a total of approximately 1,419 acres could be expected to be subject to development each year in these areas without Federal permit involvement. Based on historical records for wetland permits issued by the Corps for these areas, most of these projects will involve the construction of single-family residences in partially developed areas and will involve less than an acre of impact. This level of development represents 3.7 percent of a female panther home range and 1.4 percent of a male panther home range.

In conclusion, the Service's cumulative effect analysis has identified approximately 4,046.3 acres within the action area that could be developed without Federal wetland permit involvement. This level of development is reasonably certain to occur, will not involve a Federal action and, therefore, meets the definition of a cumulative effect. This level of development represents 14.3 percent of a female panther home range, 5.4 percent of a male panther home range, and 0.22 percent of the private non-urban lands at risk in the core area. As previously discussed, these lands are generally on the fringes of occupied panther habitat, vegetated with exotics or in row crops, are in a partially developed area, and represent less than 1 percent of the private lands at risk in the core area. Therefore, we believe the loss of the habitat associated with these lands is not significant.

SUMMARY OF EFFECTS – Florida panther

Panther Usage: The timing of construction of the project is anticipated to occur in phases over several years. The site is predominately cleared lands subject to active agricultural operations and sod farming. There are no known den sites within the project boundaries and the quality and quantity of the foraging prey base is low. Therefore, we believe panther usage of the property is limited and we do not believe project construction will result in direct panther mortality.

Traffic: There will be construction-related traffic increase in the project vicinity and a gradual, long-term increase in general traffic, predominately from the project's intersection with Oil Well Road westward to Immokalee Road and from the project's intersection with Camp Keais Road northward to Immokalee Road and terminating in urban Immokalee. In the traffic analysis, Camp Keais Strand was identified as an important panther/wildlife corridor between CREW conservation lands and Florida Panther NWR. The project related increases in traffic on Oil Well Road were considered by the Service to represent an adverse effect to the Florida panther. However, actions proposed by the applicant in cooperation with Collier County to install a panther/wildlife crossing and associated fencing appreciably reduces the adverse effects that could have occurred from the project as originally proposed. In addition, the applicant's commitment to provide panther crossing warning signage at the Camp Keais Strand/Immokalee Road juncture will further reduce potential panther/vehicle interactions. Given these commitments by the applicant, we believe it is unlikely the traffic generated by this project will result in direct or indirect road mortality or injury of Florida panthers.

Habitat Loss: The Service, based on the habitat evaluations discussed previously, believes the project will result in the loss of 5,027 acres of mostly low quality panther habitat. Habitat types are primarily cropland and sod farm areas with minimal denning or stalking opportunities. Wildlife utilization of the property shows limited foraging values to panther prey species. The loss of these 5,027 acres of poor quality habitat represents 0.26 percent of the 1,881,318 acres of available non-urban private lands in the core area. The Service believes this small loss (0.26 percent) of poor quality habitat, coupled with the proposed compensation of high quality panther lands, will not adversely affect the Service's recovery and land conservation/preservation goals.

Compensation: The project will provide for the preservation of 7,285 acres of Primary Zone habitat within the project action area. The preservation of these lands in the panther target core area represents 1.64 percent of the 443,399 acres of private lands still needed for the population of 80 individuals and 0.67 percent of the 1,086,361 acres of private lands still needed for 100 individuals. Therefore, we believe the preservation of the 7,285 acres of panther habitat in the panther core area will have a beneficial effect on the panther, will offset this low quality habitat lost, and further the Service's goal in panther conservation.

Fragmentation: The project site is comprised primarily of cleared agricultural land subject to intense agricultural activity and is not located within known dispersal or connection corridors to larger publicly owned managed lands. Traffic increases expected from the proposed development will traverse Camp Keais Strand, a designated wildlife corridor. However, the applicant, in cooperation with Collier County, is proposing the installation of a panther/wildlife crossing and associated fencing to minimize fragmentation of panther habitat. Therefore, fragmentation of panther habitat is not expected to result from project implementation.

Intraspecific Aggression: Potential increase in intraspecific aggression and disturbance to the Florida panther was evaluated. However, the Service believes, as previously discussed, the habitat on the property provides low quality foraging for prey species, which directly affects the frequency and duration of use of the property by panthers. Therefore, the Service believes it is unlikely the loss of this limited use of the site by panthers will significantly increase the risk of mortality from intraspecific aggression between panthers and increase disturbance to panthers in the project action area due to human activities.

Cumulative Analysis: In the cumulative analysis, the Service identified the potential loss of approximately 4,046.3 acres within the action area that could be developed without Federal wetland permit involvement. The 4,046.3 acres represent a small percentage (0.22 percent of the 1,881,318 acres) of available non-urban private lands in the core area. In general, these lands are primarily within previously impacted areas or are in the western more urbanized portion of the Florida panther's consultation area. Although this small percentage of lands will be lost from the core area of private lands available for panther conservation, the Service believes sufficient lands are available to meet the needs of the Service's recovery goal and land conservation/preservation goals.

Conservation Land Acquisitions: Conversely, the State and county have acquired, within the last year, 2,351 acres of lands which represent 0.53 percent of the 443,399 acres of private lands still needed for the population of 80 individuals and 0.22 percent of the 1,086,361 acres of private lands still needed for 100 individuals. These lands are generally located within the core area of the Florida panther and are actively managed for the benefit of many wildlife species including the Florida panther. The preservation of these lands in the panther core area will have a beneficial affect on the panther and further the Service's goal in panther conservation.

CONCLUSION – Florida panther

In summary, the Service believes there will be no mortality of the Florida panther resulting from this project. Taking into consideration the status of the species, remaining habitat, the applicant's commitments, and other factors considered by this biological opinion such as the overall recovery objectives and other cumulative effects from actions in the action area, the loss of lower quality habitat from implementing the project will be offset by the conservation of other, higher quality habitat. Therefore, the proposed construction of the AMU, associated town center, and the balance of the DRI is not likely to jeopardize the continued existence of the Florida panther. No critical habitat has been designated for this species; therefore, none will be affected.

CUMULATIVE EFFECTS – Audubon's crested caracara

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

The Collier County RLSA program, as noted in the section on Florida panther, will protect approximately 17,000 acres of environmentally sensitive lands of which 7,285 acres are associated with the proposed project. The program has the added benefit of providing landowner incentives for preserving agricultural land uses, such as cattle ranching that benefits caracara.

Given this project will preserve caracara habitat, and activity within the RLSA has already expanded the known breeding range of the population, the cumulative effects for caracara can reasonably be projected to be positive or at least neutral. In conclusion, the Service has considered cumulative effects within the action area in the above discussion, and does not identify any additional cumulative effects beyond those already discussed.

CONCLUSION – Audubon's crested caracara

After reviewing the status of the crested caracara in Florida, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the construction of AMU, associated town center, the balance of the DRI, the provision of in-kind compensation for direct impacts to improved pasture habitat, and the protection of associated SSA lands, as proposed, is not likely to jeopardize the continued existence of the caracara. No critical habitat has been designated for this species in Florida; therefore, none will be affected.

INCIDENTAL TAKE STATEMENT – Florida panther

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA 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 ESA provided such taking is in compliance with the terms and conditions of this Incidental Take Statement.

AMOUNT OR EXTENT OF TAKE

Although there may be traffic increase from the project, the traffic flow pattern to and from the proposed DRI will be generally to the west, into the coastal urban areas, and north into Immokalee. As previously discussed, traffic flow to the west will cross Camp Keais Strand, a designated panther/wildlife corridor. To minimize this potential adverse affect, the applicant is proposing in coordination with Collier County the installation of a panther/wildlife crossing on Oil Well Road and panther crossing warning signs on the portions of Immokalee Road crossing Camp Keais Strand and near the Collier County Stewardship Water Retention Area. Considering this information, distances from the project site to documented collisions, and low instances of documented panther movement across the affected portions of Oil Well Road, and the projected traffic decreases along the portion of Immokalee Road crossing Camp Keais Strand, the Service believes no direct mortality or injury of Florida panthers is expected from the proposed action. Accordingly, the Service is not anticipating any direct take in the form of mortality or injury to the Florida panther.

However, the Service anticipates incidental take of panthers in the form of harm and harassment associated with the loss of 5,027 acres of panther habitat within the Primary and Secondary Zones. Based on the analysis provided in the previous sections, the Service believes this level of anticipated take is not likely to result in jeopardy to the species.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined this level of anticipated take is not likely to result in jeopardy to the species. The amount of panther habitat affected by the proposed action is approximately 0.2 percent of an estimated 2 million acres (Kautz et al. In Review) of habitat occupied by the panther. It would represent approximately 5 percent of the average home range of a male panther (FWC 2004) and 13 percent of the average home range of a female panther (FWC 2004). Based on a density of 1 panther per 31,923 acres (Kautz et al. In Review), the amount of habitat affected by the proposed action would represent 0.16 panther.

The proposed action will result in the preservation of 7,285 acres of Primary Zone panther habitat within the action area. The proposed action will increase the preservation acreage of panther habitat through permitted Federal actions by about 37 percent, from 18,463 acres to 25,748 acres (see Table 1). The cumulative increase in the preservation of panther habitat to permitted Federal actions will be from 700 acres in 1990 to 25,748 acres following issuance of a permit, if issued, by the Corps.

The proposed action will result in the loss of 5,027 acres of mostly low quality panther habitat. The proposed action will increase the impacts from direct and indirect effects to panther habitat from residential and commercial developments, mining, and agriculture by about 6 percent, from 79,696 acres to 84,724 acres. Of the 84,724 acres of impacts, 39,918 acres are due to agricultural conversion and 44,806 acres to development and mining. The 44,806 acres impacted by development and mining included a mixture of agricultural fields consisting of row crops and citrus groves, and natural lands with varying degrees of exotic vegetation. The non-agricultural impacts are permanent land losses, whereas the agricultural conversions may continue to provide some habitat functional value to panthers although of less value than native habitats.

The lands proposed for compensation/preservation from the proposed take of panther habitat are large land parcels within the Primary Zone and are consistent with the Service's panther conservation goal to locate and preserve sets of lands containing sufficient area and appropriate land cover types to ensure the long-term survival of the Florida panther south of the Caloosahatchee River. Therefore, based on the evaluations provided above for the project's direct, indirect, and cumulative effects, the status of the species, and the compensation proposed by the applicant, the Service believes the proposed construction of the AMU, associated town center, and the balance of the DRI will not jeopardize the survival and recovery of the Florida panther.

REASONABLE AND PRUDENT MEASURES

The Service believes the Corps and the applicant have incorporated all reasonable and prudent measures necessary and appropriate to minimize impacts of incidental take of Florida panthers into the design of the proposed action. In summary, the Corps and the applicant will ensure no more than 5,027 acres of panther habitat will be lost as a result of implementation of the proposed action and 7,285 acres of compensation lands within Primary Zone areas will be preserved to benefit the Florida panther and its prey.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, 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 Barron Collier Investments, Incorporated, 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 Barron Collier Investments, Incorporated to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit(s) 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 Barron Collier Investments, Incorporated 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)].

The Corps will include, as special conditions to the permit instrument, the conservation measures listed below in the description of the proposed action that commits the applicant to preserve and manage high quality panther habitat, which is necessary and appropriate to minimize incidental take of panthers by the proposed action. Specifically, to compensate for impacts to 5,027 acres of Florida panther habitat, the applicant proposes to preserve 7,285 acres of panther habitat as described herein. Habitat to be preserved is within the Primary Zone designation (Kautz et al. In Review).

The Corps will provide a copy of the confirmation of project qualification for utilization of Nationwide 12 permit and DRI-wide final Corps Individual 404 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(s). The Corps will provide documentation to the Service of verification of the execution and terms of the conservation easement.

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

Care should be taken in handling sick or injured specimens to ensure effective treatment and 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 evidence intrinsic to the specimen is not unnecessarily disturbed.

INCIDENTAL TAKE STATEMENT – Audubon's crested caracara

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA 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 ESA provided such taking is in compliance with the terms and conditions of this Incidental Take Statement.

AMOUNT OR EXTENT OF TAKE

The Service anticipates incidental take of caracaras associated with the loss of 601± acres of improved pasture habitat and an active nest site along the project site's northeast boundary. The incidental take is expected to be in the form of harassment. No direct mortality of caracaras is expected from the proposed action. Our effects analysis indicates incidental take due to vehicular trauma is also not anticipated for the proposed action. Based on the analysis provided in the previous sections, the Service believes this level of anticipated take is not likely to result in jeopardy to the species.

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined this level of anticipated take is not likely to result in jeopardy to the species. The proposed action will result in the creation and/or restoration of 601± acres of improved pasture habitat offsite in areas placed under RLSA stewardship easements. The proposed action will maintain the acreage of similar caracara habitat within the RLSA while providing for perpetual management of the 601± acres of caracara habitat similar to habitat lost to the project.

The proposed action will result in the loss of 601± acres of improved pasture habitat for caracara, which include 480± acres of upland bahia grass pasture and 121± acres of knot-grass areas that are transitional between upland and wetland. The direct impacts of development are permanent land losses. The lands proposed for compensation/preservation related to the proposed take of caracara habitat are lands near to, and part of a system of, larger tracts of preserved lands and are consistent with the Service's emphasis on landscape-scale conservation and multi-species recovery. Alternatively, the applicant has offered to provide funding for acquisition of caracara habitat or easement development in areas that may be more critical to caracara conservation, at the joint discretion of Dr. Joan Morrison and the Service.

REASONABLE AND PRUDENT MEASURES

The Service believes the Corps and the applicant have incorporated all reasonable and prudent measures necessary and appropriate to minimize impacts of incidental take of the crested caracara into the design of the proposed action. In summary, the Corps and the applicant will ensure the loss of 601± acres of improved pasture habitat for caracara is offset by the

creation/restoration/preservation of 601± acres of improved pasture, which will be preserved and managed to benefit the caracara. An alternative of funding caracara habitat acquisition has also been proposed. The applicant will also provide for radio-tagging and monitoring of caracara nestlings/fledglings to track the home-range dynamics of the caracaras before, during, and after construction activities, providing detailed data that do not currently exist for the species.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above, and outline reporting/monitoring requirements. These terms and conditions are non-discretionary.

The Corps will include as special conditions to the permit instrument(s), the conservation measures listed below and in the description of the proposed action that commits the applicant to preserve and manage suitable high quality caracara habitat, which is necessary and appropriate to minimize incidental take of caracara by the proposed action.

The applicant is proposing conservation measures to minimize the direct and indirect effects of the project to the caracara. To compensate for impacts to 601± acres of caracara habitat, the applicant will preserve and enhance 601± acres of grassland/pasture and dry prairie within SSA3, SSA4, or SSA6. Such caracara compensation lands may be coincidental with Florida panther compensation lands.

The Corps will provide a copy of the confirmation of project qualification for utilization of Nationwide 12 permit and DRI-wide final Corps Individual 404 permit to the Service upon issuance. The Corps will monitor the permit conditions regarding conservation measures to minimize incidental take of caracara by providing the Service a report on implementation and compliance with the conservation measure within 1 year of the issuance date of the permit(s).

The Corps will provide documentation to the Service for verification of the execution and terms of the conservation easements for the SSA areas.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize then authorities to further the purposes of the ESA 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 additional conservation recommendations at this time.

REINITIATION NOTICE

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

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

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Fort Myers, Florida (Skip Bergman)
District, Fort Myers, Florida
EPA, West Palm Beach, Florida (Richard Harvey)
FWC, Punta Gorda, Florida (Jim Beever)
FWC, Naples, Florida (Darrell Land) – electronic copy only
FWC, Tallahassee, Florida (Bureau of Protected Species)
Service, Atlanta, Georgia (Jeff Weller)
Service, Florida Panther NWR, Naples, Florida (Layne Hamilton)
Service, Vero Beach, Florida (Chris Belden, Tylan Dean) – electronic copy only
Service, Atlanta, Georgia (Joe Johnston) – electronic copy only

LITERATURE CITED

Aebischer, N.J., P.A. Robertson, and R.E. Kenward. 1993. Compositional analysis of habitat use from animal radio-tracking data. Ecology 74:1313-1325.

Akçakaya, H.R. 1998. RAMAS GIS: Linking landscape data with population viability analysis. Version 3.0. Applied Biomathematics, Setauket, New York.

Anderson, A.E. 1983. A critical review of literature on puma (*Felis concolor*). Special report number 54. Colorado Division of Wildlife Research Section.

Audubon, J.J. 1834. Ornithological biography. Volume I. Adam and Charles Black; Edinburgh, Scotland.

Ballou, D., R. Wang, H. Pazer, and G. Tayi. 1998. Modeling information manufacturing systems to determine information product quality. Management Science 44:462-484.

Bangs, O. 1899. The Florida Puma. Proceedings of the Biological Society of Washington. 13:15-17.

Barone, M.A., M.E. Roelke, J. Howard, J.L. Brown, A.E. Anderson, and D.E. Wildt. 1994. Reproductive characteristics of male Florida panthers: Comparative studies from Florida, Texas, Colorado, Latin America, and North American zoos. Journal of Mammalogy 75(1):150-162.

Beier, P. 1995. Dispersal of juvenile cougars in fragmented habitat. Journal of Wildlife Management 59(2):228-237.

Beier, P. 2003. Comments on landscape conservation strategy for the Florida panther in south Florida. Unpublished report to the U.S. Fish and Wildlife Service, Ecological Services Office; Vero Beach, Florida.

Beier, P., M.R. Vaughan, M.J. Conroy, and H. Quigley. 2003. An analysis of scientific literature related to the Florida panther. Final Report. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida. 203 pages.

Beissinger, S.R. and M.I. Westphal. 1998. On the use of demographic models of population viability in endangered species management. Journal Wildlife Management 62:821-841.

Belden, R.C. 1986. "Florida Panther Recovery Plan Implementation – A 1983 Progress Report". Pages 159-172 *in* S.D. Miller and D.D. Everett (eds.), Cats of the world: Biology, Conservation and Management, Proceedings of the Second International Cat Symposium. Caesar Kleberg Wildlife Research Institute. Kingsville, Texas.

Belden, R.C. 1989. The Florida Panther. Pages 515-532 in Audubon wildlife Report 1988-1989. National Audubon Society, New York, New York.

Belden, R.C., W.B. Frankenberger, R.T. McBride, and S.T. Schwikert. 1988. Panther habitat use in southern Florida. Journal Wildlife Management 52(4):660-663.

Bent, A.C. 1938. Life histories of North American birds of prey, part 2. U.S. National Museum Bulletin 170. Government Printing Office; Washington, D.C.

Bent, A.C. 1961. Life histories of North American birds of prey, Volume I. Dover Publishers, Incorporated; New York, New York.

Beyer, D.E., Jr. and J.B. Haufler. 1994. Diurnal versus 24-hour sampling of habitat use. Journal of Wildlife Management 58:178-180.

Brief of Amicus Curiae Association of Community Developers, Incorporated, National Wildlife Federation verses Brownlee, Number 03-1392 (D.D.C. filed June 6, 2003).

Brook, B. 2000. Pessimistic and optimistic bias in population viability analysis. Biology Conservation 14:564-566.

Brook, B.W., L. Lim, R. Harden, and R. Frankham. 1997. Does population viability analysis software predict the behavior of real populations? A retrospective study of the Lord Howe Island Woodhen tricholimnas sylvestris (Sclater). Biology Conservation 82:119-128.

Comiskey, E.J., O.L. Bass, Jr., L.I, Gross, R.T. McBride, and R. Salinas. 2002. Panthers and forests in south Florida: an ecological perspective. Conservation Ecology 6(l):18. [online] URL: http://www.consecol.org/vol16/iss1/art18.

Cory, C.B. 1896. Hunting and fishing in Florida. Estes and Lauriat. Boston, Massachusetts.

Cox, J.R., R. Kautz, M. MacLaughlin, and T. Gilbert. 1994. Closing the gaps in Florida's wildlife habitat conservation system. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Culver, M., W.E. Johnson, J. Pecon-Slattery, and S.J. O'Brien. 2000. Genomic ancestry of the American puma (*Puma concolor*). Journal of Heredity 91(3):186-197.

Dalrymple, G.H. and O.L. Bass, Jr. 1996. The diet of the Florida panther in Everglades National Park. Bulletin of the Florida Museum of Natural History 39(5):173-194.

Dees, C.S., J.D. Clark, and F.T. Van Manen. 1999. Florida panther habitat use in response to prescribed fire at Florida Panther National Wildlife Refuge and Big Cypress National Preserve. Final Report. University of Tennessee, Knoxville, Tennessee.

Dees, C.S., J.D. Clark, and F.T. Van Manen. 2001. Florida panther habitat use in response to prescribed fire. Journal of Wildlife Management 65(1):141-147.

Dove, C.J. and R.C. Banks. 1999. A taxonomic study of crested caracaras (Falconidae). Wilson Bulletin 111(3):330-339.

Dunbar, M.R. 1993. Florida panther biomedical investigation. Annual performance report, July 1, 1992, to June 30, 1993. Study Number 7506, Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Fieberg, J. and S.P. Ellner. 2000. When it is meaningful to estimate and extinction probability? Ecology 81:2040-2047.

Fleming, D.M., J. Schortemeyer, and J Ault. 1993. Distribution, abundance, and demography of white-tailed deer in the Everglades. National Park Service, Everglades National Park; Homestead, Florida.

Florida Fish and Wildlife Conservation Commission (FWC). 1999. Land, E.D., M. Lotz, D. Shindle, and S.K. Taylor. Florida panther genetic restoration and management. Annual report, Study Number 7508; Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission (FWC). 2001. Land, E.D., M. Cunningham, M. Lotz, and D. Shindle. Florida panther genetic restoration and management. Annual report, Study Number 7500; Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission (FWC). 2002. Land, E.D., M. Cunningham, M. Lotz, and D. Shindle. Florida panther genetic restoration and management. Annual report, Florida Panther Research Number 93112503002; Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission (FWC). 2003. Land, E.D., M. Cunningham, M. Lotz, and D. Shindle. Florida panther genetic restoration and management. Annual report, Florida Panther Research Number 93112503002; Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission (FWC). 2004. Land, E.D., M. Cunningham, M. Lotz, and D. Shindle. Florida panther genetic restoration and management. Annual report, Florida Panther Research Number 93112503002; Tallahassee, Florida.

Florida Fish and Wildlife Conservation Commission (FWC). In Review. Use of least cost pathways to identify key highway segments for panther conservation. Tallahassee, Florida.

Hall, E.R. 1981. The mammals of North America Volume II. The Ronald Press Company; New York, New York.

Hall, E.R. and K.R. Kelson. 1959. The mammals of North America. Volume II. The Ronald Press Company; New York, New York.

Halls, L.K., ed. 1984. White-tailed deer, ecology and management. The Wildlife Management Institute, Washington, D.C.

Hamilton, S. and H. Moller. 1995. Can Population Viability Analysis models using computer packages offer useful conservation advice? Sooty shearwaters Puffinus griseus in New Zealand as a case study. Biology Conservation 73:107-117.

Harlow, R.F. 1959. An evaluation of white-tailed deer habitat in Florida. Florida Game and Fresh Water Fish Commission technical bulletin 5:1-64; Tallahassee, Florida.

Harris, L.D. 1985. The fragmented forest. University of Chicago Press; Chicago, Illinois.

Heinzman, G. 1970. The caracara survey: A 4-year report. Florida Naturalist 43(4):149.

Hollister, N. 1911. The Louisiana puma. Proceedings of the Biological Society of Washington 24:175-178.

Howell, A.H. 1932. Florida bird life. Coward-McCann, Incorporated; New York, New York.

Humphrey, S.R. and J.L. Morrison. 1996. Ecology of Audubon's Crested Caracara (*Caracara plancus audubonii*) in south central Florida. Unpublished final report to Florida Game and Fresh Water Fish Commission for Project Number NG91-007. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Humphrey, S.R. and J.L. Morrison. 1997. Habitat associations, reproduction and foraging ecology of the Audubon's crested caracara in south-central Florida. Unpublished Final report to Avon Park Air Force Range, Avon Park, Florida. U.S. Fish and Wildlife Service Coop Unit, University of Florida Research Work Order Number 114.

Janis, M.W. and J.D. Clark. 1999. The effects of public use on the behavior of Florida panthers at Big Cypress National Preserve. University of Tennessee, Knoxville, Tennessee.

Kautz, R.S., and J.A. Cox. 2001. Strategic habitats for biodiversity conservation in Florida. Conservation Biology 15:55-77.

Kautz, R., R. Kawula, T. Hoctor, J. Comiskey, D. Jansen, D. Jennings, J. Kasbohm, F. Mazzotti, R. McBride, L. Richardson, and K. Root. In Review. How Much Is Enough? Landscape-scale Conservation for the Florida Panther. Biological Conservation.

Land, E.D. 1994. Response of the wild Florida panther population to removals for captive breeding. Final Report, Study Number 7571. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Land, E.D. and R.C. Lacy. 2000. Introgression level achieved through Florida panther genetic restoration. Endangered Species UPDATE 17(5):99-103.

Lasley, M.F.W. 1978. Genetics of livestock improvement. Third Edition, Prentice-Hall; Englewood Cliffs, New Jersey.

Layne, J.N. 1978. Threatened, Audubon's crested caracara. Pages 34-36 *in* H.W. Kale II, ed., Rare and endangered biota of Florida. Volume II: Birds. University Press of Florida; Gainesville, Florida.

Layne, J.N. 1995. Audubon's crested caracara in Florida. Pages 82-83 *in* E.T. LaRoe, G.S. Farris, C.E. Puckett, P.D. Doran, and M.J. Mac, eds. Our living resources: A report to the nation on the distribution, abundance and health of U.S. plants, animals, and ecosystems. U.S. Department of the Interior, National Biological Service, Washington D.C.

Layne, J.N. 1996a. Letter to the U.S. Fish and Wildlife Service, South Florida Ecological Services Office, dated February 22, 1996.

Layne, J.N. 1996b. Audubon's crested caracara. Pages 197-210 *in* J.A. Rodgers, H.W. Kale, and H.T. Smith, eds. Rare and endangered biota of Florida. Volume V: Birds. University Press of Florida; Gainesville, Florida.

Layne, J.N., F.E. Lohrer, and C.E. Winegarner. 1977. Bird and mammal predators on the cattle egret in Florida. Florida Field Naturalist (5):1.1-4.

Logan, T.J., A.C. Eller, T.R. Morrell, D. Ruffner, and J. Sewell. 1993. Florida panther habitat preservation plan – south Florida population. Prepared for the Florida Panther Interagency Committee.

Maehr, D.S. 1989. Florida panther road mortality prevention. Final Performance Report, Study Number 7502. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Maehr, D.S. 1990a. Florida panther movements, social organization, and habitat utilization. Final Performance Report, Study Number 7502. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Maehr, D.S. 1990b. The Florida panther and private lands. Conservation Biology 4 (2): 167-170.

Maehr, D.S. 1992a. Florida panther. In Rare and Endangered Biota of Florida. Volume I: Mammals. S.R. Humphrey, ed. University Press of Florida; Gainesville, Florida.

Maehr. D.S. 1992b. Florida panther distribution and conservation strategy, Final Report, Study Number 7572. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Maehr, D.S. 1997. The Florida panther: life and death of a vanishing carnivore. Island Press, Washington D.C. 259 pages.

Maehr, D.S. and G.B. Caddick. 1995. Demographics and Genetic Introgression in the Florida Panther. Conservation Biology 9:1295-1298.

Maehr, D.S. and J.A. Cox. 1995. Landscape features and panthers in Florida. Conservation Biology 9(5):1008-1019.

Maehr, D.S. and R.C. Lacy. 2002. Avoiding the lurking pitfalls in Florida panther recovery. Wildlife Society Bulletin 30:971-978.

Maehr, D.S., E.D. Land, J.C. Root, and J.W. McCown. 1989. Early maternal behavior in the Florida panther (*Felis concolor coryi*). America Midlands Naturalist 122:34-43.

Maehr, D.S., R.C. Belden, E.D. Land, and L. Wilkins. 1990a. Food habits of panthers in southwest Florida. Journal of Wildlife Management 54:420-423.

Maehr, D.S., E.D. Land, J.C. Roof, and J.W. McCown. 1990b. Daybeds, natal dens, and activity of Florida panthers. Proceedings of the Annual Conference of Southeast Fish and Wildlife Agencies 44:310-318.

Maehr, D.S., E.D. Land, and J.C. Roof. 1991a. Social ecology of Florida panthers. National Geographic Research and Exploration 7(4):414-431.

Maehr, D.S., E.D. Land, and M.E. Roelke. 1991b. Mortality patterns of panthers in southwest Florida. Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies 45:201-207.

Maehr, D.S., J.L. Larkin, and J.J. Cox. 2004. Shopping Centers as panther habitat: inferring animal locations from models. Ecology and Society 9(2):9. [online] URL: http:// www.ecology and society.org/vol9/iss2/art9.

Maehr, D.S., R.C. Lacey, E.D. Land, O.L. Bass, and T.S. Hoctor. 1999. A reassessment of Florida panther population viability analysis and recovery efforts from multiple perspectives. Paper presented at Population Viability Analysis: Assessing Models for Recovering Endangered Species. University of California, Berkeley and The Wildlife Society. San Diego, California. March 15-16, 1999.

Maehr, D.S., E.D. Land, D.B. Shindle, O.L. Bass, and T.S. Hoctor. 2002a. Evolution of population viability assessments for the Florida panther: a multi-perspective approach. Pages 284-311 in S.R. Beissenger and D.R. McCullough eds. Population viability analysis. University of Chicago Press, Chicago, Illinois.

Maehr, D.S., E.D. Land, D.B. Shindle, O.L. Bass, and T.S. Hoctor. 2002b. Florida panther dispersal and conservation. Biological Conservation 106:187-197.

McBride, R.T. 2000. Current panther distribution and habitat use. A review of field notes: fall 1999 – winter 2000. Livestock Protection Company; Alpine, Texas.

McBride, R.T. 2001. Current panther distribution, population trends, and habitat use. Report of fieldwork: fall 2000 – winter 2001. Livestock Protection Company; Alpine, Texas.

McBride, R.T. 2002. Current verified population, distribution and highlights of field work. Report of field work: fall 2001 – winter 2002. Livestock Protection Company; Alpine, Texas.

McBride, R.T. 2003. Documented panther population and its current distribution. Appendix IV, Annual Report: Florida Panther Genetic Restoration and Management. Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.

McCown, J.W. 1991. Big Cypress Deer/Panther Relationships: Deer Herd Health and Reproduction. 1991 Final Report. Study number 7508. Bureau of Wildlife Research, Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Morrison, J. 1996a. Verbal comments provided to the U.S. Fish and Wildlife Service, South Florida Ecological Services Office at the multi-species recovery meeting. March 6-8, 1996.

Morrison, J. 1996b. Letter to the U.S. Fish and Wildlife Service, South Florida Ecological Services Office, received November 12, 1996.

Morrison, J. 1996c. Crested caracara (*Caracara plancus*) in A. Poole and F. Gill, eds. The Birds of North America, No. 249. The Academy of Natural Sciences, Philadelphia, Pennsylvania, and The American Onithologists Union, Washington, D.C.

Morrison, J.L. 1997. E-mail message to the U.S. Fish and Wildlife Service, South Florida Ecological Services Office, dated January 7, 1997.

Morrison, J.L. 1998. Effects of double brooding on productivity of Crested Caracaras. Auk 115(4):979-987.

Morrison, J.L. 1999. Breeding biology and productivity of Florida's Crested Caracaras. Condor 101(3):505-517.

Morrison, J.L. 2001. Recommended management practices and survey protocols for Audubon's crested caracara (*Caracara cheriway audubonii*) in Florida. Technical Report Number 18. Bureau of Wildlife Diversity Conservation, Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.

Morrison, J.L. 2003. Age-specific survival of Florida's Crested Caracaras. Journal of Field Ornithology 74(4):321-330.

Morrison, J.L. and M. Maltbie. 1999. Methods for gender determination of Crested Caracaras. Journal of Raptor Research 33(2):128-133.

Morrison, J.L. and S.R. Humphrey. 2001. Conservation value of private lands for crested caracaras in Florida. Conservation Biology 15(3):675-684.

Nelson, E.W. and E.A. Goldman. 1929. List of the pumas with three described as new. Journal of Mammalogy 10:345-350.

Nemeth, N.M. and J.L. Morrison. 2002. Natal dispersal of the Crested Caracara in Florida. Journal of Raptor Research 36(3):203-206.

Nowell, K. and P. Jackson. 1996. Status survey and conservation action plan: Wild cats. International Union for Conservation of Nature and Natural Resources. Burlington Press; Cambridge, United Kingdom.

Oberholser, H.C. 1974. The bird life of Texas (Volume I). University of Texas Press; Austin, Texas.

O'Brien, S.J., M.E. Roelke, L. Marker, A. Newman, C.A. Winkler, D. Meltzer, L. Colly, J.F. Evermann, M. Bush, and D.E. Wildt. 1985. Genetic basis for species vulnerability in the cheetah. Science 227:1428-1434.

Palmer, R.S. 1988. Crested caracara. Pages 235-249 *in* R.S. Palmer, ed. Handbook of North American Birds Volume V. Yale University Press; New Haven, Connecticut.

Passarella and Associates, Incorporated (Passarella). 2004. White-Tail Deer Census Report. Terafina Development. Passarella and Associates, Incorporated; Fort Myers, Florida.

Ralls, K. and J. Ballou. 1982. Effects of inbreeding on infant mortality in captive primates. International Journal of Primatology 3:491-505.

Reed, J.M., D.D. Murphy, and P.F. Brussard. 1998. Efficacy of population viability analysis. Wildlife Social Bulletin 26:244-251.

Rettie, L.W. and P.D. McLoughlin. 1999. Overcoming radio-telemetry bias in habitat-selection studies. Canadian Journal of Zoology 77:1175-1184.

Roelke, M.E. 1990. Florida panther biomedical investigations. Final Performance Report, July 1, 1986 – June 30, 1990. Study Number 7506. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Roelke, M.E. 1991. Florida panther biomedical investigation. Annual performance report, July 1, 1990, to June 30, 1991, Study Number 7506. Florida Game and Fresh Water Fish Commission; Tallahassee, Florida.

Roelke, M.E., J.S. Martenson, and S.J. O'Brien. 1993. The consequences of demographic reduction and genetic depletion in the endangered Florida panther. Current Biology 3:34f-350.

Root, K.V. 2004. Using models to guide recovery efforts for the Florida Panther. In H.R. Akçakaya, M. Burgman, O. Kindvall, C.C. Wood, P. Sjogren-Gulve, J. Hatfield, and M. McCarthy, eds. Species Conservation and Management: Case Studies. Oxford University Press; New York, New York.

Seal, U.S., R.C. Lacy, and Workshop Participants. 1989. Florida panther viability analysis and species survival plan. Report to the U.S. Fish and Wildlife Service, by the Conservation Breeding Specialist Group, Species Survival Commission, IUCN; Apple Valley, Minnesota.

Seal, U.S., R.C. Lacy, and Workshop Participants. 1992. Genetic management strategies and population viability of the Florida panther (*Felis concolor coryi*). Report to the U.S. Fish and Wildlife Service, IUCN SSC Captive Breeding Specialist Group; Apple Valley, Minnesota.

Seal, U.S. and Workshop Participants. 1994. A plan for genetic restoration and management of the Florida panther (*Felis concolor coryi*). Report to the Florida Game and Fresh Water Fish Commission, by the Conservation Breeding Specialist Group, Species Survival Commission, IUCN; Apple Valley, Minnesota.

Shaffer, M.L. 1981. Minimum population sizes for species conservation. BioScience 31:131-134.

Shindle, D., D. Land, M. Cunnignham, and M. Lotz. 2001. Florida panther genetic restoration. Annual Report 2000-01. Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida. 102 pages.

Sprunt, A., Jr. 1954. Florida bird life. Coward-McCann, Incorporated. New York and National Audubon Society; New York, New York.

Steelman, H.G., J.A.Bozzo, and J.L. Schortemeyer. 1999. Big Cypress National Preserve Deer and Hog Annual Report.

Stevenson, H.M. 1976. Vertebrates of Florida. University Presses of Florida; Gainesville, Florida.

Thatcher, C., F.T. van Manen, and J.D. Clark. 2003. Habitat assessment to identify potential sites for Florida panther reintroduction in the southeast. Final Report to U.S. Fish and Wildlife Service. University of Tennessee, Knoxville, Tennessee.

Tinsley, J.B. 1970. The Florida panther. Great Outdoors Publishing Company; St. Petersburg, Florida.

Turrell and Associates, Incorporated (Turrell). 2001. White-Tailed Deer Census Report. Mirasol Development. Turrell and Associated, Incorporated; Naples, Florida.

U.S. Army Corps of Engineers (Corps). 2003. Public Notice – Implementation of a Panther Key and a Proposed Additional Regional Condition to Nationwide Permits 12, 14, 39, and 40. U.S. Army Corps of Engineers, Jacksonville, Florida.

U.S. Fish and Wildlife Service (Service). 1987. Habitat management guidelines for the bald eagle in the southeast region. Fish and Wildlife Service; Atlanta, Georgia.

U.S. Fish and Wildlife Service (Service). 1989. Recovery plan for the Florida population of Audubon's crested caracara. Fish and Wildlife Service; Atlanta, Georgia.

U.S. Fish and Wildlife Service (Service). 1999. South Florida multi-species recovery plan. Fish and Wildlife Service; Atlanta, Georgia.

U.S. Fish and Wildlife Service (Service). 2000. Florida panther final interim standard local operating procedures (SLOPES) for endangered species. Fish and Wildlife Service; Vero Beach, Florida.

U.S. Fish and Wildlife Service (Service). 2002. Draft Habitat management guidelines for Audubon's crested caracara in central and southern Florida. Fish and Wildlife Service, South Florida Ecological Services Office; Vero Beach, Florida.

Wildt, D.E., E.I. Baas, P.K. Chakraborty, T.L. Wolfle, and A.P. Stewart. 1982. Influence of inbreeding on reproductive performance, ejaculate quality and testicular volume in the dog. Theriogenology 17:445-452.

Wildt, D.E. 1994. Endangered species spermatozoa: Diversity, research, and conservation. Pages 1-24 *in* A. Bartke, ed. Function of somatic cells in the testes. Springer-Verlag; New York, New York.

Wilkins, L. 1994. Practical cats: Comparing coryi to other cougars: An analysis of variation in the Florida panther, *Felis concolor coryi*. Pages 14-41 *in* D.B Jordan, ed. Proceedings of the Florida panther conference. U.S. Fish and Wildlife Service; Atlanta, Georgia.

Williams, M. 1990. Americans and their forests, a historical geography. Cambridge University Press; New York, New York.

WilsonMiller. 2005. Email message to the Fish and Wildlife Service, South Florida Ecological Services Office, dated February 11, 2005.

Young, S.P. and F.A. Goldman. 1946. The Puma-Mysterious American Cat. Dover Publications, Incorporated. New York, New York.

Table 1. Biological opinions prepared by the Service for projects affecting Florida panther habitat from March 1984 through June 2005.

Biological Opinion Date	Corps Application No.	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved Onsite (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
03/29/84	83M-1317	Ford Test Track	Collier	530	0	0	0
02/21/85	Unknown	I-75	Collier/ Broward	1,517	0	0	0
10/17/86	Unknown	Exxon Master Plan	Collier	9	0	0	0
1/07/86	861PM-20130	Collier Enterprises (Citrus Grove)	Collier	11,178	0	0	0
01/11/88	Unknown	NERCO - Clements Energy	Collier	3	0	0	0
02/23/88	Unknown	Shell Western E&P	Collier/ Monroe	0	0	0	0
02/10/89	FAP IR-75-4(88)81	SR 29/I-75 Interchange	Collier	350	0	0	0
08/15/90	Unknown	I-75 Recreational Access	Collier	150	0	0	0
09/24/90	89IPD-20207	U.S. Sugar Corporation	Hendry	28,740	700	0	700
03/12/91	90IPD-02507	Lourdes Cereceda	Miami-Dade	97	0	0	0
01/14/92	199191279	Dooner Gulf Citrus	Collier	40	40	0	40
09/25/92	Unknown	BIA, STOF, BCSIR	Hendry	1,995	0	0	0
06/18/93	199300393	Corkscrew Road	Lee	107	0	0	0
02/25/94	199301131	Daniels Road Extension	Lee	65	0	0	0
05/09/94	199202019	Corkscrew Enterprises	Lee	563	437	0	437
10/27/94	199302371 199400807 199400808	Florida Gulf Coast University Treeline Boulevard	Lee	1,088	526	0	526
05/24/95	199302130	Turner River Access	Collier	1,936	0	0	0
08/07/95	199405501	Bonita Bay Properties	Collier	509	491	0	491
08/15/95	199301495	SW Florida Airport Access Road	Lee	14	0	0	0
09/19/96	199302052 199301404	I-75 Access Points	Broward	116	0	0	0
03/10/98	L30(BICY)	Calumet Florida	Collier/ Broward/ Miami-Dade	0	0	0	0
03/27/98	199604158	Willow Run Quarry	Collier	359	190	0	190
09/27/99	199130802	Daniels Parkway	Lee	2,093	0	94	94
06/11/99	199800622	STOF	Hendry	1,091	0	0	0

Table 1. (continued)

Biological Opinion Date	Corps Application No.	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved Onsite (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
12/08/99	199607574	Cypress Creek Farms	Collier	239	0	24	24
04/17/00	199507483	Miromar	Lee	1,323		194	194
06/09/00	199900619	Naples Reserve	Collier	833	0	320	320
02/21/01	199803037	Wortzel and Landl	Lee	106	0	0	0
04/17/01	200001436	WCI	Lee	1,183	0	408	408
07/30/01	199003460	Naples Golf Estates	Collier	439	175	0	175
08/31/01	199900411	Colonial Golf Club	Lee	1,083	0	640	640
12/14/01	199301156	Southwest Florida Airport	Lee	8,058	0	6,986	6,986
01/30/02	199402492	Florida Rock	Lee	5,269	802	0	802
03/07/02	199901251	Southern Marsh Golf	Collier	121	75	80	155
04/24/02	199901378	Hawk's Haven	Lee	1,531	267	0	267
09/24/02	200001574	Verandah	Lee	1,456	0	320	320
10/08/02	199602945	Winding Cypress	Collier	1,088	840	1,030	1,870
01/27/03	200003795	Walnut Lakes	Collier	157	21	145	166
02/21/03 03/10/05R	200001926	Mirasol	Collier	800	914	145	1,059
05/19/03	200200970	Apex Center	Lee	95	10	18	28
06/18/03	199701947	Twin Eagles - Phase II	Collier	593	57	98	155
06/23/03	199905571	Airport Technology	Lee	116	55	175	230
07/02/03	199507483	Miromar	Lee	342	158	340	498
10/06/03	200102043	Bonita Beach Road	Lee	1,117	145	640	785
09/01/03	200206725	SR 80	Lee	33	2	12	14
12/29/03	200202926	The Forum	Lee	650	0	310	310
06/14/04	199603501	Terafina	Collier	436	210	261	471
01/18/05	199702288	Bonita Springs Utilities	Lee	79	0	108	108
02/22/04 03/16/05R 06/29/05R	20030946	Ava Maria DRI	Collier	5,027	0	7,285	7,285
03/31/05	200306759	Gateway Shoppes II	Collier	82	0	122	122
04/6/05	2004-5312	Seminole Mine	Broward	110	0	220	220

Table 1. (continued)

Biological Opinion Date	Corps Application No.	Project Name	County	Habitat Impacts (Acres)	Habitat Preserved Onsite (Acres)	Habitat Preserved Off-site (Acres)	Total Habitat Preserved (Acres)
05/09/05	2003-5331 2003-6965	Arborwood and Treeline Avenue	Lee	2,329	0	1,700	1,700
06/06/05	2003-11156	Collier Regional Medical	Collier	44	0	64	64
			Totals	87,290	6,155	21,739	27,854

Table 2.* Targeted and Acquired Acreage Totals of Conservation Lands in South Florida Directly Affecting the Panther

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

[1] Targeted acres not available for all lands. In Such cases, targeted equals acquired acreage.

[2] Indian lands are included due to their mention in the MSRP. Acreages taken from GIS data.

* Table 2 was excerpted from the Brief of Amicus (2003). However, the lands shown as acquired in this table may include some private in-holdings and may include lands currently under sales negotiations or condemnation actions.

Table 3. Habitat suitability scores from the Florida Panther Subteam (2002) as adjusted by the Service for use in assessing habitat value to the Florida panther.

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

Table 4. Panther-Vehicle Collisions within Ava Maria Panther Consultation Area

Date	Panther Number	Result	Location	Distance from Project
12/23/1979	UCFP04-(G80-4)	Death	SR 29 JUST N SR 84	20.6 miles south
2/7/1980	UCFP05-(G80-15)	Death	SR 29 NEAR SUNNILAND	21.2 miles south
4/19/1981	UCFP06-(G81-19)	Death	SR 29 NEAR COPELAND	29.2 miles south
12/14/1983	FP01	Death	SR 84 18 MM	20.2 miles south
11/12/1984	UCFP12-(G84-26)	Death	SR 84 16 MM	21.4 miles south
1/8/1985	UCFP13-(G85-BNZ)	Death	SR 84 MM16	21.2 miles south
4/18/1985	FP04	Death	SR 84 17 MM	20.6 miles south
5/12/1985	NONE	Injury	CR 951 2 M N US 41	31 miles southwest
10/26/1985	FP07	Death	SR 29 4 MI S SR 84	21.3 miles south
11/15/1986	UCFP15	Death	SR 84 16.5 MM	20.8 miles south
6/17/1987	FP20	Injury	CR 858 .8 M E SR 29	8.8 miles south
12/14/1987	FP13	Death	SR 29 SUNNILAND	9.1 miles south
1/25/1989	UCFP18-(RK-850)	Death	CR 850 1.5 M S SR 80	22.8 miles south
11/26/1990	FP37	Death	SR 29 .5 M N I-75	16.4 miles south
2/4/1991	UCFP20-(FP11'S	Death	SR 29 PISTOL POND BRIDGE	10 miles south
4/7/1992	NONE	Injury	ALICO RD. 1	35 miles northwest
12/6/1993	FP50	Death	CR 846 5 M E OF IMMOKALEE	14 miles northeast
3/3/1994	FP31	Death	SR 29 SUNNILAND	8.4 miles south
1/14/1995	FP52	Death	CR 846 NEAR DUPREE ROAD	15.1 miles northeast
4/24/1996	UCFP29	Death	5.5 M E SR 29 ON CR 832	27.6 miles north
7/13/1997	UCFP31	Death	CR 846 1.5 M W CR 858	15.2 miles northeast
2/14/1998	FP64	Injury	SR 29 AT CLEARCUT, FPNWR	10 miles south
6/13/1998	UCFP25	Death	CR 846 3 M E CR 858	22.9 miles northeast
7/17/1998	FP51	Death	SR 29 @ BEAR ISLAND GRADE	12 miles south
7/8/1999	UCFP27	Death	FARM ROAD E HENDRY PRISON	16.5 miles east
2/10/2000	FP80	Death	200 FT. W SWAMP SAFARI, BCSIR	25.2 miles east
2/28/2000	K76-(FP66	Death	1 MI W SR 29, ON CR 858	4.8 miles east
3/23/2000	UCFP34	Death	CR846 2 MILES E COUNTY LINE	20.8 miles northeast
6/23/2000	UCFP35	Death	CR846 2 MILES E IMMOKALEE	11.2 miles notheast
8/13/2000	UFP36	Death	CR 846 E IMMOK. NEAR POWERLINE	15.2 miles northeast
12/29/2000	UCFP37	Death	4.5 MI E SR29 ON CR846	12.4 miles northeast
5/7/2001	UCFP39	Death	SR 29 1/2 MI N OF JEROME	27.6 miles south
5/7/2001	UCFP40	Death	SR 29 1/2 MI N OF JEROME	30 miles south
6/14/2001	UCFP42	Death	CR846, 1 MILE EAST POWERLINE	22.4 miles northeast
8/17/2001	UCFP43	Injury	CR846 1 MILE EAST OF POWERLINE	22.3 miles northeast
4/10/2002	UCFP46	Death	1/2 MI N OF DEEP LAKE, COLLIER	21.2 miles south
7/1/2002	FP98	Death	1 KM N PISTOL POND, SR 29	10.1 miles south

Table 4. (continued)

Date	Panther Number	Result	Location	Distance from Project
11/10/2002	UCFP48	Death	CR846 5-6 MI E IMMOKALEE	15.4 miles northeast
11/25/2002	UCFP49 (K98)	Death	CR846 3-4 MI E IMMOKALEE	13.6 miles northeast
11/28/2002	FP99	Death	CR846 1/4 MI N COLLIER FAIRGRN	22.4 miles west
1/26/2003	UCFP50 (K33)	Death	CR846 3.4 MI E EVERGLADES BLVD	12.8 miles north
02/20/2003	FP106	Death	SR29ATSUNNILANDMINE ENTRANCE	8.8 miles south
5/25/2003	UCFP53	Death	SR29, 1.4 MI N CR858, COLLIER	7.6 miles east
6/3/2003	UCFP54	Death	SR29, 1.7 MI N CR858, COLLIER	8 miles east
6/30/2003	UCFP58	Death	CR846 3-4 MI E EVERGLADES BLVD	12.6 miles north
11/2/2003	UCFP59	Death	CR858 1.2 MI W SR29	5.2 miles east
12/10/2003	UCFP60	Death	US41 1 MI E CR92, CSSP	36miles southwest
12/25/2003	UCFP61	Death	CR833, 1.7 MI N of CR846	35 miles northeast
02/26/04	UCFP 63	Death	I-75, MM99	31 miles southwest
04/06/04	UCFP65	Death	SR 29, Bear Island Grade	12.2 miles south
06/27/04	UCFP 66	Death	I-75, MM 93	25 miles southwest

Table 5. County and State Acquisitions within the Action Area (Acres)

Year	County	State
1999	207.54	1,669.07
2000	634	1.37
2001	588.32	0.46
2002	109.09	9,651.13
2003	2,040.55	156.19
2004	1.21	**
Totals	3,580.71	11,478.22

**Data unavailable

Table 6. Lands within the Panther Core Area

Lands Within the Core Area (acres)									
	Total			Conserved			At-Risk		
	Total	Urban	Non-urban	Total	Urban	Non-urban	Total	Urban	Non-urban
Primary	2,270,617	20,732	2,249,885	1,688,033	6,697	1,681,336	582,584	14,035	568,549
Dispersal	25,410	675	24,735	3,447	40	3,407	21,963	635	21,328
Secondary	807,428	25,551	781,877	311,208	777	310,431	496,220	24,774	471,446
Other	1,545,655	115,788	1,429,867	613,499	3,627	609,872	932,156	112,161	819,995
Total	4,649,110	162,746	4,486,364	2,616,187	11,141	2,605,046	2,032,923	151,605	1,881,318
Primary Equivalents*			3,272,493			2,094,988			1,177,506

Calculated Conservation Goal for 90 Panthers					
No. of panthers	Density	Total needed	Conserved	Goal	
90	31,923	2,873,070	2,094,988	778,082	acres

*Primary equivalents are calculated as the acres within a category (Primary, Secondary, Other, etc) times the importance of the location of property in the core area for the panther. The Service has assigned the values of 1 for lands in the Primary and Dispersal Zones, "2/3" for lands in the Secondary Zone, and "1/3" for lands in the Other Zone. (The use of 0.67 and 0.33 versus 2/3 and 1/3 provide rounding errors in the math.)

For example, the 471,446 acres of non-urban lands at risk in the Secondary Zone equate to 314,297 acres of Primary Zone equivalent lands (471,446 times "2/3" equals 314,297). The 819,995 acres of at risk lands in the Other Zone equates to 273,332 acres of Primary Zone equivalent lands (819,995 times "1/3" equals 273,332).

The total acres of Primary Zone equivalent lands in the at-risk, non-urban category is 1,177,506 acres (568,549 plus 21,328 plus 314,297 plus 273,332 equals 1,177,506)

Table 7. Landscape Compensation Multipliers

Zone of Impacted Lands	Zone of Compensation Lands	Multiplier
Primary	Secondary	1.5
Secondary	Primary	0.667
Other	Secondary	0.5
Other	Primary	0.33

Table 8a. Florida Panther Habitat Matrix for Development Site.

Land Cover Types	**Habitat Values**	**Project Development-Primary Zone** 2,125 acres				**Project Development-Secondary Zone** 2,902 acres			
		Pre		Post		Pre		Post	
		Acres	FUV	Acres	FUV	Acres	FUV	Acres	FUV
Water/Urban	0	15.2	0	2,125	0	11.2	0	2,870	0
Exotic Plants	3	76.5	230	0	0	93.6	281	0	0
Cropland	4	1,923	7,692	0	0	1,987.8	7,951	0	0
Shrub swamp	5	20.8	104	0	0	0	0	0	0
Shrub and brush	5	0	0	0	0	34.9	175	0	0
Dry prairie	6	0	0			66.8	401		
Grassland/pasture	7	37.5	263	0	0	589	4,123	0	0
Freshwater marsh	9	30.1	271	0	0	69	621	0	0
Hardwood-pine forest	9	3	27	0	0	5.6	50	0	0
Cypress Swamp	9	7.2	65	0	0	6.2	56	0	0
Pine Forest	9	12	108	0	0	38	342	0	0
Totals		2,125	**8,760**	2125		2,902	**14,000**	2,870	

Table 8b. Florida Panther Habitat Matrix for SSA1 and SSA2 Compensation Lands.

Land Cover Types	**Habitat Value**	**Compensation - Primary Zone**			
		Pre		Post	
		Acres	FUV	Acres	FUV
Water/Urban	0	0	0	0	0
Cropland	4	0.28	1.12	0.28	1.12
Shrub swamp	5	0.89	4.45	0.89	4.45
Shrub and brush	5	8.95	44.75	8.95	44.75
Grassland/pasture	7	0.08	0.56	0.08	0.56
Freshwater marsh	9	325.53	2,929.77	325.53	2,929.77
Hardwood swamp	9	47.59	428.31	47.59	428.31
Cypress swamp	9	361.35	3,252.15	361.35	3,252.15
Hardwood-pine forest	9	81.44	732.96	81.44	732.96
Pine forest	9	24.44	219.96	24.44	219.96
Totals		850.55	7,614	850.55	**7,614**

Table 8c. Florida Panther Habitat Matrix for SSA3 and SSA4 Compensation Lands.

Land Cover Types	Habitat Value	Compensation - Primary Zone			
		Pre		Post	
		Acres	FUV	Acres	FUV
Water/Urban	0	0	0	0	0
Cropland	4	1293.5	5174	1293.5	5174
Shrub swamp	5	222	1110	222	1110
Shrub and brush	5	44	220	44	220
Dry Prairie	6	133	798	133	798
Grassland/Pasture	7	195.5	1368	195.5	1368
Freshwater marsh	9	1286	11574	1286	11574
Cypress Swamp	9	256	2304	256	2304
Hardwood-pine forest	9	135	1,215	135	1,215
Pine Forest	9	133	1197	133	1197
Hardwood forest	10	88	880	88	880
Totals		3,786	25,840	3,786	**25,840**

Table 8d. Florida Panther Habitat Matrix for SSA6 Compensation Lands.

Land Cover Types	Habitat Value	Compensation - Primary Zone			
		Pre		Post	
		Acres	FUV	Acres	FUV
Shrub swamp	5	63	315	63	315
Hardwood swamp	9	510	4590	510	4590
Cypress swamp	9	1667	15,003	1667	15,003
Pine forest	9	409	3681	409	3681
Totals		2649	23,589	2649	**23,589**

$\sum$ SSA FUVs = 7,614 + 25,840 + 23,589 = **57,043**

Table 9 AMU DRI Traffic Projections

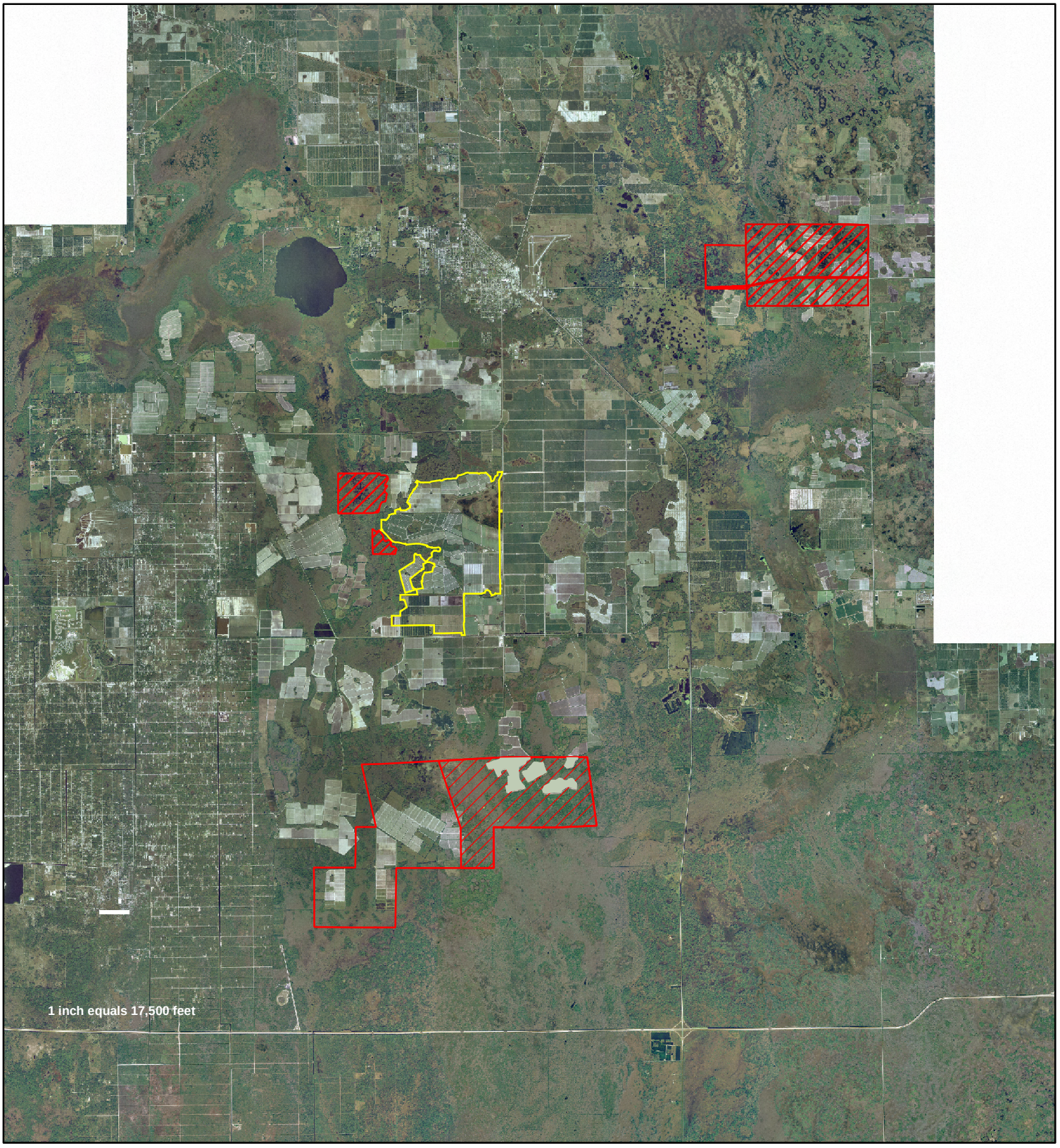
	Road Segment	2004	2011 AADT		2016 AADT			
		Average Annual Daily Traffic (AADT)	Without AMU DRI	With AMU DRI	Traffic Increase	Percent Increase	Without AMU DRI	With AMU DRI
A	Oil Well Rd. - AMU Entrance to Everglades Blvd	9,096	12,700	17,500	4,800	38	17,800	22,700
B	Oil Well Rd. - Everglades Blvd to Immokalee Rd.	9,096	16,300	15,600	(700)	(4)	20,900	18,300
C	Immokalee Rd. - Oil Well Rd. to Wilson Blvd.	25,970	35,600	35,500	(100)	(0)	45,700	43,900
D	Immokalee Rd. - Everglades Blvd to Camp Keais Rd.	5,205	14,800	12,900	(1,900)	(13)	19,700	18,100
E	Camp Keais Rd. - AMU Entrance to immokalee Rd.	3,027	7,600	16,800	9,200	121	7,600	24,700
F	Camp Keais Rd. - AMU Entrance to Oil Well Rd.	3,027	8,900	5,900	(3,000)	(34)	9,300	16,200
G	Immokalee Road - Camp Keais Road to SR 29	8,217	20,000	24,700	4,700	24	23,100	29,500
		63,638	115,900	128,900			144,100	173,400

Table 10. Ave Maria – Florida Panther Consultation Area Project List

Less than 5 percent Wetland Areas	**Permits Issued**								
Project Name	Total Acres	Wetland Acres	% -Wetland Acres	City	Comp Plan	DRI	PUD	Rezoning	District
Schuman Insurance	0.25	0.00	0.00%					2003	
Gunnery Road Commercial	0.26	0.00	0.00%					2003	
HMB Rezoning	0.47	0.00	0.00%					2004	
Sellstate Associate R	0.50	0.00	0.00%					2004	
II Rezoning	0.52	0.00	0.00%					2004	
Sunbelt Realty Sales C	0.56	0.00	0.00%					2003	
Djans Embroidery Design	0.75	0.00	0.00%					2003	
707 Canterbury Circle.	0.81	0.00	0.00%					2004	
Gunnery Rd Residential	1.24	0.00	0.00%					2003	
Wanda Hall Rezone	1.30	0.00	0.00%					2003	
Florida Landmark Community	1.93	0.00	0.00%					2004	
Coffey Discount Furniture	4.88	0.00	0.00%					2004	
Charter School	5.82	0.00	0.00%		2003				
Colonades al Santa Barbara	6.82	0.00	0.00%				0		
Immokalee Senior Housing	7.39	0.00	0.00%				0		
Summer Glen Apartments	7.58	0.00	0.00%				0		
GGFD	9.08	0.00	0.00%				0		
Egret Isles	9.99	0.00	0.00%				0		
Talavera Estates	10.12	0.00	0.00%					2004	
Bonus Density Woodward	16.34	0.00	0.00%					2003	
Bristol Pines	17.67	0.00	0.00%				2003		
Delacruz 19 Acre	18.98	0.00	0.00%					2003	
Dominion Video Satellite	21.81	0.00	0.00%						2004
Veterans Park Rezoning	36.04	0.00	0.00%					2003	
New Hope Ministries	39.99	0.00	0.00%				0		
ASGM Business Center of Naples	40.77	0.00	0.00%				2001		
Santa Barbara Landings	42.61	0.00	0.00%				0		
Collier County Gov't Center	59.78	0.00	0.00%			2004	2004		
.ASGM Business Park	128.12	0.00	0.00%						1004
Glen Eagle Golf & Cntry	300.91	0.00	0.00%			2001			
Parklands West	304.04	0.00	0.00%			2001	2001		
Orange Blossom Ranch	641.84	0.00	0.00%				0		2004
Serengeti Subdivision	29.60	0.02	0.07%						2003
Airside Plaza	121.81	0.15	0.12%			2003	2004		
Village Walk at Bonita Springs	649.40	0.87	0.13%						2004
The Brooks of Bonita Springs	18 .60	0.06	0.32%			2002	1997		
Eastwood Professional Center	158.09	2.81	1.78%						2004
River Pointe	38.75	0.74	1.91%						2004
TOTALS:	**2,627.3**	**4.65**							

Figure 1A

Ave Maria DRI Regional Aerial with DRI and SSAs



Legend

- SSA BOUNDARY
- SSA COMPENSATION LAND
- DRI BOUNDARY

AVE MARIA DRI

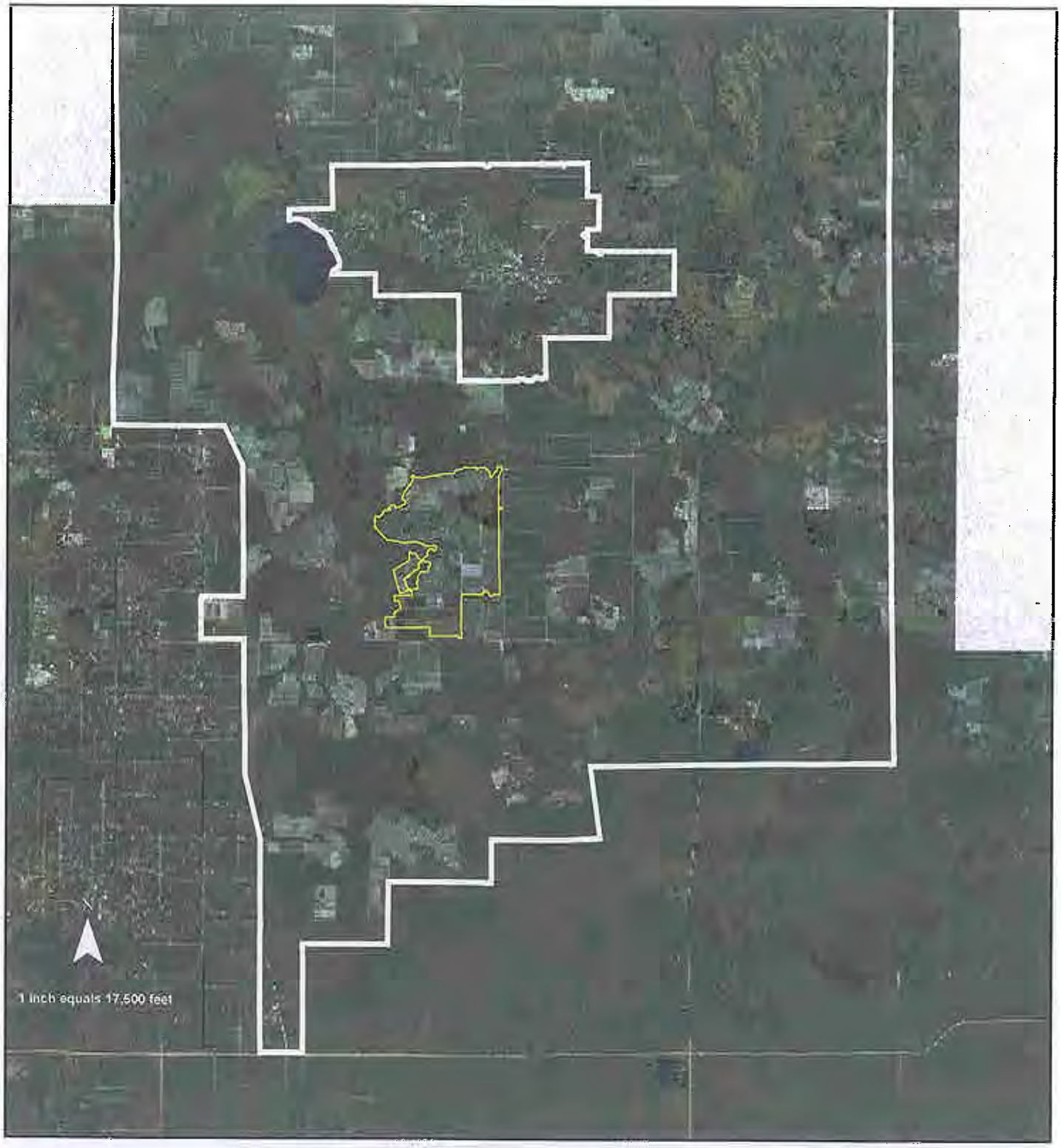
WilsonMiller
New Directions In Planning, Design & Engineering

FIGURE 1A
REGIONAL AERIAL WITH DRI AND SSAs

Prepared by: VPellegrino - 1/22/05
X:\Env\3786\Biological Opinion\Regional Exhibit_v1

Figure 1B

Ave Maria DRI Aerial with RLSA Boundary



Legend
RLSA BOUNDARY
DRI BOUNDARY

AVE MARIA DRI
RLSA MAP

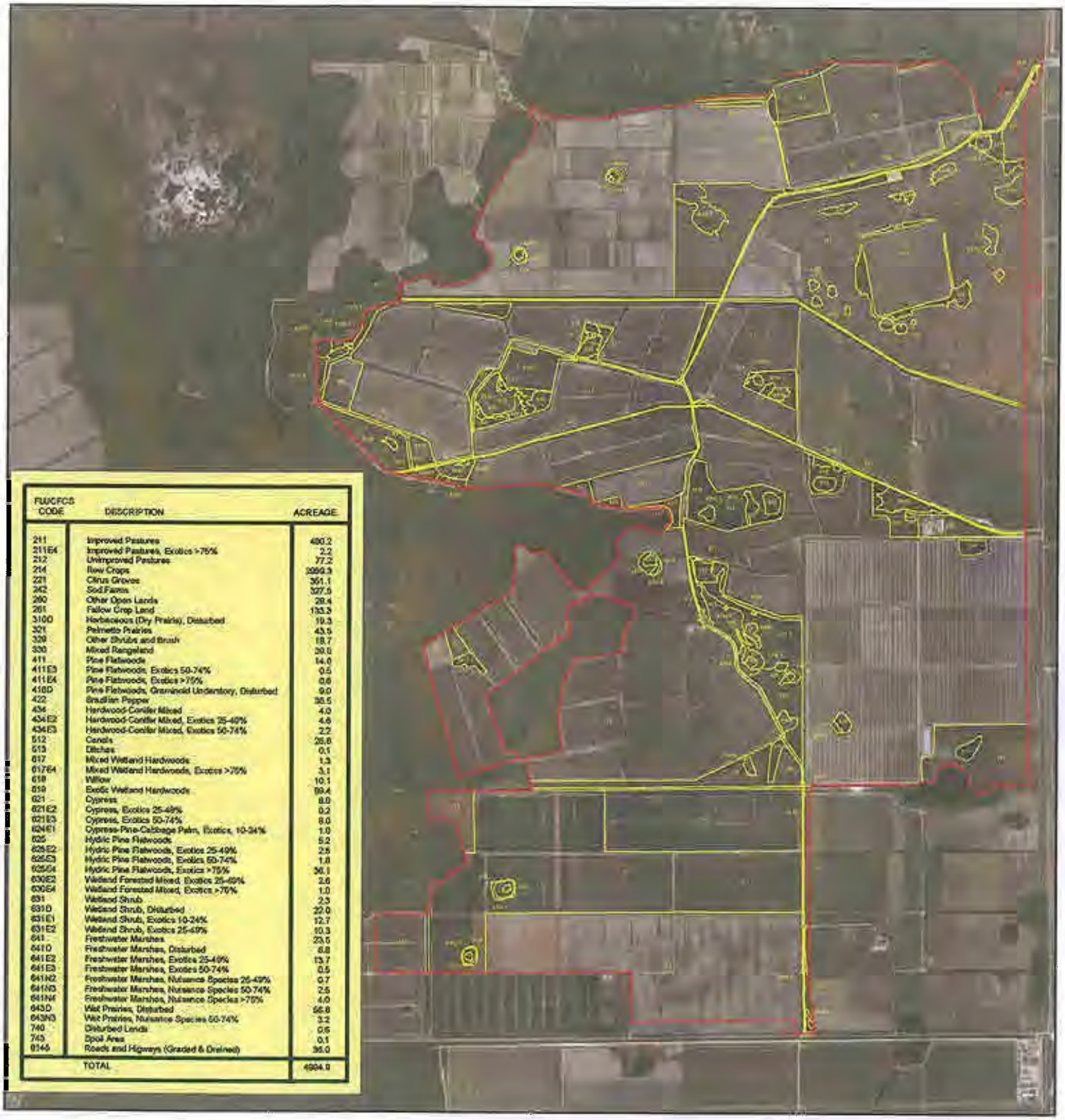
WilsonMiller
New Directions in Planning, Design & Engineering

FIGURE 1B
AERIAL WITH RLSA BOUNDARY

Prepared by: VPellegino - 1/22/05
X:\Env\3798\Biological Opinion\Fluca

Figure 2

Ave Maria DRI Primary and Secondary Zone Map



FLUCFCS CODE	DESCRIPTION	ACREAGE
211	Improved Pastures	480.2
211E4	Improved Pastures, Exotics >75%	2.2
212	Unimproved Pastures	77.2
214	Row Crops	2269.3
221	Citrus Groves	361.1
242	Sod Farms	327.5
260	Other Open Lands	28.4
261	Fallow Crop Land	133.3
3100	Herbaceous (Dry Prairie), Disturbed	19.3
321	Palmetto Prairies	43.5
329	Other Shrubs and Brush	18.7
330	Mixed Rangeland	20.0
411	Pine Flatwoods	14.0
411E3	Pine Flatwoods, Exotics 50-74%	0.5
411E4	Pine Flatwoods, Exotics >75%	0.6
410D	Pine Flatwoods, Graminoid Understory, Disturbed	9.0
422	Brazilian Pepper	35.5
434	Hardwood-Conifer Mixed	4.0
434E2	Hardwood-Conifer Mixed, Exotics 25-49%	4.6
434E3	Hardwood-Conifer Mixed, Exotics 50-74%	2.2
512	Canals	25.6
515	Ditches	0.1
617	Mixed Wetland Hardwoods	1.3
617E4	Mixed Wetland Hardwoods, Exotics >75%	3.1
618	Willow	10.1
619	Exotic Wetland Hardwoods	99.4
621	Cypress	8.0
621E2	Cypress, Exotics 25-49%	0.2
621E3	Cypress, Exotics 50-74%	8.0
624E1	Cypress-Pine-Cabbage Palm, Exotics, 10-24%	1.0
625	Hydric Pine Flatwoods	5.2
625E2	Hydric Pine Flatwoods, Exotics 25-49%	2.5
625E3	Hydric Pine Flatwoods, Exotics 50-74%	1.8
625E4	Hydric Pine Flatwoods, Exotics >75%	30.1
630E2	Wetland Forested Mixed, Exotics 25-49%	2.6
630E4	Wetland Forested Mixed, Exotics >75%	1.0
631	Wetland Shrub	2.3
631D	Wetland Shrub, Disturbed	22.0
631E1	Wetland Shrub, Exotics 10-24%	12.7
631E2	Wetland Shrub, Exotics 25-49%	10.3
641	Freshwater Marshes	23.5
641D	Freshwater Marshes, Disturbed	6.8
641E2	Freshwater Marshes, Exotics 25-49%	13.7
641E3	Freshwater Marshes, Exotics 50-74%	0.5
641N2	Freshwater Marshes, Nuisance Species 25-49%	0.7
641N3	Freshwater Marshes, Nuisance Species 50-74%	2.5
641N4	Freshwater Marshes, Nuisance Species >75%	4.0
643D	Wet Prairies, Disturbed	56.8
643N3	Wet Prairies, Nuisance Species 50-74%	3.2
740	Disturbed Lands	0.6
745	Spoil Area	0.1
8140	Roads and Highways (Graded & Drained)	35.0
	TOTAL	4904.8

Legend

- DRI BOUNDARY
- FLUCCS POLYGON

AVE MARIA DRI
FLUCCS MAP

FIGURE 2

WilsonMiller

New Directions in Planning, Design & Engineering

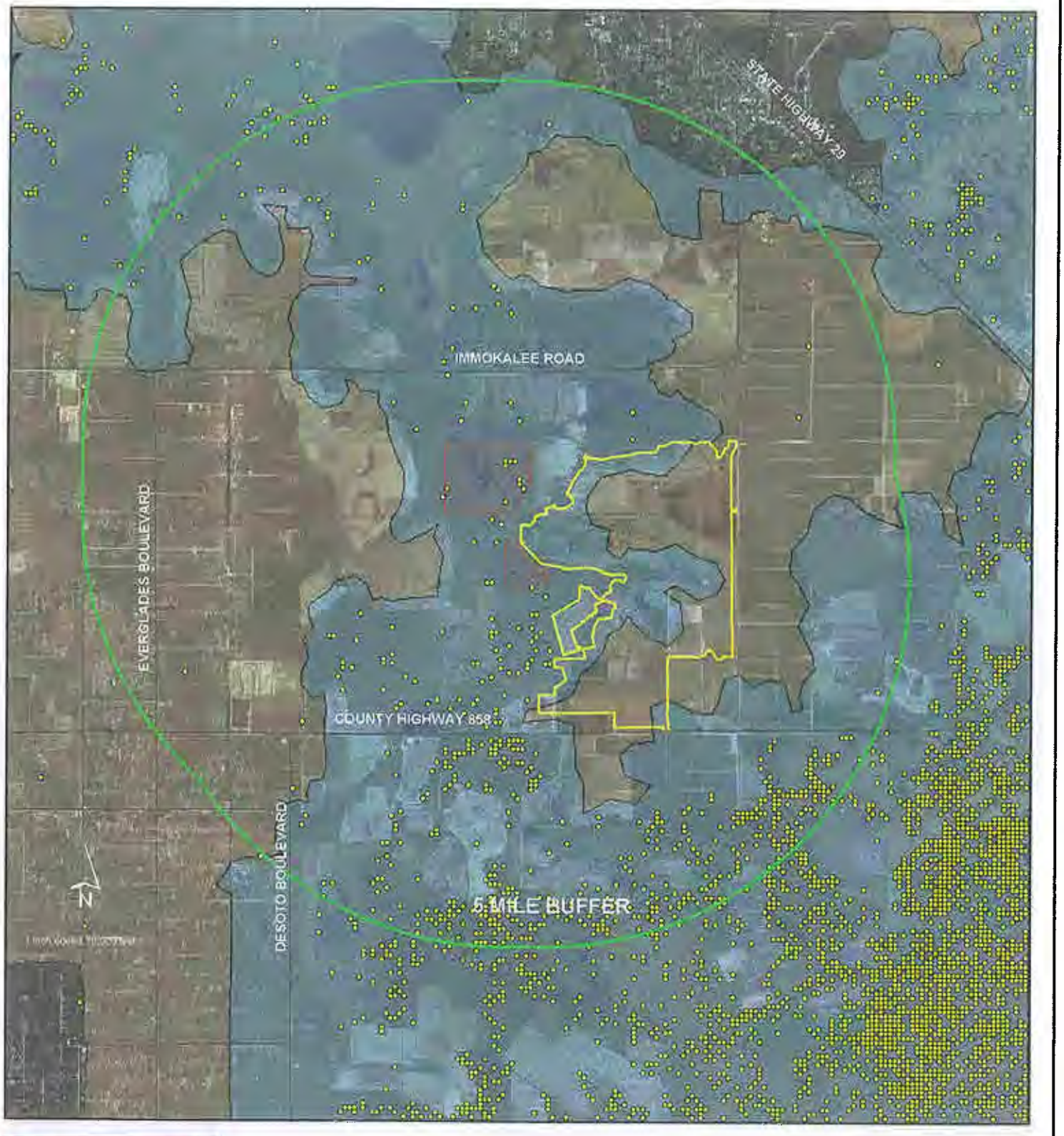
N

1 inch equals 3,000 feet

Prepared by: VPellegrino - 1/22/05
X:\Env\3789\Biological Opinion\Fluccs

Figure 3A

Ave Maria DRI and SSAs 1 & 2 In Relation To Primary and Secondary Zones and Telemetry



AVE MARIA DRI

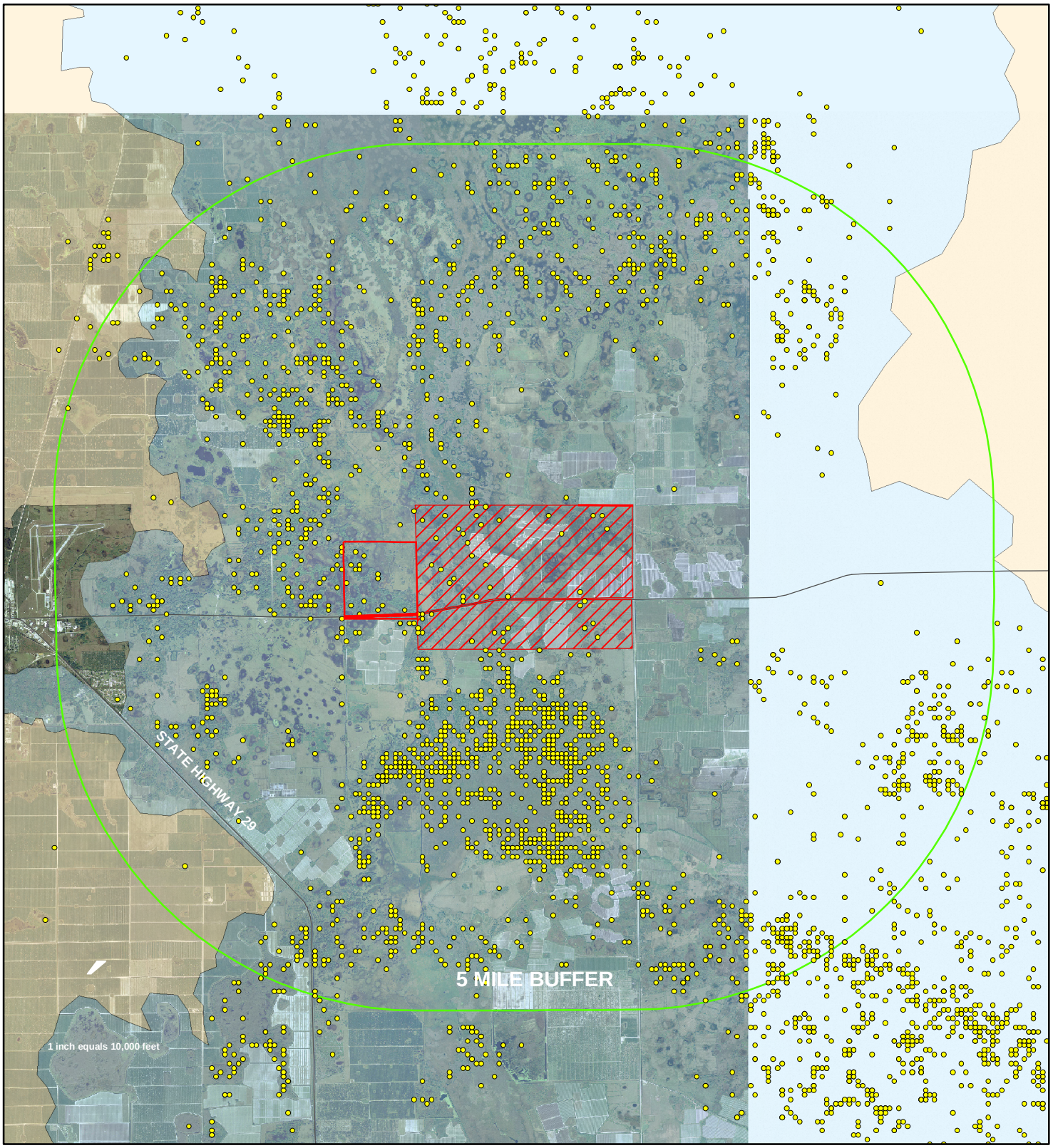
FIGURE 3A
DRI AND SSAs 1 & 2 IN RELATION TO PRIMARY AND SECONDARY ZONES AND TELEMETRY

WilsonMiller
New Directions in Planning, Design & Engineering
3200 Bailey Lane, Suite 200
Naples, Florida 34105
Phone: (239) 649-4040 Fax: (239) 643-5716

Prepared by: V. Pellegrino - 8/25/04
X:\Wilsoc\Env.\03786\TPD's Exhibits\1 & 5_Mile

Figure 3B

Ave Maria DRI SSAs 3 and 4 In Relation To Primary Zone and Telemetry



Legend

- PANTHER POINTS
- DRI PROPERTY BOUNDARY
- SSA BOUNDARY
- 5 MILE BUFFER
- PANTHER HABITAT - PRIMARY ZONE
- PANTHER HABITAT - SECONDARY ZONE

AVE MARIA DRI

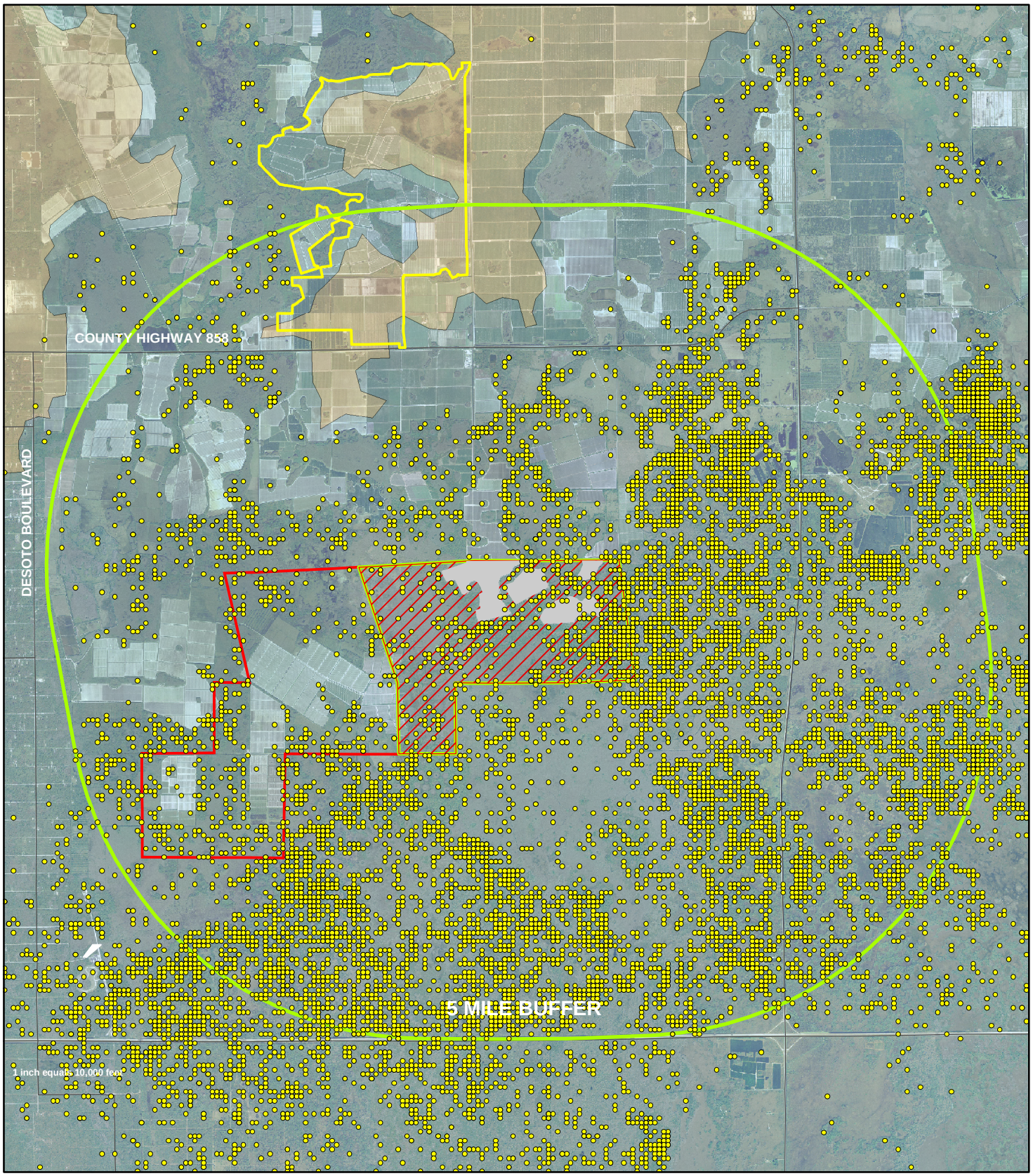
FIGURE 3B
SSA 3 & 4 IN RELATION TO PRIMARY ZONE AND TELEMETRY

Wilson Miller
New Directions In Planning, Design & Engineering
3200 Bailey Lane, Suite 200
Naples, Florida 34105
Phone: (239) 643-4040 Fax: (239) 643-5716
www.wilsonmiller.com

Prepared by: V. Pellegrino - 1/27/05
X:\Wahoo\Env.\03786\TPD's Exhibits\SSA 3 & 4

Figure 3C

Ave Maria DRI SSA6 In Relation To Primary Zone and Telemetry



Legend

- PANTHER POINTS
- DRI PROPERTY BOUNDARY
- SSA BOUNDARY
- SSA COMPENSATION AREA
- 5 MILE BUFFER
- PANTHER HABITAT - PRIMARY ZONE
- PANTHER HABITAT - SECONDARY ZONE

AVE MARIA DRI

FIGURE 3C
SSA6 IN RELATION TO PRIMARY ZONE AND TELEMETRY

WilsonMiller
New Directions In Planning, Design & Engineering
3200 Bailey Lane, Suite 200
Naples, Florida 34105
Phone: (239) 649-4040 Fax: (239) 643-5716
www.wilsonmiller.com

Prepared by: V. Pellegrino - 5/19/05
X:\Wahoo\Env.\03786\Biological Opinion\SSA 6-ver01

Figure 4

Panther Consultation Area

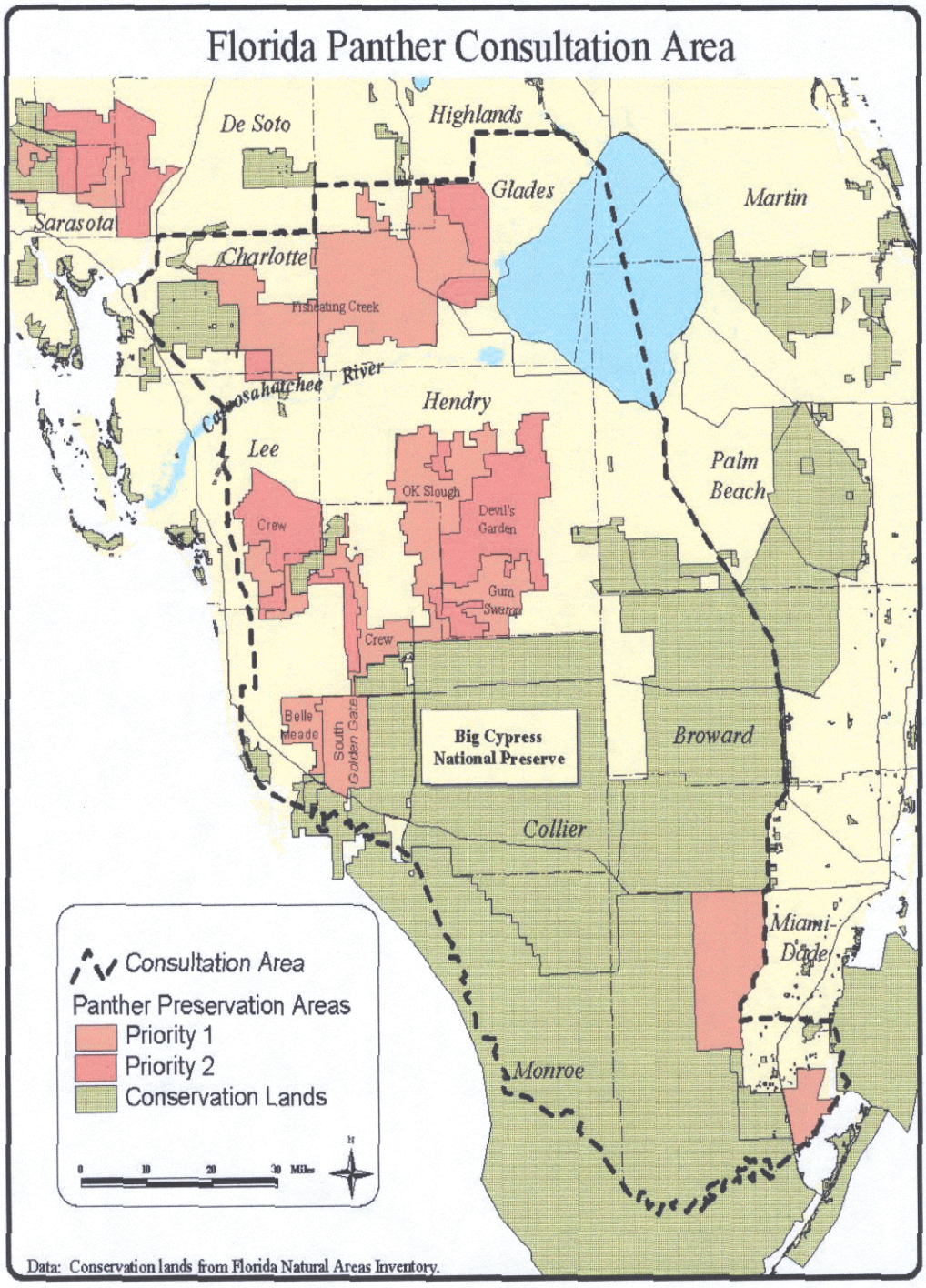

Florida Panther Consultation Area
De Soto
Highlands
Glades
Martin
Sarasota
Charlotte
Fisheating Creek
Caloosahatchee River
Hendry
Lee
Palm Beach
OK Slough
Devil's Garden
Crew
Gum Swamp
Crew
Belle Meade
South Golden Gate
Big Cypress National Preserve
Broward
Collier
Miami-Dade
Monroe
Consultation Area
Panther Preservation Areas
Priority 1
Priority 2
Conservation Lands
0 10 20 30 Miles
N
Data: Conservation lands from Florida Natural Areas Inventory.

Figure 5

Ave Maria DRI Regional Map Showing 25-Mile Action Area

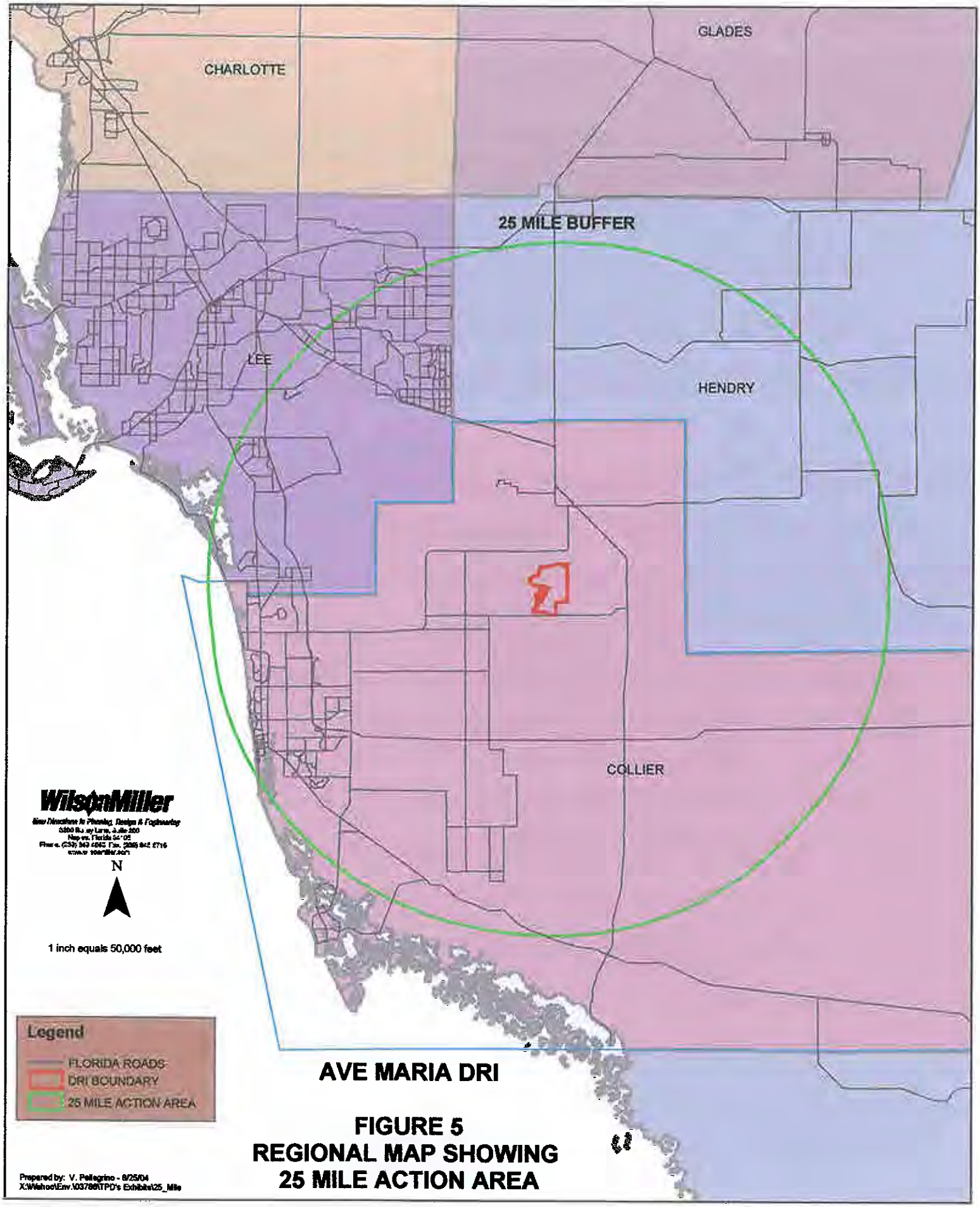


FIGURE 5
REGIONAL MAP SHOWING
25 MILE ACTION AREA

Prepared by: V. Pellegrino - 8/25/04
X:\Wahoo\Env.\03786\TPD's Exhibits\25_Mile

Figure 6

Wildlife Crossings and Panther-Vehicle Collisions Up To June 30, 2004

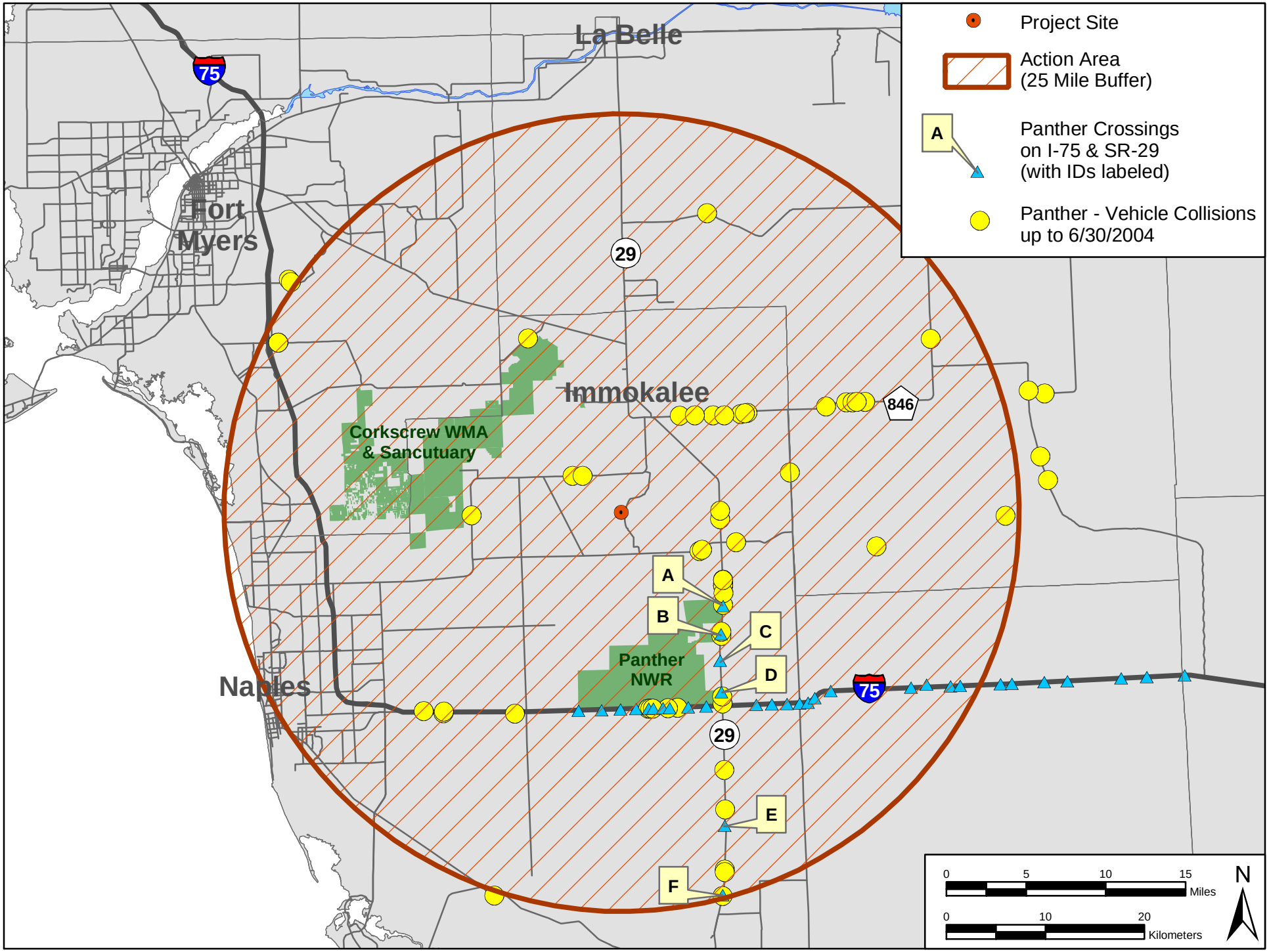
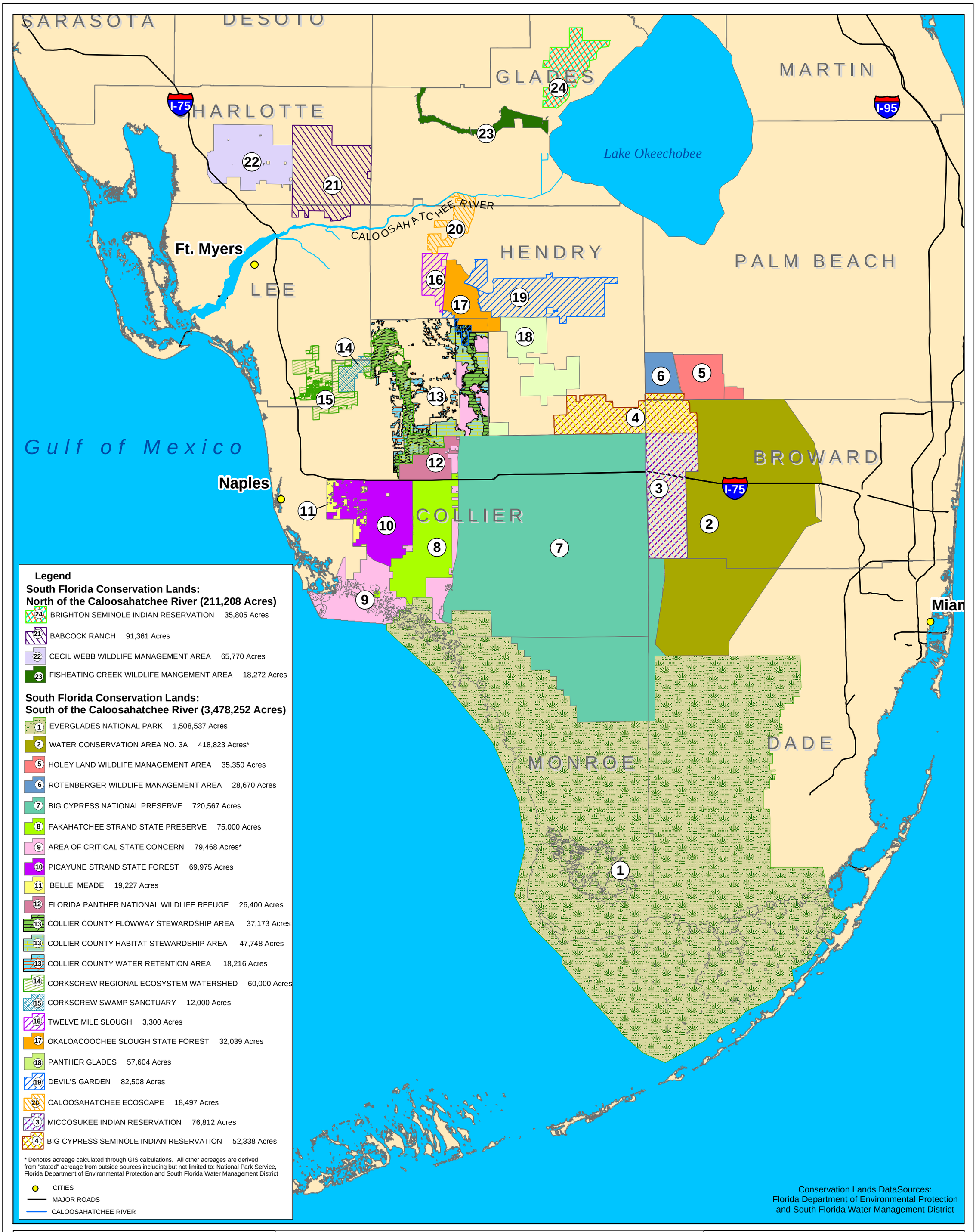

La Belle
Fort Myers
Immokalee
Naples
Corkscrew WMA & Sancutuary
Panther NWR
75
29
846
A
B
C
D
E
F
Project Site
Action Area (25 Mile Buffer)
Panther Crossings on I-75 & SR-29 (with IDs labeled)
Panther - Vehicle Collisions up to 6/30/2004
0 5 10 15 Miles
0 10 20 Kilometers
N

Figure 7

South Florida Conservation Lands

South Florida Conservation Lands



Legend

South Florida Conservation Lands:
North of the Caloosahatchee River (211,208 Acres)

- 24 BRIGHTON SEMINOLE INDIAN RESERVATION 35,805 Acres
- 21 BABCOCK RANCH 91,361 Acres
- 22 CECIL WEBB WILDLIFE MANAGEMENT AREA 65,770 Acres
- 23 FISHEATING CREEK WILDLIFE MANGEMENT AREA 18,272 Acres

South Florida Conservation Lands:
South of the Caloosahatchee River (3,478,252 Acres)

- 1 EVERGLADES NATIONAL PARK 1,508,537 Acres
- 2 WATER CONSERVATION AREA NO. 3A 418,823 Acres*
- 5 HOLEY LAND WILDLIFE MANAGEMENT AREA 35,350 Acres
- 6 ROTENBERGER WILDLIFE MANAGEMENT AREA 28,670 Acres
- 7 BIG CYPRESS NATIONAL PRESERVE 720,567 Acres
- 8 FAKAHATCHEE STRAND STATE PRESERVE 75,000 Acres
- 9 AREA OF CRITICAL STATE CONCERN 79,468 Acres*
- 10 PICAYUNE STRAND STATE FOREST 69,975 Acres
- 11 BELLE MEADE 19,227 Acres
- 12 FLORIDA PANTHER NATIONAL WILDLIFE REFUGE 26,400 Acres
- 13 COLLIER COUNTY FLOWWAY STEWARDSHIP AREA 37,173 Acres
- 13 COLLIER COUNTY HABITAT STEWARDSHIP AREA 47,748 Acres
- 13 COLLIER COUNTY WATER RETENTION AREA 18,216 Acres
- 14 CORKSCREW REGIONAL ECOSYSTEM WATERSHED 60,000 Acres
- 15 CORKSCREW SWAMP SANCTUARY 12,000 Acres
- 16 TWELVE MILE SLOUGH 3,300 Acres
- 17 OKALOACOOCHEE SLOUGH STATE FOREST 32,039 Acres
- 18 PANTHER GLADES 57,604 Acres
- 19 DEVIL'S GARDEN 82,508 Acres
- 20 CALOOSAHATCHEE ECOSCAPE 18,497 Acres
- 3 MICCOSUKEE INDIAN RESERVATION 76,812 Acres
- 4 BIG CYPRESS SEMINOLE INDIAN RESERVATION 52,338 Acres

* Denotes acreage calculated through GIS calculations. All other acreages are derived from "stated" acreage from outside sources including but not limited to: National Park Service, Florida Department of Environmental Protection and South Florida Water Management District

- CITIES
- MAJOR ROADS
- CALOOSAHATCHEE RIVER

N W E S

1 inch equals 10 miles

0 5 10 20 30 40 Miles

This exhibit was prepared using GIS data provided by various sources that may include but are not limited to federal, state, district and local agencies. WilsonMiller, Inc. does not warrant data provided by other sources for accuracy or for any particular use that may require accurate information. This map is for informational purposes only and should not be substituted for a true title search, property appraisal, survey, or for zoning verification.

WilsonMiller
New Directions In Planning, Design & Engineering
3200 Bailey Lane, Suite 200
Naples, Florida 34105
Phone: (239) 649-4040 Fax: (239) 643-5716
www.wilsonmiller.com

Figure 8

Primary, Secondary, and Dispersal Zones

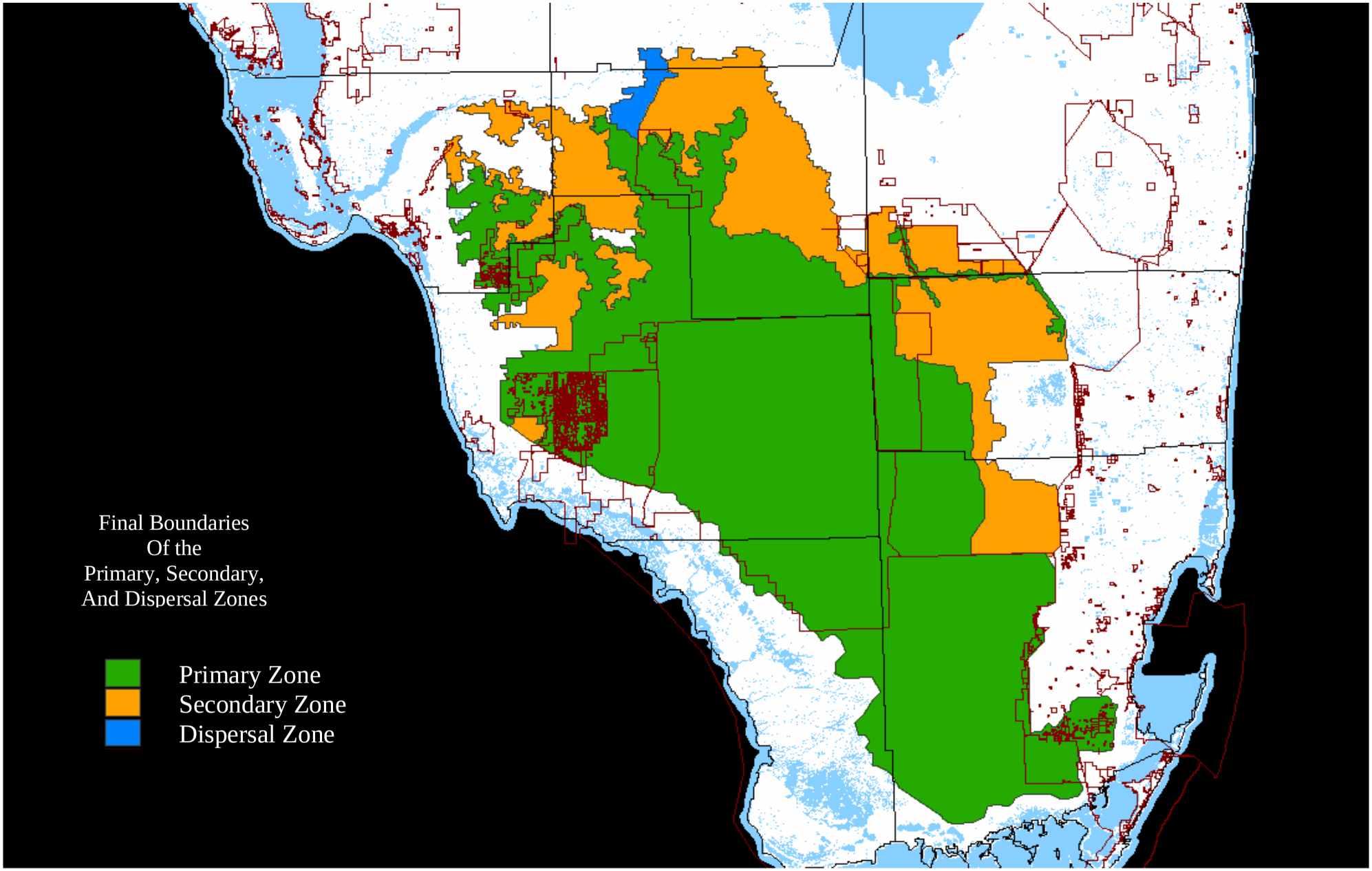
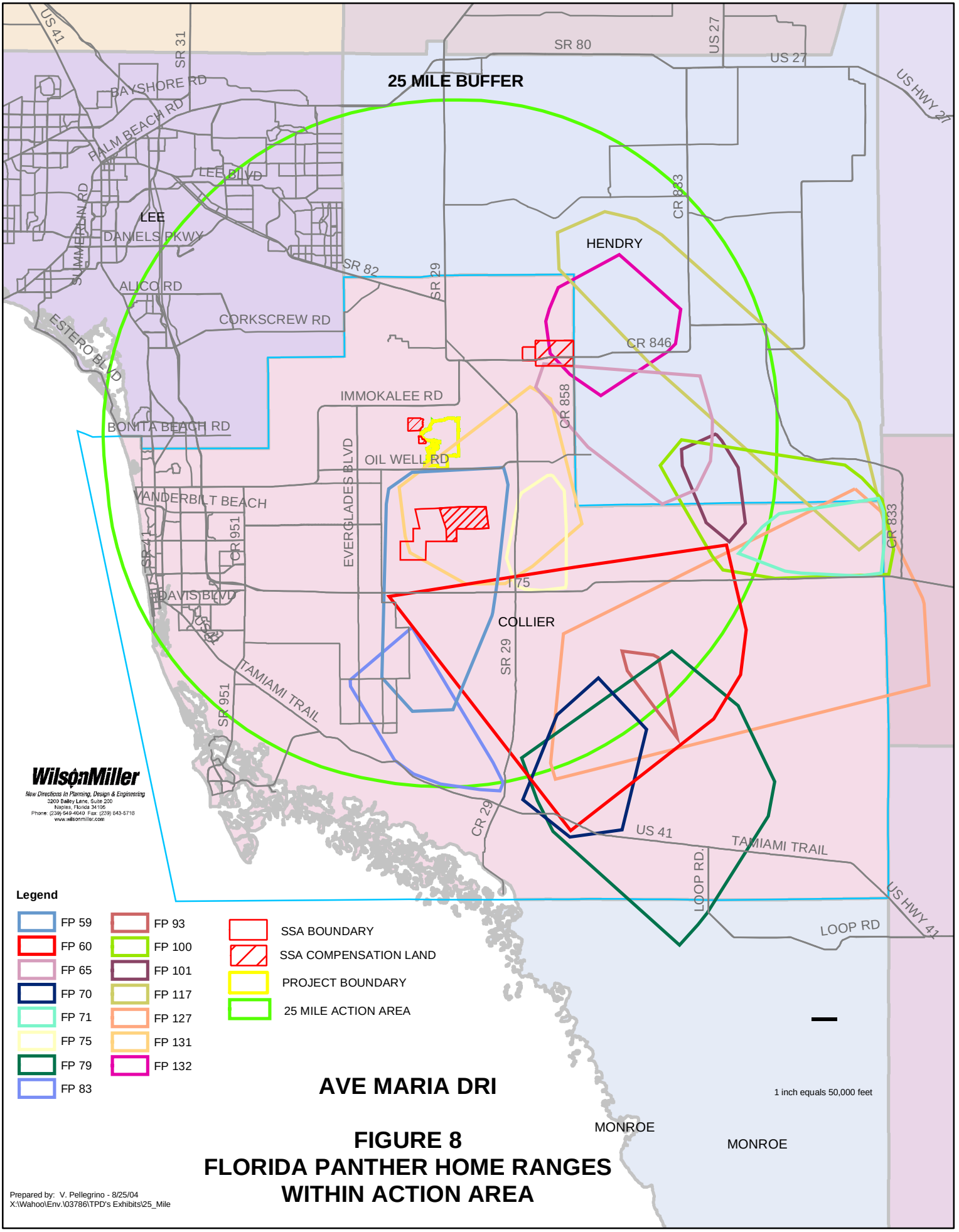

Final Boundaries
Of the
Primary, Secondary,
And Dispersal Zones
Primary Zone
Secondary Zone
Dispersal Zone

Figure 9

Ave Maria DRI Florida Panther Home Ranges Within the Action Area



WilsonMiller
New Directions in Planning, Design & Engineering
3200 Bailey Lane, Suite 200
Naples, Florida 34105
Phone: (239) 649-4040 Fax: (239) 643-5716
www.wilsonmiller.com

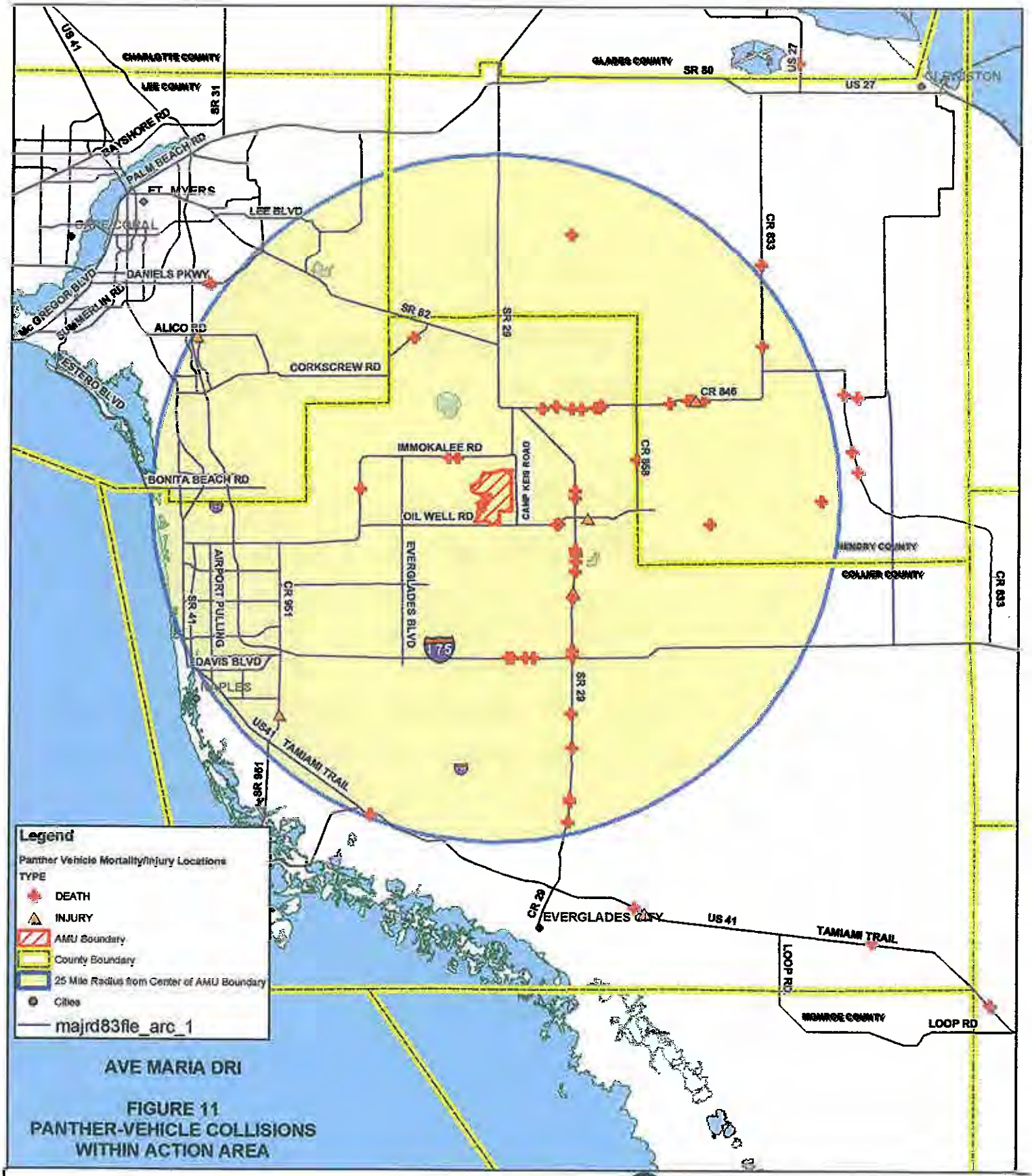
AVE MARIA DRI

FIGURE 8
FLORIDA PANTHER HOME RANGES WITHIN ACTION AREA

Prepared by: V. Pellegrino - 8/25/04
X:\Wahoo\Env.\03786\TPD's Exhibits\25_Mile

Figure 10

Ave Maria DRI Panther-Vehicle Collisions within Action Area



Panther Vehicle Mortality/Injury Location Map

Ave Maria University: 25 Mile Radius

Collier County, Florida

0 1 2 4 6 8 Miles

1 inch equals 9 miles

N

This exhibit was prepared using GIS data provided by various sources that may include but are not limited to federal, state, district and local agencies. WilsonMiller, Inc. does not warrant data provided by other sources for accuracy or for any particular use that may require accurate information. This map is for informational purposes only and should not be substituted for a true title search, property appraisal, survey, or for zoning verification.

Prepared by johnsplubl@wilsonmiller.com

T:\Projects\Projects03785_AMU\MXD\3785-AMU-PantherMortality-11X34.mxd

WilsonMiller
New Directions in Planning, Design & Engineering
3200 Bailey Lane, Suite 209
Naples, Florida 34105
Phone: (239) 643-4040 Fax: (239) 643-5716
www.wilsonmiller.com

Figure 11

Audubon's Crested Caracara Breeding Range

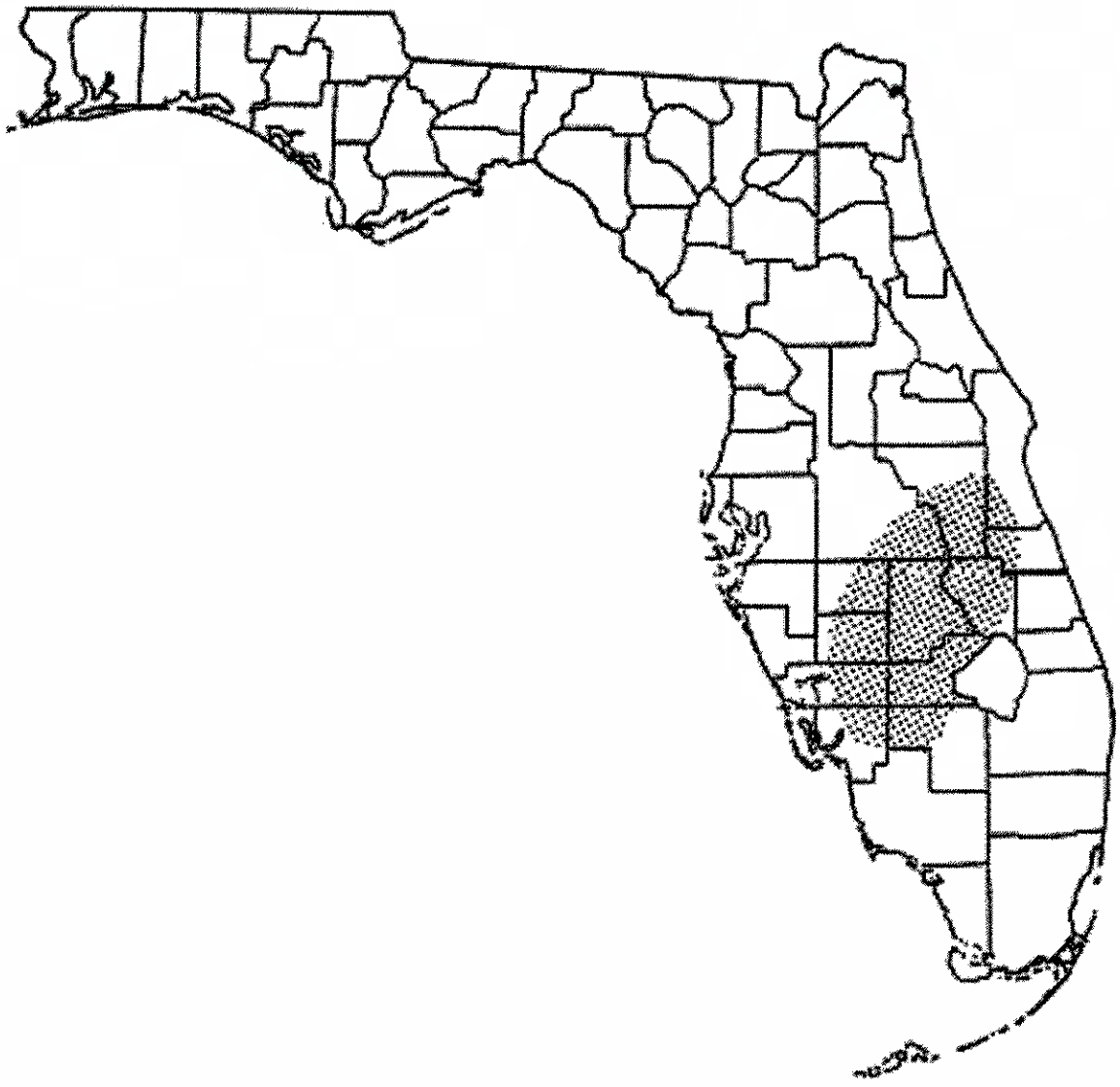


Figure 13: Depiction of the crested caracara's known breeding range in Florida, taken from Morrison (2001). Collier County occurs just south of the shaded area.

Figure 12

Florida Panther Core Area

Core Area and Expansion Area within Consultation Area.

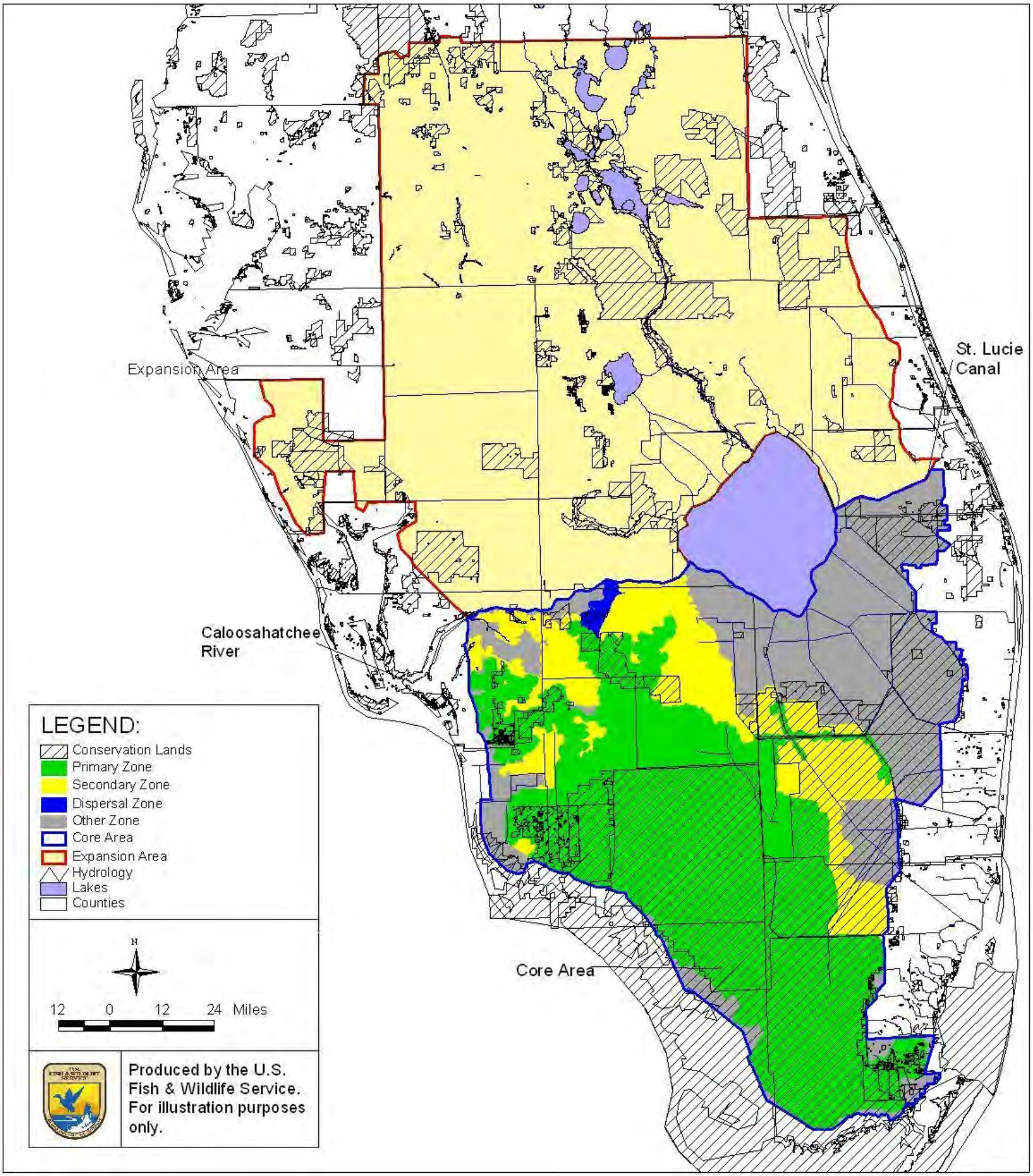
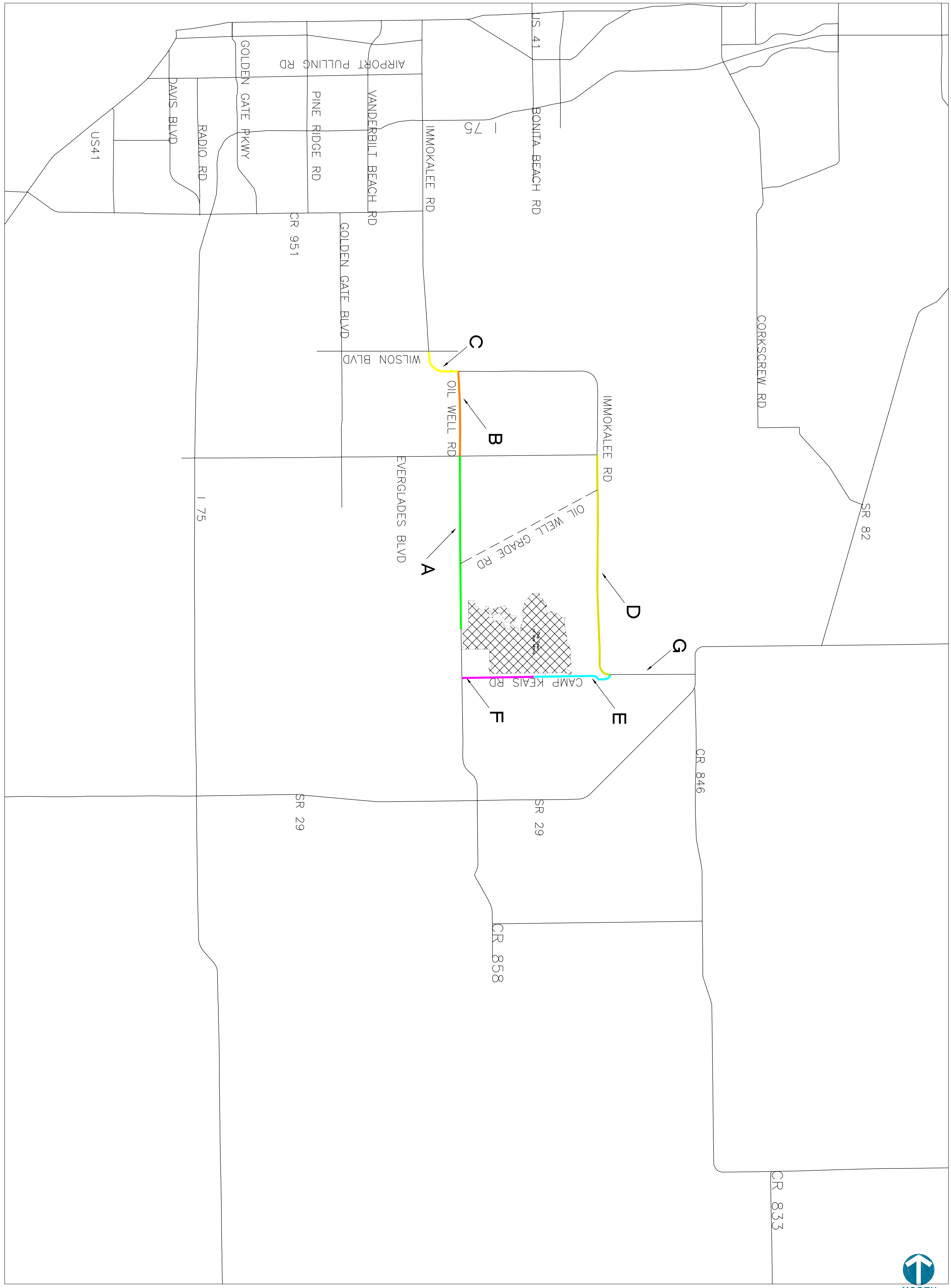


Figure 13

Local Road Network Affected by AMU University DRI



SEC 31-TWP 47, RGE 28, 33, 6-9, 48 S 29 E 17, 18
Designed by:
Drawn by: JP
Checked by: ADR/1158
Approved by:
Date: 07/14/04
Scale: N.T.S.
PIN: 03786-013-000
File #: B-3786-27
Sheet 12 of 12

TRANSPORTATION NETWORK

TOWN OF AVE MARIA

PREPARED FOR: NEW TOWN DEVELOPMENT, LLLP

WilsonMiller
Planners • Engineers • Ecologists • Surveyors
Landscape Architects • Transportation Consultants
WilsonMiller, Inc.
Naples • Fort Myers • Sarasota • Bradenton • Tampa • Tallahassee • Panama City Beach
3200 Bailey Lane, Suite 200 • Naples, Florida 34105-8507
Phone 239-649-4040 • Fax 239-643-5716
E-mail Naples@WilsonMiller.com • Web-Site www.wilsonmiller.com

Figure 14

Golden Gate Estates Vacant Lands

Golden Gate Estates Vacant Lands: Wetland Type (FLUCCS)	
Type	**Acres**
Upland	16946.2
Water	210.0
Wetland	16871.7

Golden Gate Estates
Vacant Lands, Wetlands and Uplands
Collier County, Florida

0 0.5 1 2 3 4 Miles

1 inch equals 6,320 feet

Prepared by jakeopdahl@wilsonmiller.com

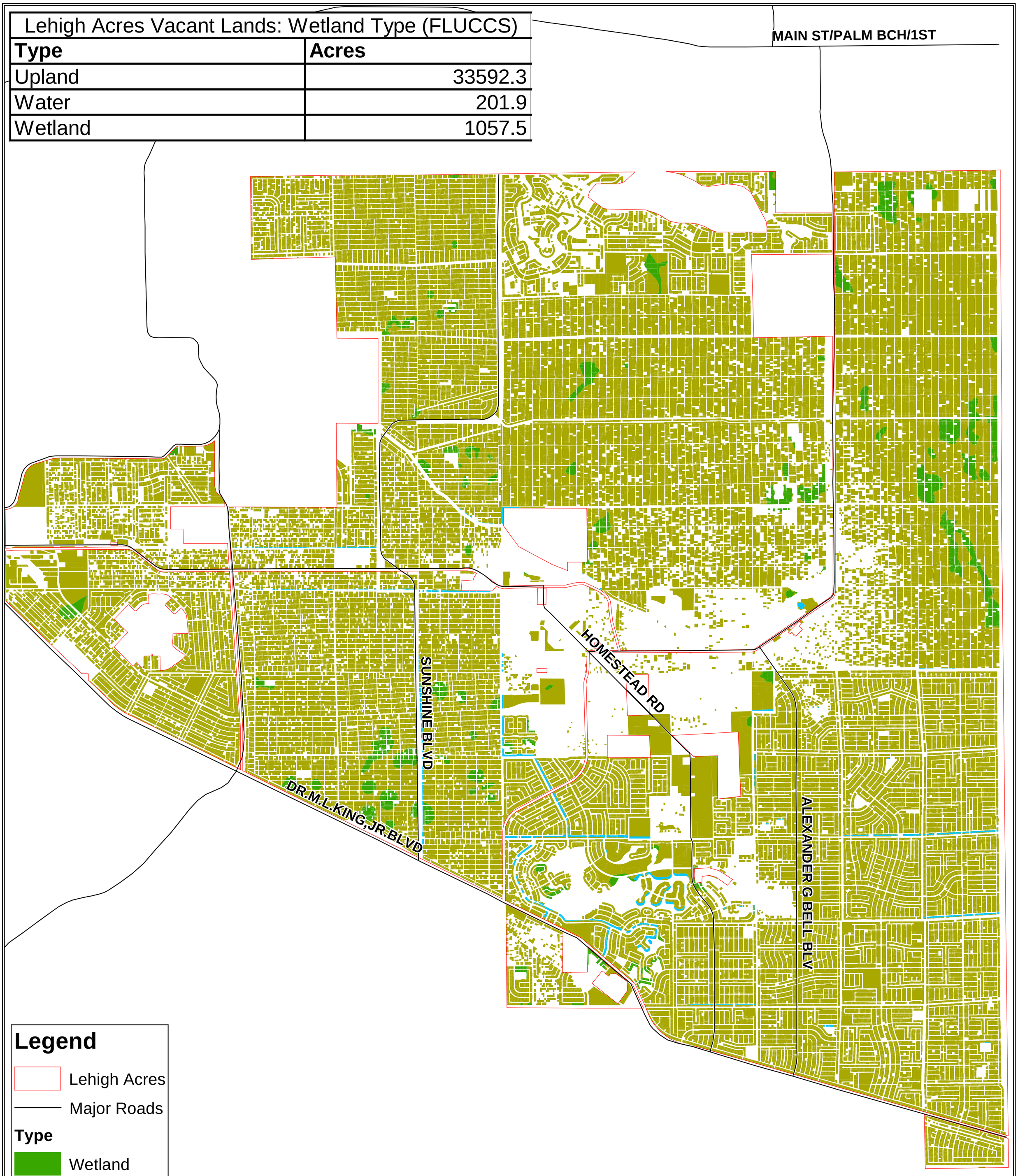
T:\Projects\T:\Projects\03786_AMU\MXD\03786-AMU-GoldenGateEstatesFLUCCS-110104.mxd

WilsonMiller
New Directions In Planning, Design & Engineering
3200 Bailey Lane, Suite 200
Naples, Florida 34105
Phone: (239) 649-4040 Fax: (239) 643-5716
www.wilsonmiller.com

Figure 15

Lehigh Acres Vacant Lands

Lehigh Acres Vacant Lands: Wetland Type (FLUCCS)	
Type	**Acres**
Upland	33592.3
Water	201.9
Wetland	1057.5



Legend

- Lehigh Acres
- Major Roads

Type

- Wetland
- Upland
- Water

Major Roads

Lehigh Acres

Vacant Lands, Wetlands and Uplands

Lee County, Florida

0 0.375 0.75 1.5 2.25 3 Miles

1 inch equals 3,955 feet

Prepared by jakeopdahl@wilsonmiller.com

T:\Projects\T:\Projects\03786_AMU\MXD\03786-AMU-LehighAcresFLUCCS-110104.mxd

WilsonMiller
New Directions In Planning, Design & Engineering
3200 Bailey Lane, Suite 200
Naples, Florida 34105
Phone: (239) 649-4040 Fax: (239) 643-5716
www.wilsonmiller.com