



United States Department of the Interior

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District Commander
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Project: C-23/24 Stormwater Treatment Area

County: St. Lucie

Dear Colonel Grosskruger:

This document transmits the Fish and Wildlife Service's (Service) Biological Opinion to the U.S. Army Corps of Engineers' (Corps) for the construction and operation of the C-23/24 Stormwater Treatment Area (STA) and its effects on the federally threatened eastern indigo snake (*Drymarchon corais couperi*) in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*).

The C-23/24 STA is a component of the Indian River Lagoon – South Project (IRL-S; a component of the Comprehensive Everglades Restoration Plan [CERP]) and is authorized under the Water Resources Development Acts of 1992 and 1996 as part of the authorizations for the Comprehensive Review Study of the entire Central and Southern Florida (C&SF) Project. The purpose of the IRL-S Project is to investigate structural and operational modifications to the features of the C&SF Project in Martin and St. Lucie Counties necessary to improve the quality of the environment, improve protection of the aquifer, and improve the integrity, capability, and conservation of urban and agricultural water supplies and other water-related purposes. The C-23/24 STA will sequester nutrients from C-24 Canal water and then discharge the treated water to the North St. Lucie River Water Control District (NSLRWCD) Canal 71 which, in turn, flows into Ten Mile Creek and then to the St. Lucie Estuary.

This Biological Opinion is based on information provided in the Corps' June 25, 2007, Biological Assessment, the Corps' *Draft Design Document Report for the C-23/24 STA* (April 2007), the *Draft Plans for Construction* and *Draft Technical Information and Specifications* documents (May 2007), maps, meetings, field investigations, telephone conversations, email correspondence, and other sources of information. The Corps' Biological Assessment described the potential effects of the proposed C-23/24 STA Project on federally listed threatened and endangered species. The Corps provided an effect determination of "may affect" for the threatened eastern indigo

snake. The Corps also provided an effect determination of “may affect, but not likely to adversely affect” for the endangered wood stork (*Mycteria americana*), threatened Audubon’s crested caracara (*Polyborus plancus audubonii*), threatened (now downlisted) bald eagle (*Haliaeetus leucocephalus*), endangered Everglade snail kite (*Rostrhamus sociabilis plumbeus*) and endangered West Indian manatee (*Trichechus manatus*). With the exception of the bald eagle, the Service concurs with the Corps’ “may affect” and “may affect, but not likely to adversely affect” determinations. The bald eagle is no longer a federally threatened species under the Act (71 FR 8238). Therefore, there is no requirement under the Act to consult on potential impacts to the bald eagle. A complete administrative record of this consultation is on file in the Service’s South Florida Ecological Services Office, Vero Beach, Florida. Table 1 lists the acronyms and abbreviations used in this Biological Opinion.

The following discussion pertains to the four federally listed threatened or endangered species for which the Corps provided an effect determination of “may affect, but not likely to adversely affect.” For these species, consultation was informal.

Audubon’s crested caracara

Historically, the threatened Audubon’s crested caracara was a common resident in Florida from northern Brevard County, south to Fort Pierce, Lake Okeechobee, and Hendry County. Today, the region of greatest abundance for this large raptor is a five-county area north and west of Lake Okeechobee. It is known to inhabit St. Lucie and Martin Counties, but the exact locations of nests and foraging habitat are only moderately-well documented. The preferred habitat is dry or wet prairies and pastures with scattered cabbage palms (Service 1999).

The closest documented caracara nest to the project site was just south of State Route (SR) 70, about 30 meters west of the C-24 Canal (approximately 1 mile south of the project site). This nest was in a cabbage palm (*Sabal palmetto*) and was active in the spring of 2006, but the tree was subsequently trimmed and was not used during the 2007 breeding season. Beginning in 2006 and continuing today, SR 70 is being widened from two lanes to four lanes near the C-24 Canal Bridge. As a part of that construction, road-killed animals are picked up daily to preclude caracara foraging along SR 70 within the construction zone. Construction workers reported seeing caracaras that foraged along SR 70, but this activity was more prevalent outside the construction zone, likely as a result of roadkill removal. Therefore, it is difficult to determine the future use of this area by caracaras after the widening of SR 70 is completed. It is possible this territory may become re-occupied in the future if a suitable nest tree is present. However, in the event a new caracara nest along SR 70 becomes established, it would still be greater than 1,500 meters (*i.e.*, outside the secondary nest tree zone) from the project site. As such, adverse impacts from the project to that pair of caracaras or their offspring would not be likely.

On March 17, 2006, a caracara was observed flying over the pasture area of STA Cell 1. On April 18, 2006, four caracaras were observed circling the north end of this same pasture. Caracaras were notably absent from the project site during 12 systematic surveys in January and February 2007. Subsequently, caracaras were observed flying over the project site on two occasions. On March 13, 2007, one caracara was observed flying southeasterly over the pasture in Cell 1. It

did not appear to land within the project footprint. On April 11, 2007, three caracaras were observed circling over the C-24 Canal, and then flew to the east over the project footprint. On April 12, 2007, a caracara was observed in a pasture about 3,200 meters northwest of the project site.

The average caracara territory is about 3,000 acres (ranges from approximately 1,200 to 5,400 acres) and is primarily composed of pasture or pasture-like habitat interspersed with wetlands. The amount of pasture habitat in the project footprint is small (approximately 232 acres) and as such would not likely fully support a breeding pair of caracaras. The surrounding area, both inside and outside of the project footprint, is citrus and may be used by foraging caracaras, but is generally considered to be lower quality habitat than pastures, prairies, and small wetlands. It is possible the pasture habitat in the project footprint may be occasionally used by more nomadic juvenile caracaras traveling to and from congregation areas, or adults looking for unoccupied territories.

After construction, the STA levees may provide good caracara foraging habitat especially if prey items become available in the STA cells. The diet of caracaras is approximately 60 percent wetland-associated species.

Recent sampling by the South Florida Water Management District (District) has indicated fish in some of the currently operating STAs south of the Everglades Agricultural Area (EAA) are contaminated with potentially problematic levels of mercury (Rumbold 2005). Sulfate concentrations in the EAA discharges to these STAs facilitate the mercury methylation process and allow methyl mercury to bioaccumulate. Since the source of mercury is atmospheric, it is assumed this could become problematic in the C-23/24 STA if suitable sulfate concentrations exist. However, there is a CERP Guidance Memo (CGM 42) and monitoring plan in place that was designed to detect and remediate any problematic mercury or pesticide contamination that may be found in the biota of the STAs. Therefore, we anticipate there would be no adverse effects on caracaras in the project area from ingesting contaminated prey.

Given the lack of caracara nests close to the project site and the low level of caracara usage observed in the project area, the Corps has determined that the proposed project “may affect, but is not likely to adversely affect” the Audubon’s crested caracara. The Service concurs with the Corps’ effect determination for this species.

West Indian Manatee

The endangered manatee is known to occur in all coastal waters of south Florida including estuaries, bays, rivers, creeks, and canals (Service 2001). Manatees are highly mobile and may be found in all waters accessible to them. They have been documented within major inland freshwater waterways and canals, including Lake Okeechobee, the Kissimmee River (*i.e.*, C-38 Canal), and the C-44 and C-43 Canals. According to the Florida Fish and Wildlife Conservation Commission (FWC) data (going back to 1986), manatees have not been found in the C-23, C-24, or C-25 Canals upstream of their respective water control structures. The height differentials between the water levels upstream and downstream of the S-48, S-49, and S-50 Structures do not allow passage of manatees upstream under normal flow conditions. Therefore, manatees are not expected to be able to access the STA. Based on the above information, the Corps has

determined the proposed C-23/24 STA Project “may affect, but is not likely to adversely affect” the manatee. The Service concurs with the Corps’ effect determination for this species.

Critical habitat was designated for the manatee in the early 1970s, although no specific primary or secondary constituent elements were included in the designation (50 CFR 17.95). Critical habitat for the manatee identifies specific areas occupied by the manatee, which have those physical or biological features essential to the conservation of the manatee and/or may require special management consideration (Service 1999). In Florida, manatee critical habitat is all waters accessible to manatees. No designated manatee critical habitat occurs within the proposed project area. However, the C-23/24 STA may benefit designated critical habitat downstream (*i.e.*, the St Lucie Estuary) by improving water quality conditions. Therefore, we do not anticipate designated West Indian manatee critical habitat will be adversely affected by the proposed project.

Everglade Snail Kite

The endangered Everglade snail kite forages almost exclusively on apple snails (*Pomacea paludosa*). Suitable habitat for Everglade snail kites consist of freshwater marshes, wet prairies, and the shallow vegetated edges of man-made or natural lakes where apple snails can be found. The closest known nesting occurrence of snail kites occurred in 2005 approximately 1,700 meters west of the project site on a 2-acre pond surrounded by citrus (Dynamac Corporation 2006). Subsequent surveys in 2006 and 2007 have found foraging kites at this pond but no nesting. The January and February 2007 surveys indicated at least four, and possibly six, individual snail kites foraged in the pond west of the STA footprint and the ditches in the open weedy areas along old groves that were recently bulldozed (Dynamac Corporation 2007). The only occurrence of snail kites within the STA footprint occurred in the mid afternoon of January 31, 2007. On two separate occasions a snail kite was observed flying over the eastern end of the project site. Observing kite behavior can be difficult in and around the project area due to the limited access to nearby private lands to and from which kites may travel and the obscured line of sight for observers in the grove (Dynamac Corporation 2007).

It is possible apple snails will inhabit the freshwater wetlands created by the construction of the STA. This may provide additional foraging habitat for the Everglade snail kite. Water depths within the STA are anticipated to be held between 6 and 24 inches, although some dry out of the cells is possible during drought conditions. As part of normal maintenance, the District may remove any small woody vegetation (*e.g.*, willows) that grows in the STA. Similarly, the extent of cattails (*Typha domingensis*) may also be controlled because they form unwanted floating clumps that stir up sediments thereby reducing the STA treatment efficiency. Woody shrubs and cattails are suitable substrates for snail kite nesting; however, because we expect the spatial extent of these types of vegetation will be controlled, we believe it is unlikely the proposed STA will be utilized by Everglade snail kites for nesting purposes. However, if snail kites do nest in the STA in the future, this would probably be considered a benefit to the species.

Citrus operations in the project area and elsewhere have routinely applied copper (Cu) treatments as a fungicide for many years, resulting in Cu contamination in the soil. Potential Cu risk to

Everglade snail kites may occur due to Cu bioaccumulation in the kite's primary food item, the apple snail (Bargar et al. 2005). Apple snails (including the exotic apple snail [*Pomacea insularum*, formerly considered *P. canaliculata*]) have been found in the larger agricultural canals around the project area. Preliminary results of Bargar et al. (2005) indicate a positive relationship between Cu concentrations in soil sediments and Cu concentrations in apple snails. An interim effects level (and clean-up guideline) of 85 milligrams per kilogram of Cu in sediment was recommended by the Service for the protection of snail kites. Thus, wetlands created as a result of the project may be colonized by apple snails and put foraging snail kites at risk if the Cu is not remediated to a level less than the clean-up guideline. As a result, the District and Corps have agreed to remediate all known Cu contamination in the project footprint (Kacvinsky 2007). Due to the low usage presently of snail kites on the site, and the planned remediation of on-site Cu-contaminated soils, the Corps has determined the proposed project "may affect, but is not likely to adversely affect" the Everglade snail kite. The Service concurs with the Corps' effect determination for this species.

Critical habitat for the Everglade snail kite was designated in 1977 (Service 1977). The designation identified nine units of critical habitat that included two small reservoirs, the littoral zone of Lake Okeechobee, and areas of Everglades' marshes within the Water Conservation Areas and Everglades National Park (ENP). This project is not within nor is it hydraulically connected to the snail kite's critical habitat; therefore, none will be affected.

Wood Stork

The endangered wood stork utilizes wetlands for foraging throughout the year. Typical foraging sites for the wood stork include freshwater marshes, stock ponds, shallow and seasonally flooded roadside or agricultural ditches, narrow tidal creeks, shallow tidal pools, managed impoundments, and depressions in cypress heads, swamps, and sloughs. Because of their specialized feeding behavior, wood storks forage most effectively in shallow water (*i.e.*, 2 to 16 inches deep) with highly concentrated prey. Almost any shallow wetland depression where fish become concentrated, either through local reproduction or receding water levels, may be used as foraging habitat during some portion of the year.

Regional declines in wood stork populations have been attributed to the loss and degradation of foraging habitat. Depending on local rainfall and habitat conditions, wood storks may forage in 50 to 200 wetlands within 5 to 40 miles of a rookery site. The Service has identified a Core Foraging Area of 18.6 miles (29,934 meters) around known wood stork rookeries to help minimize potential adverse effects to their foraging habitat. Although no wood storks are known to have nested within the project footprint, there are at least two wood stork rookeries within 18.6 miles of the project site. One rookery was active in 2004 (100 birds), 2005 (32 birds), and 2006 (100 birds estimated) at Cypress Creek approximately 8.0 miles southwest of the project site. Another rookery, active in 2004 (70 birds) and 2006 (142 birds) but not active in 2005, was located along the North Fork of the St. Lucie River, approximately 14.2 miles to the southeast of the project site. We do not yet have wood stork rookery data for 2007. Wood storks were observed on several occasions flying over the project area in 2006 (Dynamac Corporation 2006), and were also observed in relatively small numbers (5 to 17 storks) foraging in the canals to the west of the project area (Dynamac Corporation 2007).

The project will convert approximately 2,257 acres of citrus grove and 232 acres of pasture to an open-water, above-ground, constructed wetland including associated structures and a perimeter seepage canal. The project will result in the loss of approximately 2.5 acres of wetlands, 2.1 acres of agricultural ponds, and 59.4 acres of canals and ditches on the site. However, the suitability of wood stork foraging habitat in these surface waters is limited within the project area and habitat quality for wood storks is generally poor. On-site freshwater wetlands are impacted by cattle (excessive nutrients and grazing) and function as agricultural retention and detention areas. Agricultural canals and ditches may provide shallow-water foraging habitat and concentrate prey during low water periods; their hydrology is dependent on rainfall and irrigation. These canals and ditches may also receive nutrients and chemicals (*i.e.*, fertilizers, pesticides, and fungicides) in runoff directly from the citrus grove beds.

Approximately 19.5 acres of cypress wetlands will be preserved in the footprint of Cell 1 of the STA. After construction, there will be an additional 3.9 acres of littoral shelf in the perimeter seepage canal and 1,950.5 acres of freshwater emergent marsh in the STA (in addition to the preserved cypress wetlands). Therefore, the loss of approximately 60.3 acres of low-quality wood stork foraging habitat would be offset by the creation of approximately 1,954.4 acres of STA and littoral shelf wood stork foraging habitat. Additionally, the preservation of the cypress wetland may encourage the formation of a new wood stork rookery (assuming adequate wood stork forage becomes established in the STA and foraging conditions are suitable).

The Service uses a quantitative wood stork foraging habitat analysis to assess potential impacts to wood storks from landscape changes. The analysis follows the method as established by the Service in its August 28, 2007, Biological Opinion for the Terafina Project (Service Federal Activity Code 41420-2007-FA-0677). For this method, the acreage of each wetland habitat in the project area is calculated and then assigned a hydroperiod class based on an average rainfall year. These acreages are also estimated for the post-project condition. The acreages in each hydroperiod class are multiplied by a numerical qualifier that is based the percent of exotic plants infesting each habitat type. This value is then converted to a wood stork prey biomass value.

Table 2 shows the various habitat types and their respective hydroperiod class for pre- and post-construction conditions. Wetland habitats for both pre- and post-construction conditions represented hydroperiod classes 4, 6, and 7. Table 3 shows the resulting prey biomass estimates. There were no losses in any of these classes and an overall net gain of approximately 2,032 acres of wetlands which would provide approximately 10,564 kilograms of annual wood stork prey. Based on this information, the Corps has determined the proposed C-23/24 STA Project “may affect, but is not likely to adversely affect” the wood stork. The Service concurs with the Corps’ effect determination.

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

The Use of Best Scientific and Commercial Information by the Service

The Service uses the most current scientific and commercial information available. The nature of the scientific process dictates information is constantly changing and improving as new

studies are completed. The scientific method is an iterative process that builds on previous information. As the Service becomes aware of new information, we will ensure it is fully considered in our decisions, evaluations, reviews, and analyses as it relates to the base of scientific knowledge and any publications cited in our documents.

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

South Florida Multi-Species Recovery Plan

The MSRP was designed to be a living document and to be flexible to accommodate changes 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 has occurred in the intervening years since the MSRP was published. The Service uses the MSRP in the context it still presents useful information when taken in conjunction with all the new scientific information developed subsequent to its publication.

Consultation History

On January 25, 2001, the Service received a request from the Corps for a threatened and endangered species list for the IRL-S Project area.

On February 9, 2001, the requested list was finalized and sent to the Corps. The species identified were: the West Indian manatee, the threatened Florida scrub-jay (*Aphelocoma coerulescens*), the Audubon's crested caracara, the wood stork, the endangered red-cockaded woodpecker (*Picoides borealis*), the Everglade snail kite, the endangered Florida panther (*Puma concolor coryi*), the bald eagle, the eastern indigo snake, the endangered tiny polygala (*Polygala smallii*), the endangered four-petal pawpaw (*Asimina tetramera*), the endangered fragrant prickly apple (*Cereus eriophorus var. fragrans*), and the endangered Florida perforate cladonia (*Cladonia perforata*).

On February 12, 2001, the Service received a letter from the Corps stating Alternative 5 was the selected plan for the IRL-S Project. Later, it was decided Alternative 6 was the selected plan, but the Service determined the changes to the selected plan did not alter our conclusions relative to effects on threatened or endangered species.

On February 22, 2001, the Service received a letter from the Corps in which they determined the IRL-S Project, as described, was not likely to adversely affect any federally listed species or their critical habitat. Furthermore, the letter stated "the Corps believes that this IRL-S Project will enhance or restore habitats that these listed species occupy," and "standard protection methods for the bald eagle, [eastern] indigo snake and [West Indian] manatee will be utilized during project implementation when construction occurs in areas where these species could occur."

On March 2, 2001, the Service responded with a letter concurring with the Corps' determination for the entire IRL-S Project with the caveat that if modifications are made to the project or if additional information involving potential impacts on listed species becomes available, consultation may be reinitiated.

On May 3, 2001, the Service issued a draft Fish and Wildlife Coordination Act (FWCA) report for the IRL-S Project.

On or about October 15, 2001, the Service received the Corps' Draft Integrated Feasibility Report and Supplemental Environmental Impact Statement (SEIS) for the IRL-S Project.

On February 7, 2002, the Service issued a final FWCA report for the IRL-S Project.

On or about October 15, 2002, the Service received the Corps' Final Integrated Feasibility Report and SEIS for the IRL-S Project.

On January 28, 2003, the Service sent a letter to the District regarding our review of the Phase I and Phase II Environmental Site Assessment for the Birdsall Property, Coleman Groves parcel in the proposed C-23/24 STA.

On May 13, 2003, the Service issued a Planning Aid Letter to reiterate the importance of including the full complement of components known as the Natural Storage and Water Quality Treatment Areas and to recommend that the integrity of these essential features of the plan not be compromised in the potential splitting of the IRL-S plan into several parts.

On August 3, 2003, the Service sent a letter to the District regarding our review of the Phase I and Phase II Environmental Site Assessment for the Platts Property parcel in the proposed C-23/24 STA.

On or about December 15, 2003, the Service received the draft PIR and SEIS for the IRL-S Project from the Corps.

On January 7, 2004, the Service completed a National Environmental Policy Act Review of the draft PIR and SEIS for the IRL-S Project.

On February 6, 2004, the Service issued a supplement to the final FWCA report for the IRL-S Project.

On or about March 16, 2004, the Service received the Final PIR and SEIS for the IRL-S Project from the Corps.

On June 16, 2004, the Service sent a letter to the District regarding our review of the Phase I and Phase II Environmental Site Assessment for the Graves Brothers Property and JRD Property parcels in the proposed C-23/24 STA.

On July 1, 2004, the Service sent a letter to the District regarding our review of the Phase I and Phase II Environmental Site Assessment for the Graves/Tetley Property parcels in the proposed C-23/24 STA.

On November 19, 2004, the Service sent a letter to the District's consultant, Mr. Marc Lefebvre, regarding our review of the *Evaluation of Aldicarb Degradation* report for the Graves Brothers Property and JRD Property parcels in the proposed C-23/24 STA.

On February 8, 2006, staff from the District, Corps, and the project's environmental contractor (Dynamac Corporation) conducted a preliminary wildlife survey (with an emphasis on listed species) at the future C-23/24 Reservoir and STA sites.

On February 17, 2006, the Service recommended to the Corps and District that future listed species surveys at the planned C-23/24 Reservoir and STA sites include the Everglade snail kite.

On March 6, 2006, staff from the Service, District, Corps, and Dynamac Corporation conducted a general wildlife survey at the planned C-23/24 Reservoir and STA sites.

During the last week in March 2006, Dynamac Corporation and the Corps conducted listed species surveys at the planned C-23/24 Reservoir and STA sites.

On March 31, 2006, the Corps issued the *30% Draft Design Documentation Report* for the IRL-S C-23/24 STA.

On April 4, 2006, the Corps emailed the Service photos of a pair of adult caracaras and their nest tree along SR 70 just west of the C-24 Canal. Another email that same day from the Corps included photos of a snail kite in a dead citrus tree adjacent to a pond on the planned C-23/24 North Reservoir property.

On April 15, 2006, the Service emailed comments to the Corps on the *30% Draft Design Documentation Report* for the C-23/24 STA.

On April 20, 2006, staff from the Service and Corps conducted a site visit to the planned C-23/24 STA site. We delineated the cypress wetland in Cell 1 of the STA so that construction crews could avoid the cypress trees, but remove other tree species (pines and oaks) that would not survive the inundation after completion of the STA.

On July 20, 2006, the Service received Dynamac Corporation's *Draft 2006 Threatened and Endangered Species Survey and General Fish and Wildlife Inventory for the IRL-S C-23/24 Project*.

On August 7, 2006, the Service emailed comments on the *Draft 2006 Threatened and Endangered Species Survey and General Fish and Wildlife Inventory for the IRL-S C-23/24 Project* report to the District, Corps, and Dynamac Corporation.

On August 9, 2006, the Service participated in a conference call with the District, Corps, and Dynamac Corporation regarding the potential density of eastern indigo snakes on the C-23/24 STA site.

On October 3, 2006, the Service received the *Final 2006 Threatened and Endangered Species Survey and General Fish and Wildlife Inventory for the IRL-S C-23/24 Project* report from the Corps.

On October 10, 2006, the Service commented on the *Final 2006 Threatened and Endangered Species Survey and General Fish and Wildlife Inventory for the IRL-S C-23/24 Project* report and requested clarification of the eastern indigo snake density estimate.

On October 11, 2006, the Service received an additional explanation from Ms. Rebecca Bolt (Dynamac Corporation) on the eastern indigo snake estimates for the project site.

On October 25, 2006, the Corps emailed a request for reinitiation of section 7 consultation for the eastern indigo snake for the C-23/24 STA.

On December 12, 2006, the Service and District conducted a site visit to the planned C-23 South Reservoir site. The purpose was to evaluate the potential for listed species to occupy the area of a planned experimental copper remediation technique (soil inversion) on the Agler Property. Audubon's crested caracaras were observed in the nearby active citrus grove and along the C-23 Canal, but no nesting activity was evident in the area of the planned remediation testing.

On January 10, 2007, the Service, Corps, District, and Dynamac Corporation conducted a site visit for listed species and general wildlife at the C-23/24 Reservoir and STA site.

On March 13, 2007, the Service, District, Corps, FDEP, and Dynamac Corporation conducted a wetlands assessment on the project site using the Unified Mitigation Assessment Method. During this survey, a single caracara flew in a southeasterly direction over STA Cell 1.

On March 27, 2007, a caracara was observed flying along the south side of SR 70 approximately 1,300 m west of the C-24 Canal.

On April 3, 2007, the Service commented to the Corps and District on the *Draft 2007 Threatened and Endangered Species Survey and General Fish and Wildlife Inventory for the IRL-S C-23/24 Project* report.

On April 12, 2007, the Service conducted a caracara survey along SR 70 south of the STA site. A caracara nest was found in a cabbage palm approximately 2,800 meters south of SR 70 and 500 meters west of the C-24 Canal. Two other adult caracaras were observed approximately 3,400 meters west of C-24 Canal along SR 70.

On April 20, 2007, the Corps completed the *Draft 60% Plans and Specifications and 60% Design Documentation Report* for the proposed C-23/24 STA Project.

On April 25, 2007, the Service attended a public meeting on the design and operation of the C-23/24 Reservoir and STA Project.

On April 26, 2007, the Service received the *Final 2007 Threatened and Endangered Species Survey and General Fish and Wildlife Inventory for the IRL-S C-23/24 Project* report from the Corps.

On July 9, 2007, the Corps provided additional information via email regarding citrus tree removal that had been conducted on the STA site by the previous land owner due to citrus canker.

The Service has reviewed all information received pertinent to the eastern indigo snake for the C-23/24 STA Project and concurs with the Corps' determination that this proposed project "may affect and is likely to adversely affect" the eastern indigo snake. As of July 9, 2007, the Service received all information necessary for initiation of formal consultation on the eastern indigo snake for this project as required in the regulations governing interagency consultations (50 CFR § 402.14). The Service is providing this Biological Opinion in conclusion of formal consultation.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

Proposed Action

The Corps proposes to build the C-23/24 STA component as part of the larger C-23/24 Reservoir and STA component of the IRL-S Project. The STA can function independently of the C-24 Reservoir by pulling water from the C-24 Canal. The STA can also accept water from the C-24 Reservoir when it comes on-line. However, according to the current design of the C-23 Reservoir, water will not be pumped from that reservoir to the C-23/24 STA. The purpose of the STA is to remove nutrients from surface water and to attenuate storm water flow to the St. Lucie Estuary.

The C-23/24 STA is configured with multiple cells to provide several scenarios of flows, depths, and treatment detention times. The STA is divided by County Road 613 (CR 613; Sneed Road) with Cells 1 and 2 to the west and Cells 3, 4, and 5 to the east. Water from the C-24 Canal will be pumped into the western end of the STA and released on the eastern end to the NSLRWCD's Canal 71 (Figure 1). Treated water will then flow down Canal 71 into Ten Mile Creek and then the North Fork of the St. Lucie Estuary. Project lands cover approximately 2,513 acres and are located in St. Lucie County, Township 35 South, and Range 38 East. Cells 1 and 2 are located in Section 33. Cells 4 and 5 are located in Sections 34 and 35. Cell 3 is in the southern half section of Sections 26 and 27.

The STA will provide 1,970 acres of treatment area including 1950.5 acres of emergent freshwater marsh and 19.5 acres of preserved cypress wetland. The STA will have a capacity of 3,940 ac-ft of storage. The maximum operational water depth is 2 feet. The STA may dry out occasionally if environmental conditions and water supply demands outweigh the need to keep the STA hydrated.

Other features of the project include a 500-ft intake canal from the C-24 Canal, eight 65-cubic feet per second (cfs) electric pumps, one non-gated culvert, three 5-ft gated culverts, a 53,034-ft perimeter canal (containing 3.9 acres of littoral shelf), 79,744 feet of levees, and a maintenance road at the top of the levee. The target outflow rate is 200 cfs.

Construction is anticipated to take 18 months; the first 2 or 3 months will be dedicated to tree clearing and grubbing. The start date is dependent on the passage of the next Water Resources Development Act. Construction equipment expected on the site will include excavators, backhoes, bulldozers, vibratory rollers, off-road dump trucks, hydraulic cranes, motor graders, pans, fuel and lube trucks, water trucks, and pickup trucks.

Approximately 88 percent of the site is citrus grove; 11 percent is pasture. The area surrounding the STA site is primarily citrus with a small amount of pasture. There are 61.5 acres of surface water on the site comprised primarily of agricultural ditches and canals (59.4 acres). There are also 2.1 acres of agricultural ponds. There are 24.23 acres of wetlands on the site including 21.70 acres of cypress (that will be preserved), 1.90 acres of mixed wetland hardwoods, and 0.63 acres of freshwater marsh. Approximately 0.13 acres of freshwater marsh are outside of the STA footprint and will be preserved.

Approximately 835 acres of citrus grove have been cleared over the last two years by the previous owner due to citrus canker infection. There are still 235 acres of citrus trees in Cells 1 and 2, and 1,160 acres of citrus trees in Cells 3, 4 and 5 that will need to be removed. Additionally, there are 232 acres of pasture that will require clearing in Cells 1 and 2.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate project area involved in the action. Therefore, the action area for the proposed project includes the 2,513-acre project area and additional adjacent areas that may also be used by the eastern indigo snake. The largest reported eastern indigo snake home range in Florida was approximately 805 acres (327 hectare [ha]; Barkaszi et al. 1995). Assuming a roughly square pattern, this home range would be 5,933 ft by 5,933 ft. Therefore, the Service has defined the action area as the 2,513-acre site plus a 6,000-ft buffer zone around the grove (Figure 2). The entire action area is approximately 10,863 acres. This action area is necessary to account for intra-specific aggression by eastern indigo snakes displaced from the project site into adjacent areas as well as recolonization of the project site after construction. At this time, we anticipate that some eastern indigo snakes may recolonize the C-23/24 STA if prey items and cover become available.

STATUS OF THE SPECIES AND CRITICAL HABITAT RANGEWIDE

Species description

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

Critical habitat description

Critical habitat has not been designated for this species.

Life history

In northern Florida, eastern indigo snakes breed between November and April, with females depositing 4 to 12 eggs during May or June (Moler 1992). Young hatch in approximately

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

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

Population dynamics

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

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

Status and distribution

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

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

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

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

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

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

ENVIRONMENTAL BASELINE

Status of the species within the action area

Although the eastern indigo snake is known to occupy citrus groves in addition to many other types of native and non-native habitats in Florida, we have little information on the distribution and abundance of the eastern indigo snake within the action area. Eastern indigo snakes have been occasionally sighted in the citrus grove west of the STA site at the planned C-24 North Reservoir by the former landowner (Dynamac Corporation 2007). Some information on eastern indigo snake abundance in citrus groves may be inferred from another nearby but larger site. At least five live sightings and two deaths of eastern indigo snakes occurred on the C-44 Project site from 2005 to 2007. One eastern indigo snake was killed on a public perimeter road prior to construction and another was killed by heavy equipment operation during tree clearing. All the live sightings occurred during either surveys or construction on the C-44 Project site. These observations indicate eastern indigo snakes can be present in citrus groves and furthermore may be harmed by the proposed action. They also indicate the density of eastern indigo snakes is probably lower than their density in a more natural or native setting.

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

Factors affecting species environment within the action area

The historic land use classification in the action area was predominantly pine flatwoods, a preferred habitat type for eastern indigo snakes. These pine forests were interspersed with freshwater marshes and wet prairies. However, for the last few decades, agricultural citrus has been the dominant land use. Pasture with some blocks or corridors of natural areas comprise a secondary portion of the general land use. Residential development pressure in the action area has not been nearly as intense as in the coastal areas of Florida. Still, habitat loss and fragmentation, or at least a lessening of the quality of the habitat due to agricultural development has likely reduced the availability of both refugia and prey for this species.

The project footprint is primarily citrus. There are also approximately 232 acres of woodland and improved pastures that encompass a 22-acre cypress wetland. Other features of the property include maintenance roads, agricultural canals and ditches, and two excavated ponds. Other wetlands comprise less than three acres of the site and include mixed wetland hardwoods and freshwater marshes. These habitats, even though they may have an impacted hydrology and vegetative community, still may provide some prey items and refugia for eastern indigo snakes.

Pesticide usage is typical for this type of crop and includes a copper-based fungicidal spray twice a year. Canal banks and tree rows are regularly mowed. Maintenance vehicles regularly travel on the roads in the grove, providing opportunities for vehicle mortality.

It is not easy to estimate the density of eastern indigo snakes at the C-23/24 STA site using existing data. However, a 26-year study conducted by Layne and Steiner (1996) at ABS estimated a population density of 2.6 eastern indigo snakes (1.9 males, 0.7 females) per 247 acres (100 ha). They also estimated a more conservative density based on 5 snakes (3 males and 2 females) that occupied 314 ha at 1.6 eastern indigo snakes per 100 ha (0.96 males to 0.64 females). ABS is approximately 51 miles west of the project area and contains better snake habitat (*i.e.*, the study area was comprised of 60 percent xeric pine and oak uplands, and 40 percent pine flatwoods, bayheads, swale, and seasonal ponds). Eastern indigo snakes have been observed at ABS in all natural and man-altered habitats with no obvious habitat preferences (Layne and Steiner 1996).

From a sample of 181 adult and juvenile eastern indigo snakes, Layne and Steiner (1996) found that 58 percent of the individuals were males and 42 percent were females. The juvenile eastern indigo snakes (< 800 mm; n = 36) were present at a 1:1 sex ratio, therefore, it was the larger snakes that slightly skewed the sex ratio towards males. This led Layne and Steiner (1996) to postulate that the estimated adult sex ratio may be artificially skewed because males have larger home ranges and move more than females in winter. Therefore, male snakes may have a higher probability of being captured or killed by vehicular traffic (and thus added to their sample). It may be that an adult sex ratio of 1:1 is more appropriate for eastern indigo snakes. This ratio is more typical of colubrid snakes according to Parker and Plummer (2001). A 1:1 sex ratio was also reported by Moulis (1976) for 11 captive hatchling eastern indigo snakes.

The C-23/24 STA Project site likely contains or intersects some eastern indigo snake home ranges. Based on the population density estimate at ABS, one could estimate that up to 26 adult eastern indigo snakes may be present within the C-23/24 STA Project site (2,513 acres/247 acres x 2.6 snakes = 26 snakes). However, due to the differences in habitat between ABS and the project site, we anticipate that the density of eastern indigo snakes at the C-23/24 STA Project site would be lower than that at ABS. Regular mowing, vehicular traffic, and pesticide usage on the project site are also likely to have decreased the suitability of the habitat for eastern indigo snakes and their prey. If we estimate that the quality of the eastern indigo snake habitat at the project site is half that of ABS, then there could be up to 13 adult eastern indigo snakes within the C-23/24 STA Project site. Assuming that both sexes would be present, there is a possibility that eastern indigo snake nests could also be present. Using a 1:1 sex ratio, there could be up to seven nests on the site. This may be an overestimate of the number of indigo snake nests on site because as the quality of the habitat is reduced, there may be an additional reduction in reproductive potential

due to less snake resources (*e.g.*, prey and cover) and that with fewer snakes, the likelihood of a snake finding a mate is also reduced. However, we find it difficult to quantify this potential reduction and therefore, have assumed that there could be up to seven nests on the site. Each nest could have between 4 and 12 eggs or hatchlings (Moler 1992). We cannot estimate the number of subadult eastern indigo snakes (*i.e.*, older than the hatchling stage) that would be on site, primarily due to an unknown natural mortality rate of hatchlings and subadults due to intraspecific aggression (*i.e.*, the territoriality of males and eastern indigo snakes will eat conspecifics) as well as the other factors listed in the Status of the Species section of this opinion.

Ms. Rebecca Bolt, an eastern indigo snake researcher (Dynamac Corporation, Cape Canaveral, Florida), conducted a site assessment and provided the Corps and Service with an eastern indigo snake population estimate for the project area as part of the Corps' Biological Assessment. She believed that the sizes of most of the semi-natural habitat areas on the project site are less than the home range required by eastern indigo snakes. Her estimate also took into account pesticide use, road mortality, predation by domestic animals and birds of prey, and frequent disturbance (*i.e.*, mowing and land clearing).

Utilizing the average home range size (271.6 acres) for male eastern indigo snakes ($n = 23$) that she has tracked in Brevard County, and assuming the project site was considered to be "average" eastern indigo snake habitat quality, and the snakes were evenly distributed, she estimated up to 22 eastern indigo snakes (11 males and 11 females) could occur there (she used 2,900 acres as the size of project site). She estimated the number of males and females using a 1:1 sex ratio based on the information in Parker and Plummer (2001).

However, after her site visit, she believed that the habitat quality throughout the C-23/24 site was poor (*i.e.*, worse than her original assumption of "average" quality) as compared to those habitats used by radio-tagged eastern indigo snakes in Brevard County. Conditions at the STA project site are generally mesic to hydric and suitable den sites were not observed. No gopher tortoises or burrows were found. The groves were either active and intensively managed (mowed and sprayed) or were plowed down to bare soil, offering no cover for snakes or other wildlife. There were a few areas of non-grove habitat, but these were small, isolated, disturbed, and not capable of independently supporting more than a single individual or pair of eastern indigo snakes. Therefore, she proposed a "more defensible" density estimate of 8 male and 8 female eastern indigo snakes (Dynamac Corporation 2006). She also believed these estimates are "likely too high as well, but are the best that can currently be determined given the data available" (Dynamac Corporation 2006).

She also recognized estimating the number of eastern indigo snake nests or eggs during any given year on the STA site is even more problematic. Researchers at Kennedy Space Center have x-rayed female eastern indigo snakes 2 years in a row and found some to be gravid in both years, and others were gravid in one year and not another (Bolt 2007). Assuming every female could find a male and produce a clutch would be a high estimate, but it is probably the best estimate that can be made. Therefore, she estimated there could be up to 8 nests on site.

We recognize the Service's and Ms. Bolt's estimates of adult snake density on the project site are subjective, but are encouraged they are similar. We acknowledge the expertise of Ms. Bolt, and

therefore, will use her density estimate for the remainder of this Biological Opinion. Therefore, we assume there are up to 16 adult and an unknown number of subadult eastern indigo snakes on the project site. We also assume there are up to 8 eastern indigo snake nests on site.

EFFECTS OF THE ACTION

This section includes an analysis of the direct and indirect effects of the proposed action on eastern indigo snakes, including beneficial effects, interrelated and interdependent actions, and species response to the proposed action.

Factors to be considered

Eastern indigo snakes have been documented within the project's action area, but outside the STA footprint. Because eastern indigo snakes use a variety of habitats, and have very large home ranges, they may occur throughout the project site and adjacent citrus groves, pastures, and natural areas. This action will take place when this species is likely to be present in the area. The duration of the tree clearing will be up to 3 months and the remainder of construction will last an additional 15 months. The operation and maintenance of the project is anticipated to last approximately 50 years. Potential impacts to eastern indigo snakes may occur due to tree and shrub removal and burning, habitat destruction and degradation, earthmoving, construction of the STA, and operation and maintenance of the project. The action may also cause eastern indigo snakes to leave the area, abandon den sites, and possibly miss foraging and mating opportunities. Individual eastern indigo snakes fleeing the area may be more vulnerable to road mortality, predation, and intraspecific aggression. Potential direct negative impacts to the eastern indigo snake include loss of habitat and injury or mortality from: (1) all construction activities including tree removal, burning, and contaminant remediation; (2) vehicular traffic; (3) initial hydration and subsequent rehydration; and (4) disruption of normal foraging, breeding, and dispersing behaviors. Potential indirect impacts include mortality or injury from future operation and maintenance of the project via: (1) vehicular traffic, mowing, and pesticide usage; and (2) changes in prey density within the STA and associated infrastructure as water levels fluctuate (including complete dry-out).

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

Analyses for effects of the action

Direct effects

Direct effects are those effects that are caused by the proposed action. The direct effects evaluated by the Service include injury and mortality from construction; loss of habitat for foraging, breeding, and dispersing; disturbance that causes snakes to leave the area (and possibly

miss foraging and mating opportunities); and disturbance related to the initial hydration of the STA. The direct effects that this project may have on eastern indigo snakes within the action area are discussed below. For purposes of this analysis, the total impact area is estimated to be 2,513 acres.

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

On March 8, 2007, an eastern indigo snake was killed while citrus trees were being removed from the C-44 Project site (approximately 22 miles south of the C-23/24 STA site). The snake was in the roots of the tree and was crushed by the excavator when the tree was lifted out of the ground by the root ball. During tree clearing the next day, another eastern indigo snake was sighted nearby but was not injured or killed. However, when the trees near the snake sighting were removed a few days later, only barren ground was available to this snake for refugia. The final disposition of this snake is not known.

Additional mortality or injury of eastern indigo snakes may result from an increase in construction travel. The travel routes in the vicinity of the project site include secondary roads with light to moderate traffic. The main access road to the site is a two-lane rural road (CR 613) which splits the STA into east and west sections (Figure 1). Construction traffic will come from CR 613 and then use the existing agricultural roads in the project area. Construction is proposed to take place in phases, exposing eastern indigo snakes to changes or additions in vehicle traffic on the site over a period of approximately 18 months.

Loss of habitat: In general, citrus groves are not optimal eastern indigo snake habitat (Bolt 2006, Mazzotti et al. 1993). Some citrus growers maintain a higher herbaceous vegetative structure along canals, roads, and wet ditches as well as in between the rows of trees. Islands of more natural areas (hydric hammocks, cypress, and other wetlands) may also be present, either in or at the periphery of the groves. Groves interspersed or adjacent to natural habitat would have more prey items for eastern indigo snakes and also provide more cover than a grove that is more intensively managed (Zeigler 2006). Factors which influence species richness in citrus groves in addition to grove age are size, interspersion of other important habitats, sampling effort, proximity to large natural areas, visibility of wildlife in groves of different ages and effects of workers on wildlife (especially snakes) (Mazzotti et al. 1993). Grove beds, agricultural reservoirs, impacted wetlands, canals, and ditches in citrus groves provided habitat for prey species such as small mammals, birds, toads, frogs, fish, lizards, turtles, alligators, other snakes, and non-native species such as house mice (*Mus musculus*), black rats (*Rattus rattus*), and Norway rats (*Rattus norvegicus*). For this project, we are assuming the entire site is potential habitat for the eastern indigo snake even though the areas around the wet ditches and canals are likely to have better snake habitat and prey than the interior portions. Therefore, the Service considers the entire 2,513 acres to be habitat lost as a result of construction.

Disturbance during construction: The increased human presence onsite during construction along with the operation of construction vehicles may disturb eastern indigo snakes to the point they leave the project area. This may result in missed foraging and mating opportunities and these individuals may be more vulnerable to predation and intraspecific aggression.

Initial hydration: The initial flooding of the STA has the potential to drown indigo snakes and nests/eggs, and inundate their burrows and other refugia. A slow initial flooding may allow some indigo snakes to vacate the STA, although some snakes may still drown if trapped in underground air pockets that are subsequently filled with water.

Indirect effects

Indirect effects are those that are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. The indirect impacts evaluated by the Service include injury and mortality associated with: (1) post-construction traffic increases from vehicles accessing the area for project monitoring, operations, maintenance, or possible recreational access; (2) post-construction maintenance of the roads, levees, pump stations, and STA (including vegetation management methods such as mowing, herbicide application, and physical removal); (3) reduced foraging opportunities associated with fluctuations in the prey populations due to STA and canal drying or flooding; and (4) drowning or disturbance of snakes associated with STA rehydration. The indirect effects that the proposed action may have on eastern indigo snakes within the action area are discussed below.

Injury and Mortality: Once construction is completed, additional vehicular traffic will access and operate in the area as a result of project monitoring, operations, and maintenance. Some of the levees may also be accessible to the public for recreational purposes. The Service anticipates that a small number of eastern indigo snakes may occupy the project area during operation and maintenance for the life of the project. Given the elevation of the project site levees and the number of prey items that could become established in and around the STA, these snakes may be injured or killed from the operation of vehicles and equipment, although the precise impacts are difficult to measure. Considering this information, it is possible that a small amount of injury or mortality of the species will occur as a result of additional vehicles or equipment accessing the site.

Specifically, the mowing of embankments has the potential to injure or kill individual eastern indigo snakes, and destroy or degrade potential habitat. In general, the District uses guidelines that specify that wildlife is not to be harmed during mowing; however, mowing does not usually occur until vegetation reaches 8 to 10 inches in height. At this height it may be difficult for equipment operators to observe and avoid snakes or other wildlife.

Loss of Prey: We expect that an eastern indigo snake prey base would become established within the wet portion of the STA and along the levees and roads following the establishment of an appropriate vegetative cover (probably within six months after completion). Depending on the operation of the project and available water, the STA may occasionally dry out in low-precipitation years and result in a loss of prey items. However, due to the large volume of water available within the C-24 system, and after the C-24 Reservoir comes on-line, complete drying of the STA is anticipated to occur infrequently. Pesticide application may occur as part of project maintenance or accommodation of recreational activities. Prey (*e.g.*, insects, fish,

amphibians, and some reptiles) may be vulnerable to pesticide application and may be killed, and therefore, not available to eastern indigo snakes as a result of these activities.

STA Rehydration: We anticipate that eastern indigo snakes may move into the STA if it becomes dry. These snakes may be drowned or, at a minimum, disturbed when the STA is rehydrated. However, we anticipate that the STA may only occasionally become dry (not an annual event), and therefore, the magnitude of this indirect effect on eastern indigo snakes is expected to be low.

Beneficial Effects

The operation and management of the C-23/24 STA Project may result in potential benefits to the eastern indigo snake. The loss of eastern indigo snake habitat when the citrus grove is cleared and inundated may be minimally offset after vegetation on the site has stabilized and prey items for the eastern indigo snake become available at sufficient densities. At that time, there should be habitat suitable for the eastern indigo snake on the STA levees (and possibly roads), along the intake and seepage canals, and possibly other features (*e.g.*, easement areas outside the STA proper). The width of the side slope of the perimeter STA levees will be 18 ft. Therefore, there would be potentially 21.9 acres (53,034 ft of levee x 18 ft) of eastern indigo snake habitat on the perimeter levees. For interior STA levees, the width of the side slope is 12 ft, and both sides are considered usable; therefore, this area would approximate 14.7 acres (26,710 ft levee x 12 ft x 2). For the 500-ft intake canal and the 53,034-ft perimeter seepage canal, we estimated that approximately 10 ft on each side would be suitable eastern indigo snake habitat. The anticipated total acreage of habitat along these canals is 24.6 acres (53,534 ft of canals x 10 ft x 2). The tops of levees and roads were not counted as habitat even though they may be used by eastern indigo snakes, due to the offsetting consequence of road mortality and relative lack of prey (compared to the STA). We could not quantify other areas that may be suitable for eastern indigo snakes (*e.g.*, easement areas) because we do not have the dimensions or expected habitat of those areas. The total potential eastern indigo snake habitat that would be created by this project is estimated to be approximately 61.2 acres (21.9 + 14.7 + 24.6). Using the average home range for a male eastern indigo snake (Dynamac Corporation 2006), if this amount of habitat was in one block (rather than linear in shape) and of optimum quality, it would only partially support one eastern indigo snake. However, since much of this habitat covers the perimeter of the site, we expect that it may intersect, and therefore, support more than one eastern indigo snake home range. We anticipate that these snakes could use the STA, but only if prey and cover are suitable, and if they can safely cross the perimeter seepage canal. It is difficult to accurately estimate how many eastern indigo snakes will use the site following 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. There are no interrelated or interdependent actions for this project.

Species' response to the proposed action

Construction, operation, and maintenance of the project can result in actions that may kill or injure individual eastern indigo snakes and destroy nests, and destroy or degrade occupied and potential habitat and foraging areas. Clearing, burning, earthmoving, construction, operation, and maintenance activities may also adversely affect eastern indigo snakes by causing them to leave the area, and possibly miss foraging and mating opportunities. Individual eastern indigo snakes fleeing the area may be more vulnerable to predation and intraspecific aggression. The Service anticipates that the number of eastern indigo snakes at the C-23/24 STA Project will be less after construction than that of the baseline condition.

The Service anticipates all 2,513 acres of potential eastern indigo snake habitat within the construction site would be impacted by the proposed action. The number of individuals present at the time of the action is not known. The Service estimates as many as 8 adult male and 8 adult female eastern indigo snakes may be present within the site prior to construction. Furthermore, we anticipate that up to 8 nests may be present during any given nesting season (April to October) prior to construction. These population estimates are based partly on population density estimates at ABS (Layne and Steiner 1996) and in Brevard County (Dynamac Corporation 2006) and reduced based on inferior habitat quality on the site. It is not known how many juvenile eastern indigo snakes may be present at the time of the action. Juvenile eastern indigo snakes may be more vulnerable because they typically do not use underground refugia as adults do, preferring thick vegetation for cover (Speake et al. 1987). After construction, we anticipate the number of eastern indigo snakes and nests affected will decrease due to loss of habitat and ongoing disturbance.

We believe some eastern indigo snakes may move to the STA levees and canal banks following construction and subsequent stabilization of the vegetation with establishment of prey items. Eastern indigo snakes may also access the STA if extended periods of dry-down occur and new prey items occupy the STA. Access to these prey items will likely be controlled by the ability of the snake to negotiate water depth and the extent of available foraging habitat in ecotones between dry and wet areas. We cannot estimate the number or age of eastern indigo snakes that may move into a dehydrated STA. Individual eastern indigo snakes may also be affected by ongoing and future maintenance and management activities.

CUMULATIVE EFFECTS

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

Conversion of surrounding citrus lands to more intensive agricultural (*e.g.*, row crops or sod) or residential uses could be a cumulative effect on the species if no wetlands were impacted (*i.e.*, no federal permit was required). The primary threat to the eastern indigo snake is habitat loss and fragmentation due to development (Lawler 1977; Moler 1985a). Non-federally reviewed actions such as single-family residential developments encompass the most likely future threats

to the species in this area. Besides loss of habitat, residential developments also increase risk of harm to eastern indigo snakes in the interface areas between urban and native habitats because it increases the likelihood of snakes being killed by property owners and domestic pets. Increased traffic associated with development may also lead to increased eastern indigo snake mortality.

It is difficult to predict the extent of eastern indigo snake habitat loss due to land use conversion within the action area (but outside of the project site). However, given the proximity of the action area to a major travel corridor (SR 70 and then the Florida Turnpike and I-95; Figures 1 and 2) and the relative closeness to the Atlantic Coast (15 miles), it is likely residential development will eventually occur here. Additionally, the public recreational amenities that could be offered by the C-23/24 Reservoir and STA (*e.g.*, hiking, fishing, and wildlife viewing) may encourage residential development adjacent to the project site. Therefore, we anticipate the action area will only support a limited number of eastern indigo snakes in the future.

SUMMARY OF EFFECTS

The C-23/24 STA Project will affect the eastern indigo snake by the loss of habitat associated with conversion of 2,513 acres of primarily citrus grove (including 232 acres of pasture) to STA, levees, canals, and roadways. Direct injury or mortality could occur from construction activity and vehicle operation, destruction of temporary refugia (vegetation and debris piles), and the initial hydration of the STA. During construction, and possibly as a result of the initial hydration, eastern indigo snakes will probably move off of the site, risking exposure to predation and intraspecific aggression. Post-construction management and maintenance activities will include mowing, pesticide application, equipment maintenance, and possible recreation opportunities for the public which may result in injury or mortality. Rehydration after dry-down may result in mortality, loss of habitat, and loss of prey. The potential habitat replacement associated with the levees and canal banks after construction is estimated to be only 61.2 acres of habitat.

CONCLUSION

After reviewing the current status of the eastern indigo snake, the environmental baseline for the action area, the effects of the proposed action and cumulative effects, it is the Service's biological opinion that the C-23/24 STA Project, as proposed, is not likely to jeopardize the continued existence of the eastern indigo snake. Although we anticipate limited mortality of eastern indigo snakes, the loss of 2,513 acres of primarily citrus grove (considered poor quality habitat) will not substantially reduce the distribution of eastern indigo snakes in south Florida. The eastern indigo snake has a broad distribution in a mosaic of habitats and is a generalist that forages on a variety of available prey. The eastern indigo snake has some ability to move away from situations which may result in direct injury and mortality (construction and hydration) and can access adjacent habitat if escape opportunities are made available.

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

INCIDENTAL TAKE STATEMENT

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

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

AMOUNT OR EXTENT OF TAKE

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

The Service anticipates the direct permanent loss of approximately 2,513 acres of eastern indigo snake habitat will occur through conversion of citrus grove and pasture to STA and associated levees, canals, and other infrastructure. Based on the reported densities of eastern indigo snakes at ABS and in Brevard County, and reducing that density based on the inferior habitat characteristics of the existing citrus grove, the Service anticipates up to 16 eastern indigo snakes will be taken incidental (in the form of harm) to the initial project construction and operations.

The Service estimates up to 25 percent of the eastern indigo snakes potentially impacted by the C-23/24 STA Project site may be killed or injured by the initial construction activities. Above-ground refugia (sediment or debris piles) may be lost during clearing and construction.

Additionally, individual eastern indigo snakes fleeing the area may be more vulnerable to roadkill, predation, and intraspecific aggression. The remaining 75 percent of the snakes would not be directly killed or injured but would be affected by the loss of habitat. These individuals could leave the area, abandon den sites, miss foraging and mating opportunities and as a result experience lower productivity. These animals would be incidentally taken through harassment. We anticipate up to 8 eastern indigo snake nests may be taken in the first year of construction. After the first year, the site will be cleared and graded, and little or no snake refugia or prey will be available. Therefore, we do not anticipate additional eastern indigo snake nests will be on site until after construction is completed and vegetation has become established. The incidental take associated with construction activities and loss of the majority of the habitat on the site is in the form of harm and harassment. The initial hydration of the STA may drown or disturb eastern indigo snakes. This incidental take is expected to be in the form of harm and harassment.

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

EFFECT OF THE TAKE

In the accompanying biological opinion, the Service determined that this level of anticipated take is not likely to result in jeopardy to the eastern indigo snake or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the eastern indigo snake: (1) disturbance and injury to eastern indigo snakes should be minimized during construction activities; (2) disturbance and habitat loss should be minimized during STA hydration and project operation and maintenance; (3) the Corps and District will coordinate and report to the Service on construction activities, STA filling and rehydration, long-term operation and maintenance, management, and recreational activities; and (4) dead or injured eastern indigo snake will be handled appropriately including the proper notification of the FWC and Service.

TERMS AND CONDITIONS

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures, described above and outline reporting and monitoring requirements. The terms and conditions described below are non-discretionary, and must be undertaken by the Corps so they become binding conditions of any grant, agreement, or permit issued to the District.

Minimize road and construction-related mortality:

- a. The *Draft Standard Protection Measures for the Eastern Indigo Snake* (Service 2002) shall be incorporated into any subsequent permit or agreement between the Corps and the District to avoid injury to any individual animal.
- b. The Corps shall provide at least one qualified observer during ground clearing activities. The observer's qualifications will be provided to and approved by the Service's C-23/24 STA Project biologist; Fish and Wildlife Service, South Florida Ecological Services Office; Vero Beach, Florida 32962, 772-562-3909 (ext. 249), 2 weeks prior to initiation of construction. The observer's primary function would be to visually evaluate the area to be cleared immediately prior to, and following vegetation removal, stockpiling, and burning and to record any eastern indigo snake activity. This would also include any other relevant wildlife observations for eastern indigo snake prey or predators. Only the qualified observer or individuals who have been either authorized by a section 10(a)(1)(A) permit issued by the Service, or by the State of Florida through the FWC for such activities, are permitted to come in contact with an eastern indigo snake.
- c. During initial removal of the trees, the canal banks shall not be altered. The trees should be up-rooted, allowed to dry, and subsequently pushed into piles and burned. Brush piles shall be located as far away from the ditches (*i.e.*, snake habitat) as possible in order to keep snakes from recolonizing brush piles before they are burned. Removal of trees should proceed at a relatively slow pace, thus affording the equipment operators the maximum possibility to observe eastern indigo snakes and allow the snakes the opportunity to move away.
- d. During tree clearing, the equipment operators should start work at the farthest point from ditches, canals, or other potential temporary refugia and work towards the ditches or canals so that the eastern indigo snake, if encountered, should be encouraged to move away from the disturbance and towards refugia.
- e. The Corps shall conduct a pre-construction wildlife education meeting with all workers and contractors that will be present on the site, including those conducting any chemical contaminant remediation activities, using the preconstruction package developed for the Acceler8 Program (or a similarly suitable package). This training must include the conditions under which the Service should be notified with regard to eastern indigo snake concerns and potential observations.
- f. A speed limit of 35 mph shall be posted for all vehicular traffic on non-public roads. Pre-construction education materials shall specify speed restrictions.

2. Minimize harm (habitat loss, mortality due to drowning) and harassment (disturbance, loss of prey):
 - a. Initial hydration of the STA shall be at a maximum rate of 6 inches per day until the water depth is 6 inches above the STA floor. Once that depth is reached, the STA fill rate should not be restricted.
 - b. Subsequent rehydration of the STA after an extended dry-down event of two weeks or more shall be at a maximum rate of 1 foot per day until the water is 1 foot above the STA floor. Once that depth is reached, the STA fill rate should not be restricted.
 - c. The Corps shall monitor eastern indigo snake response during the initial fill to determine the effect of hydration on indigo snakes. If necessary, individual eastern indigo snakes will be captured by authorized personnel and released outside the STA. If necessary, eastern indigo snakes shall be held in captivity only long enough to be moved the minimum distance into suitable habitat out of harm's way; at no time shall more than one snake be kept in the same container. A detailed monitoring plan shall be submitted to the Service for review and approval at least 30 days prior to initial filling of the STA.
 - d. All on-site personnel shall be notified to avoid all snakes and burrows if at all possible and will be educated to recognize the eastern indigo snake. If an eastern indigo snake is encountered, equipment operation shall cease and the snake shall be avoided and allowed to leave the area on its own before vehicle or equipment use is resumed.
 - e. Educational information on the eastern indigo snake shall be posted at the educational kiosks on the site.

3. Monitoring and reporting requirements:

- a. Results of all wildlife observations associated with ground clearing activities (as required in Terms and Conditions 1.b.) shall be provided to the Service's C-23/24 STA Project biologist; Fish and Wildlife Service, South Florida Ecological Services Office; Vero Beach, Florida 32962, 772-562-3909 (ext. 249), within 30 days following the activity. The report should also contain summaries of snakes moved off-site (e.g., where and when they were found and relocated).
- b. Hydration of the STA shall be monitored to assure consistency with the Terms and Conditions 2.a., 2.b., and 2.c. Results of observations associated with initial hydration including water levels, observations of indigo snakes or their prey, additional information identified in the monitoring plan, and recommendations to reduce effects to indigo snakes during rehydration shall be provided to the Service's C-23/24 STA Project biologist; Fish and Wildlife Service, South Florida Ecological Services Office; Vero Beach, Florida 32962, 772-562-3909 (ext. 249) within 10 days following the activity.
- c. The Corps shall provide the Service's C-23/24 STA Project biologist; Fish and Wildlife Service, South Florida Ecological Services Office; Vero Beach, Florida 32962, 772-562-3909 (ext. 249), a one-week advance notice on the schedule for ground clearing of trees and other construction phases so that we may participate in on-site observational activities.

4. Disposition of dead or injured animals (salvage):

- a. Annually, a report of all eastern indigo snakes killed or injured by operation or maintenance of the C-23/24 STA Project must be submitted to the Service's C-23/24 STA Project biologist; Fish and Wildlife Service, South Florida Ecological Services Office; Vero Beach, Florida 32962, 772-562-3909 (ext. 249). This report shall contain the location, dates, times, prevailing environmental conditions, and the circumstances surrounding all sightings of eastern indigo snakes and the disposition of all eastern indigo snakes found. A site map with observation locations shall also be included in this report. If no snakes are encountered, a report shall be submitted indicating that fact.
- b. Upon locating a dead, injured, or sick federally listed species, initial notification must be made to referenced project biologist and the nearest Service Law Enforcement Office (Fish and Wildlife Service; 1339 20th Street; Vero Beach, Florida 32960; 772-562-3909. Secondary notification should be made to the FWC, South Region; 8535 Northlake Boulevard; West Palm Beach, Florida; 33412-3303; 561-625-5122; 1-888-404-3922. Injured eastern indigo snakes may be transported to the Busch Wildlife Sanctuary; 2500 Jupiter Park Drive, Jupiter, Florida, 33458; 561-575-3399 for immediate medical care. If not specifically instructed by Service law enforcement to submit dead specimens, all dead specimens and snake sheds should be offered to the Florida Museum of Natural History, Gainesville, Florida 32960. The museum should be contacted with regard to details for preservation and transport.
- c. Care should be taken in handling sick or injured specimens to ensure effective treatment and care or in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. Dead eastern indigo snakes should be placed on ice and frozen as soon as possible. In conjunction with the care of sick or injured specimens or preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. We recommend the following:

1. Following construction, maintain an educational kiosk for the public on the listed species and other wildlife that may be observed in the C-23/24 STA Project.
2. If large snake skins are found, they should be collected, and sent to the Florida Ecological Services Office; 1339 20th St., Vero Beach, Florida 32962, 772-562-3909Museum of Natural History, Gainesville, FL 32960 for positive identification and genetic studies. The museum should be contacted with regard to details for preservation and transport. Information on the collection date and location should be included.

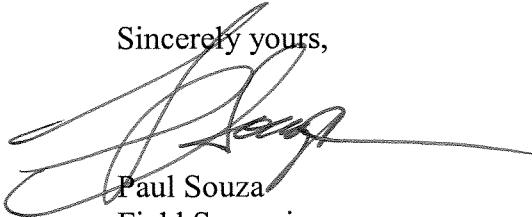
3. Cooperate with research-based efforts to provide for long-term ecological monitoring on eastern indigo snake prey densities and habitats in the project area.

REINITIATION NOTICE

This concludes formal consultation on the C-23/24 STA Project. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; (3) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Thank you for your cooperation and effort in protecting fish and wildlife resources. If you have any questions regarding this project, please contact Steve Schubert at 772-562-3909, extension 249.

Sincerely yours,



Paul Souza
Field Supervisor
South Florida Ecological Services Office

cc:

Corps, Jacksonville, Florida (Mike Rogalski, Paul Stodola)
Corps, West Palm Beach, Florida (Tori White) (electronic copy only)
District, West Palm Beach, Florida (Beth Kacvinsky)
FWC, Vero Beach, Florida (Joe Walsh)
Service, Atlanta, Georgia (Noreen Walsh) (electronic copy only)
Service, Atlanta, Georgia (Dave Flemming) (electronic copy only)
Service, Jackson, Mississippi (Linda LaClaire, Eastern Indigo Snake Species Lead)
Service, Jacksonville, Florida (Miles Meyer)

LITERATURE CITED

- Babis, W.A. 1949. Notes on the food of the indigo snake. *Copeia* 1949 (2):147.
- Bargar, Tim, R. Frakes, J. Boggs, E. Boughner. 2005. Uptake of Copper by Apple Snails from Contaminated Sediments in South Florida, Interim Report. Environmental contaminants Program South Florida Ecological Services Office, U.S. Fish and Wildlife Service, Vero Beach, Florida.
- Barkaszi, M., R. B. Smith, and D. R. Breininger. 1995. Home range characteristics of the eastern indigo snake (*Drymarchon corais couperi*) on John F. Kennedy Space Center, Florida, USA. Page 100 (abstract) in Proceedings of the 38th Annual Meeting of the Society for the Study of Amphibians and Reptiles, August 8-13, 1995, Appalachian State University; Boone, North Carolina, USA.
- Bolt, R. 2006. Personal communication. Biologist. Conference call with the U.S. Fish and Wildlife Service, South Florida Water Management District and U.S. Army Corps of Engineers on August 9, 2006 for the C-44 Project. Dynamac Corporation; Cape Canaveral, Florida.
- Bolt, R. 2007. Personal communication. Biologist. Information to Paul Stodola at the U.S. Army Corps of Engineers on June 8, 2007. Dynamac Corporation; Cape Canaveral, Florida.
- Carson, H.L. 1945. Delayed fertilization in a captive indigo snake with note of feeding and shedding. *Copeia* 1945(4): 222-224.
- Conant, R. and J.T. Collins. 1998. A field guide to reptiles and amphibians of eastern and central North America. Third Edition, Expanded. Houghton Mifflin Company; New York, New York.
- Cox, J.A. and R.S. Kautz. 2000. Habitat conservation needs of rare and imperiled wildlife in Florida. Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.
- Diemer, J.E. and D.W. Speake. 1983. The distribution of the eastern indigo snake, *Drymarchon corais couperi*, in Georgia. *Journal of Herpetology* 17(3): 256-264.
- Dynamac Corporation. 2006. Final report: threatened and endangered species survey and general fish and wildlife inventory for Indian River Lagoon-South Project C23/C24. Cape Canaveral, Florida. 58 pp. September 28.
- Dynamac Corporation. 2007. Final report: threatened and endangered species survey and general fish and wildlife inventory for Indian River Lagoon-South Project C23/C24. Cape Canaveral, Florida. 52 pp. April 24.

- Kacvinsky, B. 2007. Personal communication. Project Manager for the C-23/24 Reservoir and STA Project. Email to U.S. Fish and Wildlife Service on August 10, 2007. South Florida Water Management District; West Palm Beach, Florida.
- Keegan, H.L. 1944. Indigo snakes feeding upon poisonous snakes. *Copeia* 1944 (1):59.
- Kochman, H.I. 1978. Eastern indigo snake, *Drymarchon corais couperi*. Pages 68-69 in R.W. McDiarmid, ed. Rare and endangered biota of Florida. University Presses of Florida; Gainesville, Florida.
- Landers, J.L. and D.W. Speake. 1980. Management needs of sandhill reptiles in southern Georgia. Proceedings of the annual conference of the Southeastern Association of Fish and Wildlife Agencies 34: 515-529.
- Lawler, H.E. 1977. The status of *Drymarchon corais couperi* (Holbrook), the eastern indigo snake, in the southeastern USA. *Herpetological Review* 8(3): 76-79.
- Layne, J.N. and T.M. Steiner. 1996. Eastern indigo snake (*Drymarchon corais couperi*): summary of research conducted on Archbold Biological Station. Report prepared under Order 43910-6-0134 to the U.S. Fish and Wildlife Service; Jackson, Mississippi.
- Lazell, Jr. J.D., Jr. 1989. Wildlife of the Florida Keys: a natural history. Island Press; Washington, D.C.
- Mazzotti, F.J., L.A. Brandt, L.G. Pearlstine, W.M. Kitchens, T.A. Obreza, F.C. Depkin, N.E. Morris, and C.E. Arnold. 1993. An evaluation of the regional effects of new citrus development on the ecological integrity of wildlife resources in southwest Florida. Volume I. South Florida Water Management District. West Palm Beach, Florida.
- Moler, P.E. 1985a. Distribution of the eastern indigo snake, *Drymarchon corais couperi*, in Florida. *Herpetological Review* 16(2): 37-38.
- Moler, P.E. 1985b. Home range and seasonal activity of the eastern indigo snake, *Drymarchon corais couperi*, in northern Florida. Final Performance Report, Study E-1-06, III-A-5. Florida Game and Freshwater Fish Commission; Tallahassee, Florida.
- Moler, P.E. 1992. Rare and endangered biota of Florida. Volume III. Amphibians and reptiles. University presses of Florida; Gainesville, Florida.
- Moler, P.E. 1998. Personal communication. Biologist. Comments dated January 9, 2006, to the U.S. Fish and Wildlife Service on the technical/agency draft Multi-Species Recovery Plan for South Florida. Florida Fish and Wildlife Conservation Commission; Tallahassee, Florida.
- Moulis, R. 1976. Autecology of the eastern indigo snake, *Drymarchon corais couperi*. *Bulletin of the New York Herpetological Society* 12: 14-23.

- Parker, W.S. and M.V. Plummer. 2001. Population ecology in snakes: Ecology and Evolutionary Biology (Seigel, R.A., J.T. Collins, and S.S. Novak, editors). The Blackburn Press; Caldwell, New Jersey. pp. 253-301.
- Rumbold, D.G. 2005. A probabilistic risk assessment of the effects of methylmercury on great egrets and bald eagles foraging at a constructed wetland in South Florida relative to the Everglades. *Human Ecology and Risk Assessment* 11(2): 365-388.
- Shaw, C.E. 1959. Longevity of snakes in the United States as of January 1, 1959. *Copeia* 1959(4): 336-337.
- Smith, C.R. 1987. Ecology of juvenile and gravid eastern indigo snakes in north Florida. M.S. thesis, Auburn University; Auburn, Alabama.
- Smith, R. 2003. Personal communication. Biologist. Presentation to the U.S. Fish and Wildlife Service on February 24, 2003. Dynamac Corporation; Kennedy Space Center, Florida.
- Speake, D.W., J.A. McGlincy, and T.R. Colvin. 1978. Ecology and management of the eastern indigo snake in Georgia: A progress report. Pages 64-73 in R.R. Odum and L. Landers, editors. *Proceedings of rare and endangered wildlife symposium*, Georgia Department of Natural Resources, Game and Fish Division; Technical Bulletin WL 4.
- Speake, D.W., D. McGlincy, and C. Smith. 1987. Captive breeding and experimental reintroduction of the eastern indigo snake. Pages 84-90 in *Proceedings of the 3rd Southeastern Nongame and Endangered Wildlife Symposium*; Athens, Georgia.
- Steiner, T.M., O.L. Bass, Jr., and J.A. Kushlan. 1983. Status of the eastern indigo snake in Southern Florida National Parks and vicinity. South Florida Research Center Report SFRC-83-01, Everglades National Park; Homestead, Florida.
- U.S. Fish and Wildlife Service. 1977. Final correction and augmentation of critical habitat reorganization. *Federal Register* 42 FR 47840-47845. September 22, 1977.
- U.S Fish and Wildlife Service. 1999. South Florida Multi-Species Recovery Plan. Southeast Region; Atlanta, Georgia.
- U.S. Fish and Wildlife Service. 2001. Florida Manatee Recovery Plan (*Trichechus manatus latirostris*), Third Revision. Atlanta, Georgia.
- U. S. Fish and Wildlife Service. 2002. Standard protection measures for the eastern indigo snake. South Florida Ecological Services Office; Vero Beach, Florida.
- Zeigler, M. 2006. Personal communication. Citrus grove operations manager. Meeting with the U.S. Fish and Wildlife Service on August 1, 2006. Agricultural Resource Management; Vero Beach, Florida.

Table 1. Table of acronyms and abbreviations used in this Biological Opinion.

Acronym/Abbreviation	Definition
ABS	Archbold Biological Station
Ac-ft	Acre-feet
C&SF	Central and Southern Florida
CERP	Comprehensive Everglades Restoration Plan
CFR	Code of Federal Register
cfs	cubic feet per second
CGM	CERO Guidance Memorandum
Corps	United States Army Corps of Engineers
CR	County Route
Cu	Copper
District	South Florida Water Management District
EAA	Everglades Agricultural Area
ESA	Endangered Species Act of 1973, as amended
ft	feet
FWC	Florida Fish and Wildlife Conservation Commission
FWCA	Fish and Wildlife Conservation Act
ha	hectare
IRL-S	Indian River Lagoon - South
MSRP	Multi-Species Recovery Plan
NSLRWCD	North St. Lucie River Water Control District
PIR	Project Implementation Report
SEIS	Supplemental Environmental Impact Statement
Service	United States Fish and Wildlife Service
SR	State Route
STA	Stormwater Treatment Area

Table 2. The various wetland habitat types in the project area and their respective hydroperiod class for pre- and post-construction conditions.

Wetland or Surface Water Ecotype*	Hydroperiod Class**	Acres Pre-Construction	Hydroperiod Class	Acres Post-Construction
Freshwater Marsh	4	0.63	4	0.13
Mixed Wetland Hardwoods	4	1.90		
Agricultural Ditches	6	41.80		
Ponds	7	2.10		
Cypress	7	21.70	7	19.50
Agricultural Canals	7	17.60		
Littoral shelf on seepage canal			4	3.90
Seepage Canal			6	42.50
STA (freshwater marsh)			7	1950.50
Distribution Canals			7	15.70
Deep zone trenches			7	18.70
Internal STA distribution canals			7	43.50
Pump station discharge basin			7	3.20

* based on SFWMD FLUCCS codes and verified with a field visit for existing conditions

** based on the classes below

Hydroperiod Class

- Class 1: 0 to 60 Days
- Class 2: 60 to 120 Days
- Class 3: 120 to 180 Days
- Class 4: 180 to 240 Days
- Class 5: 240 to 300 Days
- Class 6: 300 to 330 Days
- Class 7: 330 to 365 Days

Table 3. The results of the wood stork foraging assessment showing prey biomass estimates per hydroperiod class. There was an overall net gain of approximately 2,032 acres of wetlands which would provide approximately 10,564 kilograms of annual wood stork prey.

Hydroperiod	Existing Footprint		Preserve Areas				Net Change Per Hydroperiod Class	
			Pre Enhancement		Post Enhancement			
	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams
Class 1								
Class 2								
Class 3								
Class 4	2.40	7.85	0.13	0.61	3.90	18.23	1.63	10.98
Class 5								
Class 6	41.80	99.83			42.50	274.33	0.70	174.50
Class 7	21.90	62.88	19.50	138.89	2,031.60	10,302.34	2,029.20	10,378.34
Total	66.10	170.57	19.63	139.50	2,078.00	10,594.89	2,031.53	10,563.82



Figure 1. The various features surrounding the C-23/24 STA Project site in St Lucie County.

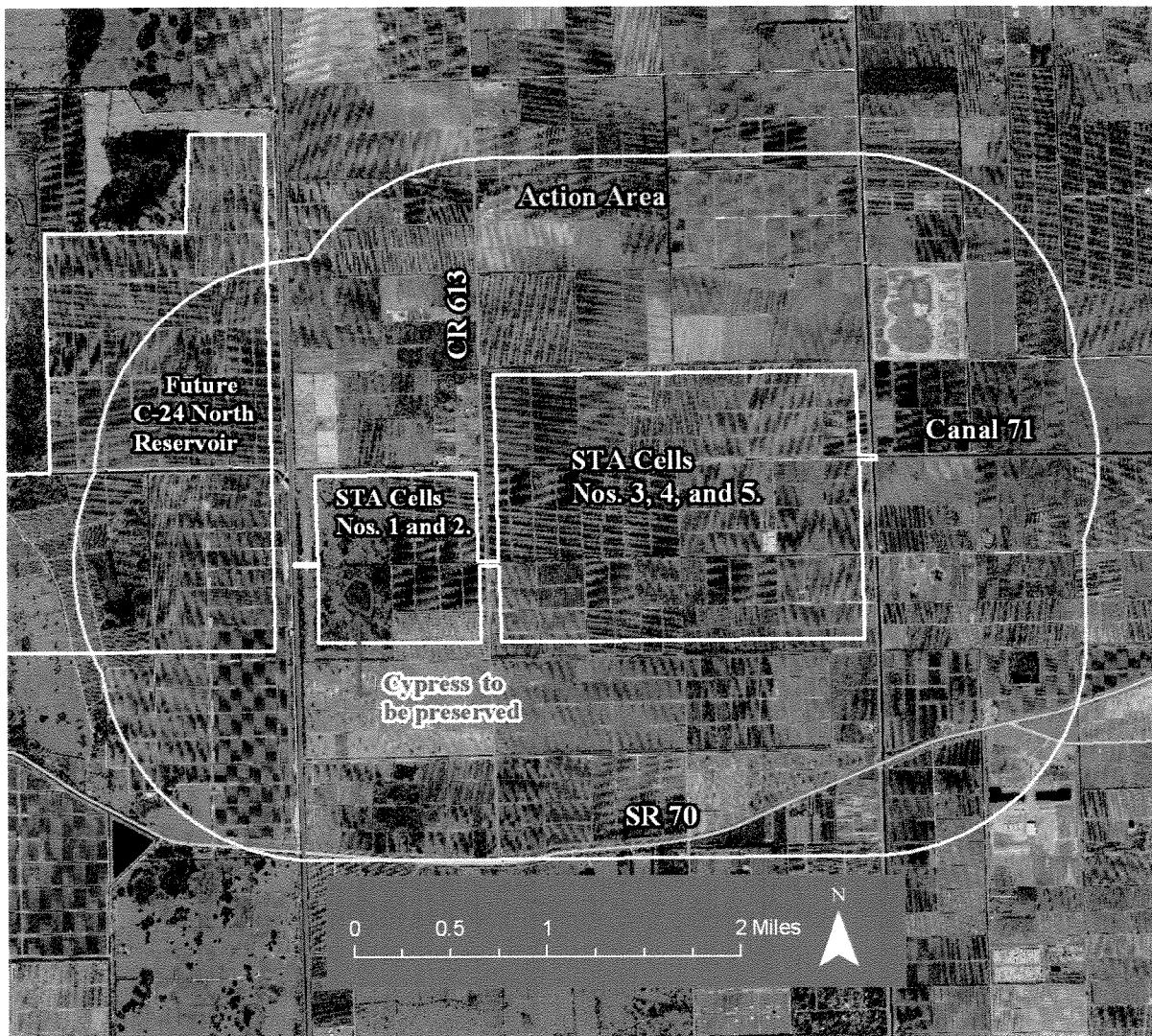


Figure 2. The action area for the C-23/24 STA Project site in St Lucie County as shown on a 2004 natural color aerial photograph. The agricultural areas are primarily citrus.