

VOLUME II OF III

CALCULATIONS AND REPORTS

Natural Resources Evaluation Report

**Improvements to SW 87 Avenue
Bridge Over Canal C-100**

Miami-Dade County

Small Business Enterprise-Construction Program (SBE-CONST.):
SBE-Con 22.01%

Small Business Enterprise-Services Program (SBE-S):
SBE-S 0.26%

Community Workforce Program:
N/A

DTPW Capital Improvements Engineer:
Katherine Fernandez

RPQ Issue Date:
May 26, 2022

NATURAL RESOURCES EVALUATION REPORT

SW 87th Avenue Bridge Over the C-100 Canal From SW 164th Street to SW 163rd Terrace

Miami-Dade County Project No. EDP-2024



Prepared By:

*Cyriacks Environmental Consulting Services (CECOS), Inc.
3001 Southwest 15th Street, Suite B
Deerfield Beach, FL 33442*



In Association with:

*R.J. Behar & Company, Inc.
6861 SW 196th Avenue, Ste 302
Pembroke Pines, FL 33332*

NOVEMBER 2021

□□□□ □□□□□□□□

1.0	Executive Summary.....	1
2.0	Project Description	1
3.0	Existing Conditions	4
3.1	Land Use.....	4
3.2	Soils	4
3.3	Other Natural Features.....	4
4.0	Protected Species and Habitat	8
4.1	Data Collection	8
4.2	Assessment and Methodology	8
4.2.1	Terrestrial Survey	8
4.2.2	Benthic Survey.....	9
4.3	Listed Species Occurrence	9
4.3.1	Federally Listed Species.....	9
4.3.1.1	<i>Eastern Indigo Snake</i>	10
4.3.1.2	<i>American Crocodile</i>	10
4.3.1.3	<i>Sea Turtles</i>	12
4.3.1.4	<i>Wood Stork</i>	12
4.3.1.5	<i>West Indian (Florida) Manatee</i>	12
4.3.1.6	<i>Florida Bonneted Bat</i>	12
4.3.1.7	<i>Smalltooth Sawfish</i>	14
4.3.1.8	<i>Johnson's Seagrass</i>	16
4.3.2	State Listed Species	16
4.3.2.1	<i>Rim Rock crowned snake</i>	17
4.3.2.2	<i>Gopher tortoise</i>	17
4.3.2.3	<i>White-crowned Pigeon</i>	17
4.3.2.4	<i>Little Blue Heron</i>	17
4.3.2.5	<i>Tricolored Heron</i>	17
4.3.2.6	<i>Burrowing Owl</i>	17
4.3.2.7	<i>Smooth Strongbark</i>	18
4.3.2.8	<i>Florida Tree Fern</i>	18
4.3.2.9	<i>Eaton's Spike Moss</i>	18
4.3.2.10	<i>Redberry Stopper</i>	18
4.3.2.11	<i>Florida Royal Palm</i>	18
4.3.2.12	<i>Silver Palm</i>	18
4.3.2.13	<i>West Indian Cherry</i>	19
4.3.2.14	<i>West Indian Mahogany</i>	19

4.4	Incidental species.....	19
4.5	Listed Species Effect Determinations.....	19
4.5.1	Federally Listed Species.....	20
4.5.1.1	<i>Eastern Indigo Snake</i>	20
4.5.1.2	<i>American Crocodile</i>	20
4.5.1.3	<i>Sea Turtles</i>	21
4.5.1.4	<i>Wood Stork</i>	21
4.5.1.5	<i>Florida Manatee</i>	21
4.5.1.6	<i>Florida Bonneted Bat</i>	21
4.5.1.7	<i>Smalltooth sawfish</i>	22
4.5.1.8	<i>Johnson's seagrass</i>	22
4.5.2	State Listed Species	22
4.5.2.1	<i>Rim Rock Crowned Snake</i>	23
4.5.2.2	<i>Gopher Tortoise</i>	23
4.5.2.3	<i>State listed birds</i>	23
4.5.2.4	<i>State-listed plant species</i>	23
4.6	Cumulative Impacts.....	23
5.0	Wetlands and Other Surface Waters	23
5.1	Assessment Methodology	24
5.2	Existing Wetlands and Other Surface Waters	24
5.2.1	Potential Project Impacts	26
6.0	Essential Fish Habitat.....	26
7.0	Conclusions.....	26
8.0	References	27

Figure 1 – Project Location Map.....	2
Figure 2 – Proposed Project Plan.....	3
Figure 3 – Existing Land Use Map	5
Figure 4 – Soils Map	6
Figure 5 – Other Natural Features.....	7
Figure 6 – USFWS Species Consultation Areas Map	11
Figure 7 – Wood Stork Core Foraging Area Map	13
Figure 8 – FBB Consultation Area and SF Urban Bat Area Map.....	15
Figure 9 – Wetland and Surface Waters Map.....	25

□**S**□ □ □ □ □ □ □**S**

Table 1 – Mapped Soils Within 500 feet of the Project.....	4
Table 2 – Federally Listed Species Probability of Occurrence	10
Table 3 – FBB Potential Roosting Habitat.....	14
Table 4 – State Listed Species Probability of Occurrence.....	16
Table 5 – Incidental Species Observed within the Project Area.....	19
Table 6 – Federally Listed Species Determination of Effect.....	20
Table 7 – State Listed Species Determination of Effect.....	22

LIST OF APPENDICES

Appendix A – Ground Level Photographs

Appendix B – Standard Protection Measures for Eastern Indigo Snake and Consultation Key for the
Eastern Indigo Snake

Appendix C – Wood Stork Effect Key and Determination and Habitat Management Guidelines

Appendix D – Manatee Accessibility Map and Standard Protection Measures

1.0 Executive Summary

The Miami-Dade County Department of Transportation and Public Works (DTPW) is proposing to construct a new bridge on SW 87th avenue over the C-100 Canal between SW 164th Street and SW 163rd Terrace (see **Figure 1**). This project is located in Miami-Dade County within the incorporated City of Palmetto Bay. The length of the project is approximately 700 feet.

The purpose of this report is to document the threatened and endangered species and wetland analyses in support of the environmental study consistent with federal, state, and local objectives for the proposed bridge.

The analysis results determined that this project **May Affect, Not Likely to Adversely Affect** the federally listed Eastern indigo snake, American crocodile, Wood Stork, Florida manatee, and Florida bonneted bat (FBB), and will have **No Effect** on sea turtles, smalltooth sawfish, and Johnson's seagrass.

The project will also have **No Effect Anticipated** to the state listed rim rock crown snake, gopher tortoise (which is a candidate species for federal listing), all state listed birds, and all state listed plants.

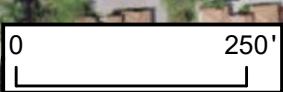
The FLUCCs 510 category includes rivers, creeks, canals, and other linear waterbodies. The project crosses the C-100 Canal. No natural wetland systems are present. Direct impacts to the South Florida Water Management District (SFWMD) C-100 Canal is anticipated including the addition of new pilings, in-water construction, and increased shading as a result of the new bridge. The C-100 Canal is connected to Biscayne Bay, located approximately two (2) miles east. However, the project is located west of the S-123 control structure and as such it is nontidal and freshwater within the project area. A benthic survey was conducted and benthic resources (i.e., tape grass (*Vallisneria americana*)) were identified. An estimated 0.06 acre of tape grass will be impacted due to in water work and will require mitigation. Suitable Foraging Habitat (SFH) for the Wood stork is anticipated to be impacted and will also require mitigation.

Essential Fish Habitat (EFH) was evaluated for this project. According to the National Oceanic and Atmospheric Administration (NOAA) Fisheries EFH Mapper, no EFH is present within the C-100 Canal at the location of the project.

2.0 Project Description

The DTPW proposes to construct a new bridge over the C-100 Canal (see **Figure 1**). This project is located within the incorporated City of Palmetto Bay.

The project consists of the construction of a new section of SW 87th Avenue, from south of SW 164th Street to SW 163rd Terrace and includes the construction of a new bridge over C-100 Canal with associated MSE Walls, drainage improvements and street lighting. The length of the project is approximately 700 feet. The roadway/bridge typical section consists of one 11-foot travel lane in each direction with a 5-foot bike lane and 8-foot concrete sidewalk on each side. The new bridge over the C-100 Canal will have a span length of 66-feet 4-inches and a vertical clearance of 6-feet 11-inches. Dredging in the C-100 Canal is also proposed due to the SFWMD requirement to meet the design canal cross section depth. Due to the need for dredging, in-water work using barges is anticipated. **Figure 2** illustrates the proposed project plan.

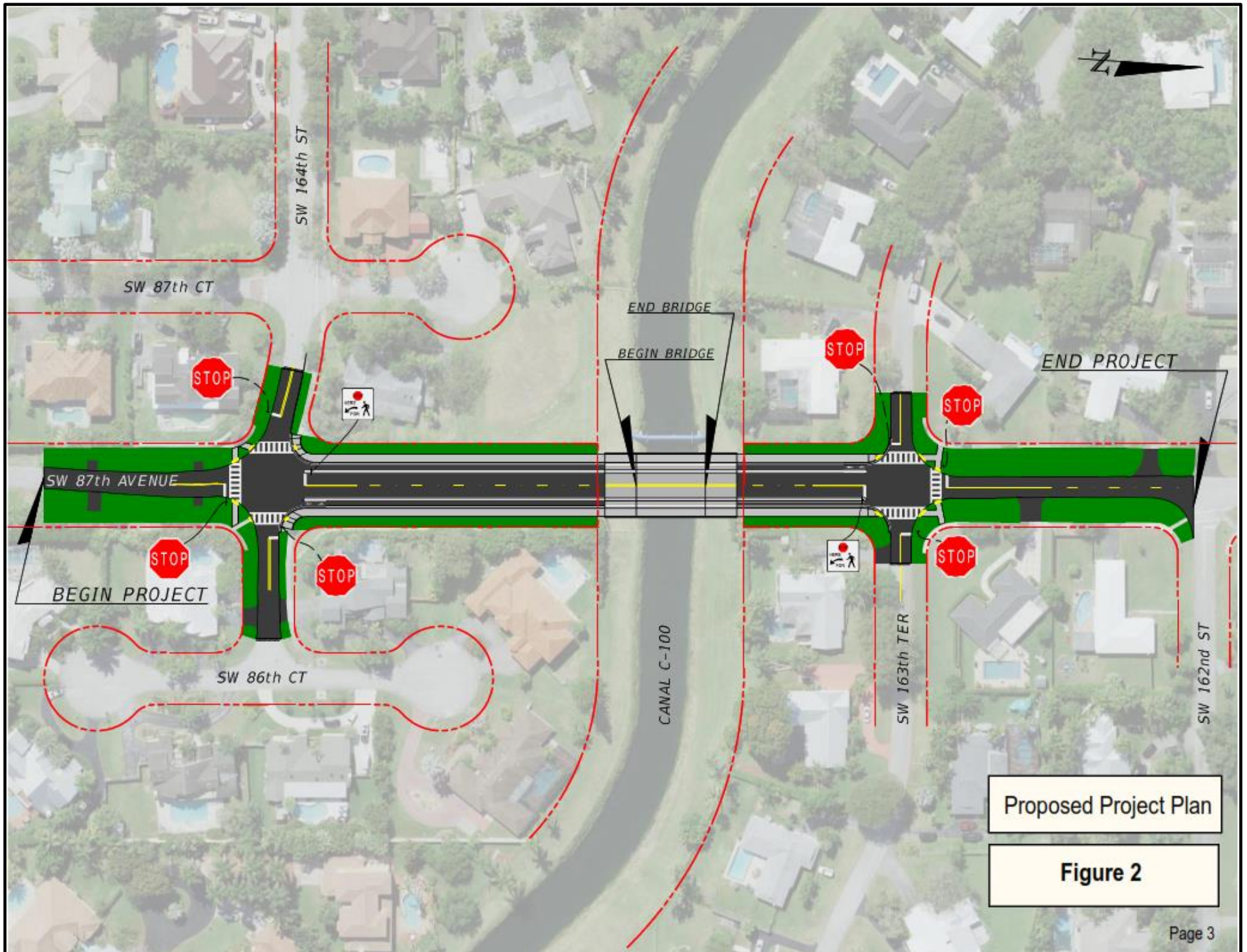


SW 87th Ave □□□
 Bridge Design Over
 C-100 Canal

Project
 Location Map

Figure 1

2017 Basemap Source: ESRI
 Prepared: September 15, 2021



Proposed Project Plan

Figure 2

3.0 Existing Conditions

The project begins along SW 87th Avenue from SW 164th Street and continues north to SW 163rd Terrace. The project area consists of a completely developed urban environment, with minimal habitat for listed species within and immediately adjacent to the right-of-way (ROW). The C-100 Canal is owned and managed by the SFWMD and is a dredged manmade waterway with steep side slopes and the top of bank on either side of the canal is grassed (primarily St. Augustine grass) and maintained. Vegetation within the proposed SW 87th Avenue ROW is also grassed with sporadic landscaped trees and palms.

3.1 Land Use

Existing land use within and adjacent to the project was mapped using the Land Use Layer from the SFWMD Geographic Information System (GIS) Data Catalog. Land use within the ROW is transportation (undeveloped road and highway) with supporting features such as stormwater drains, and the C-100 canal. The primary land use adjacent to the project corridor is comprised of developed residential homes and open land. **Figure 3** depicts the existing land use and cover within 500 feet of the project corridor.

3.2 Soils

Based on the *Natural Resources Conservation Service (NRCS) Soil Survey*, mapped soil types within close proximity to the proposed bridge are classified in **Table 1** and shown in **Figure 4**.

None of the soils listed below in **Table 1** are classified as hydric. The soils are characterized as well-drained to excessively drained soils that consists of fill material, and areas covered by buildings and pavement. Most of the areas within and adjacent to the project corridor have been disturbed by residential development and may not currently exhibit historic soil conditions.

Table 1 - Mapped Soils within 500 feet of the Project

Soil Name	Hydric Rating
Udorthents, marl substratum – Urban land complex	No
Udorthents, limestone substratum - Urban land complex	No

3.3 Other Natural Features

Biscayne Bay is an Aquatic Preserve and Outstanding Florida Water (OFW) and is a large estuary bordering Miami-Dade County on the Atlantic coast and numerous natural and unnatural waterways that are tidally connected to the Bay. The C-100 Canal connects to Biscayne Bay and the Bay is located about two (2) miles east of the project corridor (See **Figure 5**). While the C-100 Canal connects to Biscayne Bay, the canal is not tidally influenced due to the presence of the S-123 control structure and is determined to be freshwater.



SW 87th Ave □□□ Bridge Design Over C-100 Canal

Existing Land Use Map

Legend

FLUCCS Description

- 120 - Residential, Medium Density
- 510 - Canals and Waterways
- 814 - Roads and Highways
- 814(U) - Undeveloped Roads and Highways
- 816 - Canals and Locks

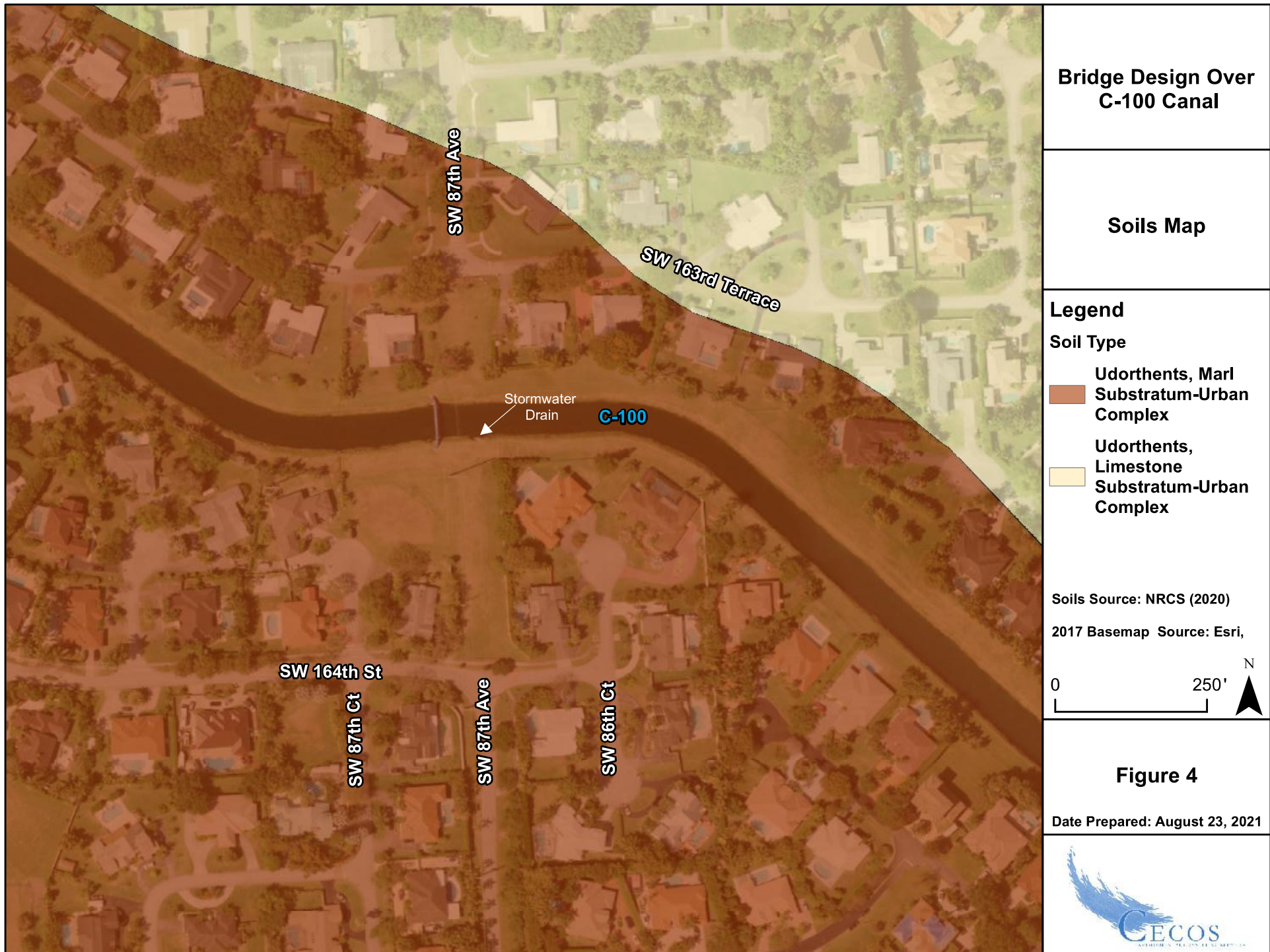
Existing Land Use Source:
 SFWMD (2016) and Miami-Dade
 GIS Database (2020) and Aerial
 Image Interpretation (ESRI 2017)
 2017 Basemap Source: ESRI

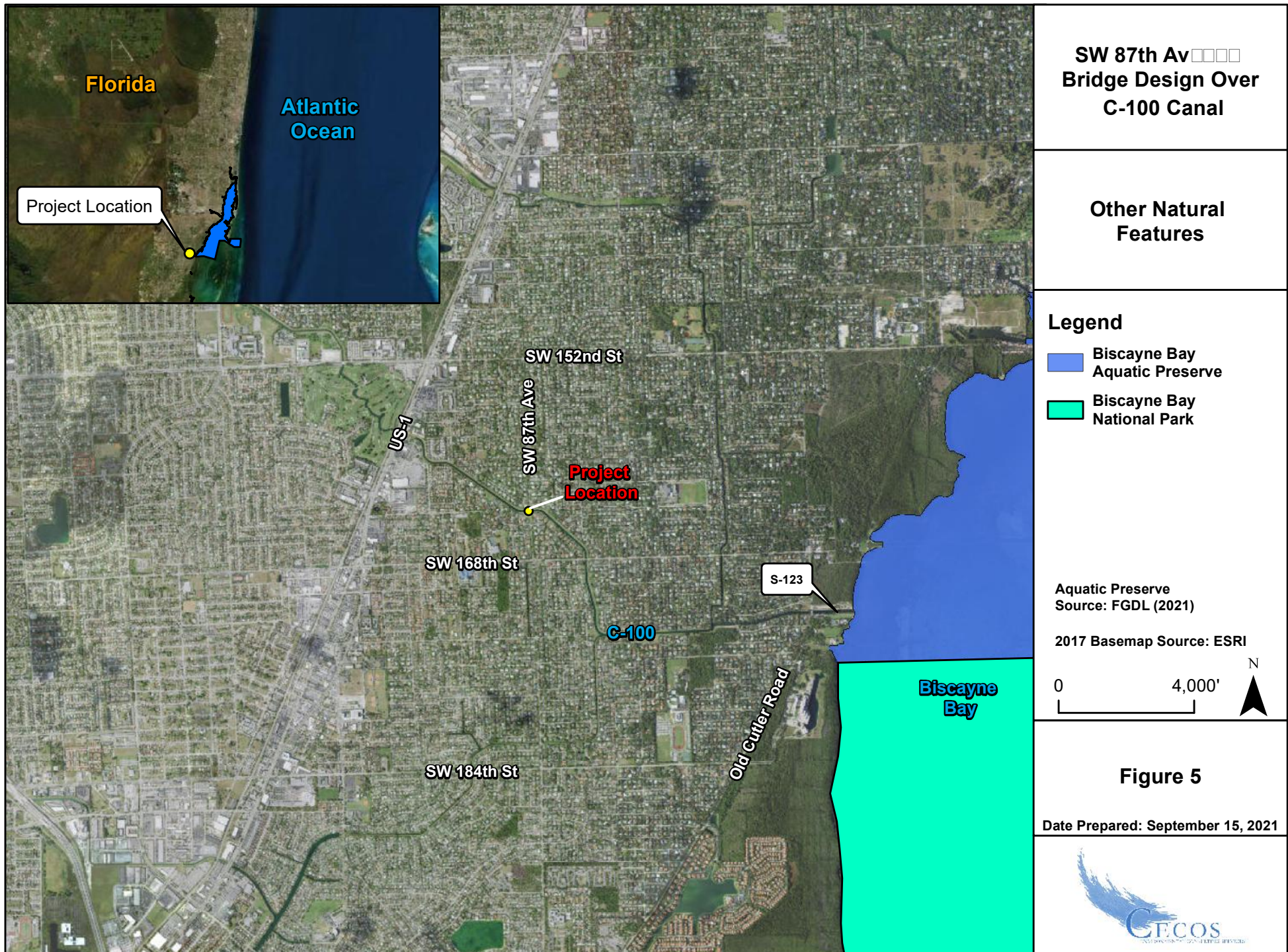


Figure 3

Date Prepared: September 16, 2021







4.0 Protected Species and Habitat

This project was evaluated for impacts to wildlife and habitat resources, including protected species, in accordance with *50 Code of Federal Regulations (CFR) Part 402 of the Endangered Species Act (ESA) of 1973, as amended*. Wildlife species are protected under the ESA, the *Migratory Bird Treaty Act (MBTA)*, and the State of Florida, pursuant to *Florida Statute 379.411*.

4.1 Data Collection

A preliminary desktop review was conducted prior to performing field assessments to establish baseline information. Data collection through literature review, regulatory agency databases, agency coordination, and GIS analyses were performed to identify federal and state protected species occurring or potentially occurring within the project area that may be impacted by the construction of the proposed bridge and improvements. Information sources and databases used for the wildlife analyses include the following:

- ESRI and Google Earth aerial imagery
- Florida Natural Areas Inventory (FNAI) Biodiversity Matrix
- Florida Fish and Wildlife Conservation Commission (FWC) databases
- FWC Bald Eagle Nesting database
- FWC Waterbird Colony Locator
- FWC's Strategic Habitat Conservation Areas (SHCA)
- National Marine Fisheries Service (NMFS) Essential Fish Habitat (EFH) Mapper, v3.0
- USFWS Environmental Conservation Online System (ECOS)
- USFWS Information for Planning and Consultation (IPaC)
- USFWS Listed Species GIS databases
- USFWS CERP Manatee Accessibility Map
- USFWS South Florida Multi-Species Recovery Plan (1999)

4.2 Assessment and Methodology

4.2.1 Terrestrial Survey

Six (6) transects (three (3) on the north side of the C-100 Canal and three (3) on the south side of the C-100 Canal) were used to survey the upland areas within the SW 87th Ave ROW. The transects were placed north to south, perpendicular to the C-100 Canal, approximately 15-20 feet apart and extended from the top of the canal bank to the project limits; approximately 250 feet on the north side and approximately 415 feet on the south side. Additional transects were done east and west along the canal banks approximately 128.5 feet on either side of the ROW centerline. This survey was conducted on August 9th, 2021, during daylight hours. The weather conditions were sunny, clear, and the temperature was approximately 89° F. The area was surveyed for protected plant and animal species.

In accordance with the US Fish and Wildlife Service (USFWS) Florida Bonneted Bat Guidelines (October 22, 2019), a Limited Roost Survey was conducted to identify any potential roost structures. Any trees or structures within and immediately adjacent to the ROW that could potentially be suitable for bat roosting were visually inspected with binoculars on all sides for potential roosting characteristics (cavities, crevices, cracks, loose bark, or other deformations that could that provide shelter). Potential roost tree habitat was defined as

trees and snags (standing dead trees) ≥ 15 feet tall with a diameter at breast height (DBH) ≥ 8 inches and evidence of cavities, hollows, crevices, cracks, loose bark, or other deformations that are large enough for FBB, per the potential roosting habitat outlined in the Consultation Key for the Florida bonneted bat (USFWS 2019). Trees were identified and the approximate height and DBH were recorded, and the location noted on aerial maps. Trees and existing structures were inspected for indications of bat use including guano, guano/urine staining, and audible chirps.

4.2.2 Benthic Survey

A benthic survey was conducted in the C-100 Canal on August 9th, 2021, during daylight hours to identify marine resources in the project area. The benthic survey consisted of three (3) transects from east to west within the canal, extending 128.5 feet east and west from the proposed bridge centerline. Weather conditions were clear, and temperature was approximately 89°F. The water elevation did not change from the hours of 10:00 am to 3:30 pm. The C-100 Canal appeared to be freshwater and nontidal. Photographs from the field surveys are included in **Appendix A**.

4.3 Listed Species Occurrence

The USFWS listed species database for Miami-Dade County and FNAI were reviewed to develop a project-specific protected species list. This list was then compared to field conditions during the field reviews to correlate the habitat of each listed species with habitat present on the corridor.

4.3.1 Federally Listed Species

Based on the results of the combined desktop and on-site reviews, the federally listed species with potential to exist within or adjacent to the project are presented in **Table 2**. Each species was assigned a **No**, **Low**, **Moderate**, or **High** probability of occurrence within the project based on the following definitions:

- **No** – The project is outside the species' known range, or the project is within the species' range but no suitable habitat for, or previous documentation of this species occurs, within the project, and the species was not observed during field reviews.
- **Low** – The project is located within the species' known range and minimal or marginal quality habitat is present within or adjacent to the project. However, there are no documented occurrences of the species in the vicinity, and it was not observed during field reviews.
- **Moderate** – The project is within the species' range and suitable habitat exists; but there are no known occurrences of the species, and it was not observed during field reviews.
- **High** – The project is within the species' known range, suitable habitat exists within the project, there is a minimum of one documented occurrence of the species within the project, and/or the species was observed during field reviews.

Note that federally listed species are also considered state-listed species.

Table 2 - Federally Listed Species Probability of Occurrence

Scientific Name	Common Name	Listing Status	Probability of Occurrence
REPTILES			
<i>Drymarchon corais couperi</i>	Eastern indigo snake	FT	Low
<i>Crocodylus acutus</i>	American crocodile	FT	Low
<i>Caretta caretta</i>	Loggerhead sea turtle	FT	No
<i>Chelonia mydas</i>	Green sea turtle	FE	No
<i>Dermochelys coriacea</i>	Leatherback sea turtle	FE	No
<i>Eretmochelys imbricata</i>	Hawksbill sea turtle	FE	No
BIRDS			
<i>Mycteria americana</i>	Wood stork	FT	Moderate
MAMMALS			
<i>Trichechus manatus latirostris</i>	Florida manatee	FT	Moderate
<i>Eumops floridanus</i>	Florida bonneted bat	FE	Moderate
FISH			
<i>Pristis pectinata</i>	Smalltooth sawfish	FE	No
PLANTS			
<i>Halophila johnsonii</i>	Johnson's seagrass	FT	No

□□□□: FT = Federally designated Threatened; FE = Federally designated Endangered

S□□□□□: FWC. June 2021. *Florida's Endangered Species, Threatened Species and Species of Special Concern. Official Lists*; FNAI. 2021. *Biodiversity Matrix*; USFWS. 2020. *ECOS*; USFWS. September 2006. *Central and Southern Florida Project Manatee Accessibility*. SFWMD Miami Field Station. 2019 *Florida Bonneted Bat Consultation Key*; Institute for Regional Conservation. 2021. *Floristic Inventory of South Florida Database Online*.

4.3.1.1 Eastern Indigo Snake

The project site is within USFWS consultation area for the Eastern Indigo snake (see **Figure 6**). Habitat requirements for the Eastern indigo snake are broad, ranging from scrub and sandhills to wet prairies and disturbed uplands. These snakes can also inhabit gopher tortoise burrows. However, no burrows were observed within the project area, and minimal habitat for both the gopher tortoise and Eastern indigo snake was present in the survey area. Individuals of this species were not observed during field reviews. A probability of occurrence of **Low** was assigned.

4.3.1.2 American Crocodile

The project site is within USFWS consultation area for the American crocodile (see **Figure 6**). The American crocodile is federally and state listed as threatened due to human activities and coastal development. During the non-nesting season, the American crocodile inhabits brackish or saltwater and can be found in ponds, coves, canals, and creeks in mangrove swamps in southern Florida. During the non-nesting season, the American crocodile is found primarily in fresh and brackish water inland swamps, creeks, and bays. Nesting habitat includes sites with well drained sandy shorelines or marl creek banks adjacent to deep water. Crocodiles also nest on elevated man-made structures such as sandy canal berms. However due to the existing control structure located approximately two (2) miles east of the project, the potential for these





**SW 87th Ave □□□
Bridge Design Over
C-100 Canal**

**USFWS
Species Consultation
Areas Map**

Legend

Species Habitat

-  American Crocodile
-  Eastern Indigo Snake

Consultation Areas Source:
FWS 2020

2017 Basemap Source: Esri,



Figure 6

Date Prepared: Septmeber 16, 2021



species to be present is low. In addition, suitable nesting habitat is not present in the project area due to the steep canal slopes. Individuals of this species were not observed during field reviews. A **Low** probability occurrence was assigned.

4.3.1.3 Sea Turtles

The green, leatherback, and hawksbill sea turtles are listed as endangered both federally and at the state level, and loggerhead sea turtles are federally and state listed as threatened. These marine turtles are often found in the coastal waters of Florida, although leatherbacks are rarely seen in coastal waters except when hatchlings are dispersing from nesting beaches. Sea turtles generally nest on sandy beaches near the dune lines, away from areas that are disturbed by tidal influences. These four (4) sea turtles are known to nest on the east coast of Florida. No nesting habitat exists within the project footprint for these sea turtles. Due to the existing control structure located approximately two (2) miles east of the project, the potential for these species to be present is not likely. A probability of **No** was assigned to all sea turtle species.

4.3.1.4 Wood Stork

The wood stork is a large wading bird that nests in inundated wetland forests and forages in water depths ranging from two (2) to 15 inches. The project corridor falls within the Core Foraging Area (CFA), 18.6 miles of three (3) nesting wood stork colonies; the Tamiami Trail West, Tamiami Trail East 1, and Tamiami Trail East 2 (see **Figure 7**). The Tamiami Trail West colony was last recorded active in 2019. The Tamiami Trail East 1 and the Tamiami Trail East 2 colonies were last recorded active in 2013 and 2010, respectively. Portions of the C-100 Canal may be SFH for this species although individuals of this species were not observed during the field review. A **Moderate** probability of occurrence was assigned.

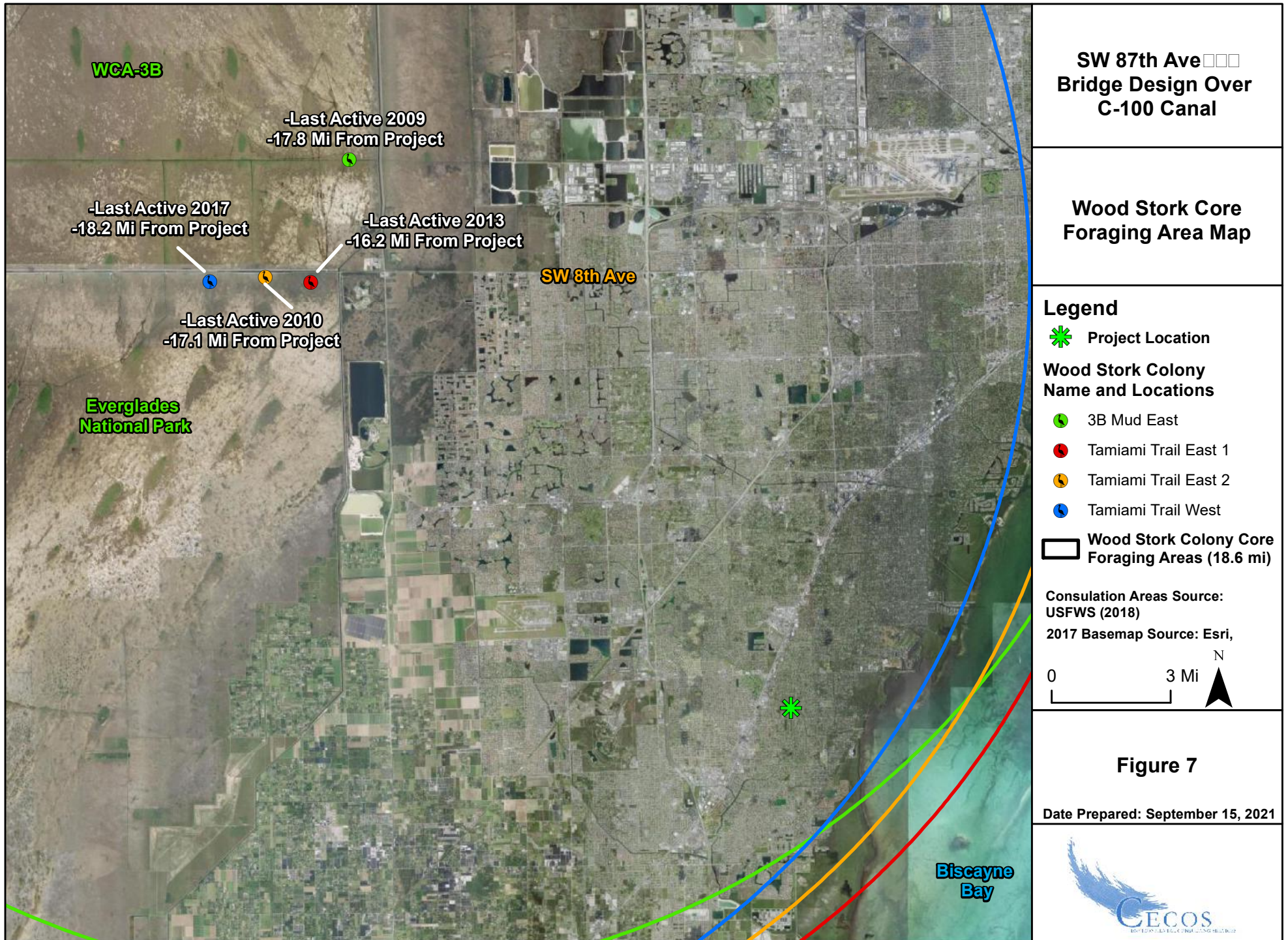
4.3.1.5 West Indian (Florida) Manatee

The West Indian (Florida) manatee is listed as threatened by the USFWS. Florida manatees utilize coastal waters, bays, estuaries, rivers, canals, and occasionally lakes. The project is located along the C-100 canal, which according to USFWS' Central and Southern Florida Project Manatee Accessibility Map from the SFWMD Miami Field Station, is accessible to manatee. No manatees were sighted during the field review. A probability of **Moderate** was assigned to this species.

4.3.1.6 Florida Bonneted Bat

The Florida bonneted bat is listed as endangered by USFWS and FWC due to habitat loss and a restricted range. They are suspected to be found in only six (6) counties in southern Florida, including Miami-Dade County. This species is endemic, non-migratory, and roosts within a variety of habitat types such as pine flatwoods, scrubby flatwoods, pine rocklands, royal palm hammocks, mixed or hardwood hammocks, cypress, sand pine scrub, or other forest types. The species may also utilize artificial or man-made structures for roosting, including buildings, bridges, and bat houses.

The project site is located within USFWS 2019 Florida Bonneted Bat Consultation Area and South Florida Urban Bat Area (**Figure 8**). According to USFWS's Florida Bonneted Bat Guidelines, roosting generally occurs in tall, mature trees greater than 33 feet in height, greater than eight (8) inches in DBH, with cavity elevations higher than 16 feet above ground level and retain Potential Roost Features (PRF) cavities, hollows,



deformities, decay, crevices, dead palm leaves, or loose bark. Foraging generally occurs near sources of drinking water and prey in relatively open areas, including open fresh water, marsh, upland forests, or urban development in patches of natural or semi-natural habitat such as golf courses or parks. Within the project there is little open space available for foraging, however, the C-100 Canal may provide both a foraging space and a commuting route for the FBB.

In accordance with the USFWS's Florida Bonneted Bat Guidelines, a Limited Roost Survey was conducted to identify any potential roost structures. Any trees or structures within the right-of-way that could potentially be suitable for bat roosting were visually inspected with binoculars on all sides accessible for potential roosting characteristics (cavities, crevices, cracks, loose bark, or other deformations that could provide shelter). Potential roost tree habitat was adopted from the Florida Bonneted Bat Guidelines (USFWS, 2019) with a modified, conservative methodology for urban areas. Under this conservative methodology, potential roost tree habitat was defined as trees and snags (standing dead trees) ≥ 15 ft. tall with a diameter at breast height ≥ 8 inches (in.) and evidence of PRF such as cavities, hollows, crevices, cracks, loose bark, or other deformations that are large enough for FBB (≥ 1 in. diameter). Trees within and adjacent to the project were surveyed by two biologists using binoculars.

One (1) bishop wood (*Bischofia javanica*) tree and two (2) royal palms (*Roystonea regia*) that meet the height and DBH criteria were observed. No PRF were observed on the bishop wood tree. The two (2) royal palms contained PRF in the form of overlapping dying/dead and live leaves at the palm shaft that may provide shelter for FBB. FBB have been documented roosting in royal palm shafts similar to those found in the corridor. **Table 3** presents the locations of these three potential roosting habitats.

Table 3 – FBB Potential Roosting Habitat

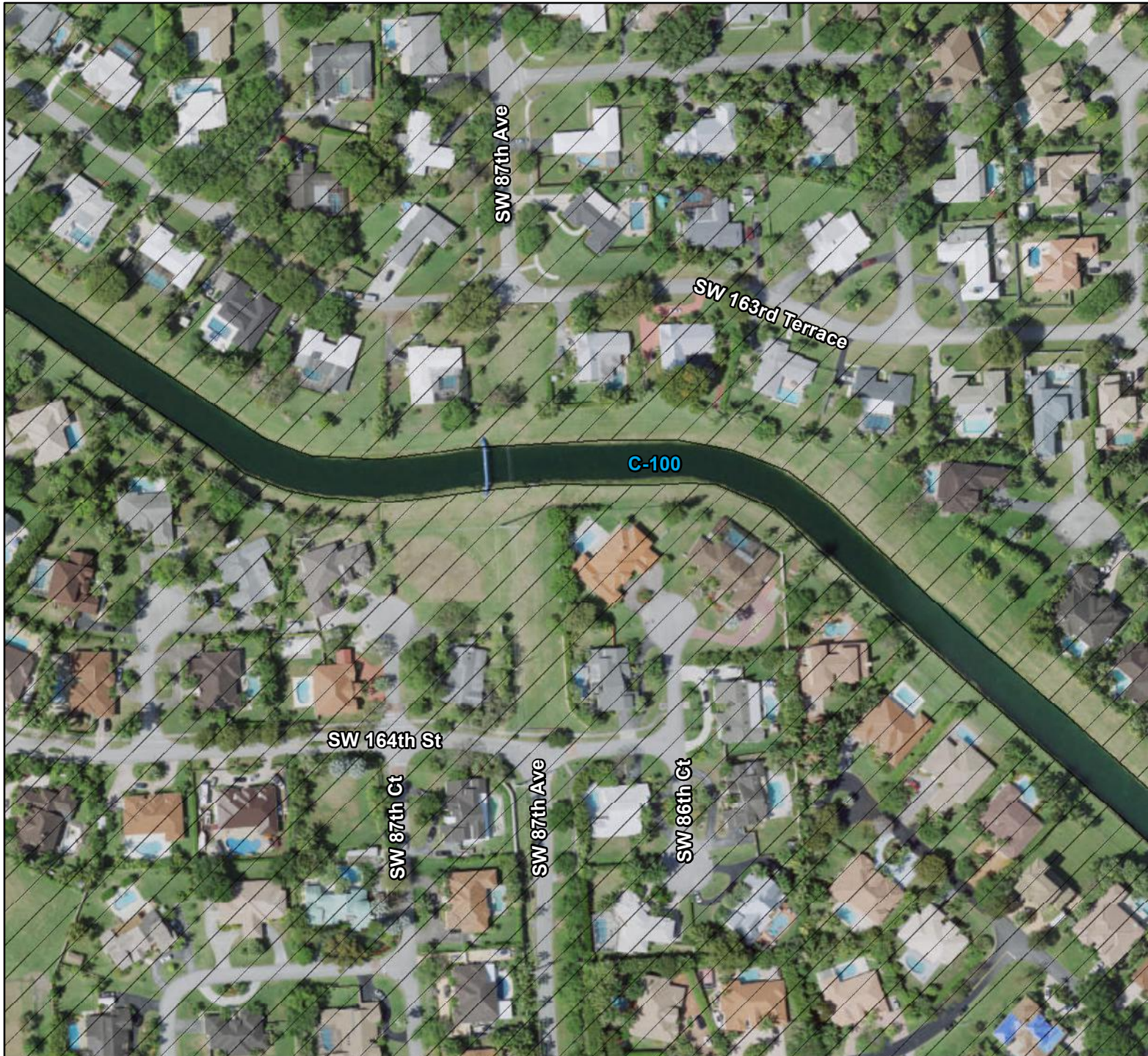
Species of tree	Location (LAT/LONG)	Suitable Roosting Habitat
Bishop wood	25.6182804, -80.33305	No
Royal Palm (north side)	25.6182404, -80.3329	Yes
Royal Palm (south side)	25.6167908, -80.33297	Yes

During the survey, no bats were observed, no auditory chirps were heard, and no indications (guano and guano/urine staining) of bat use were observed. A **Moderate** probability of occurrence was assigned.

Representative photos of potential roost habitat are included in **Appendix A**.

4.3.1.7 Smalltooth Sawfish


The smalltooth sawfish typically inhabits shallow, tropical coastal waters and estuarine habitats such as seagrass beds, mangroves, and inshore bars. They can be found in sheltered bays, estuaries, and mouths of rivers, and migrate to deeper waters as they grow. Development of Florida's shallow estuarine habitat has altered or reduced the amount of habitat available as nursery areas to young smalltooth sawfish, particular areas containing habitat fringed with vegetation such as mangroves. Due to the existing control structure located approximately two (2) miles east of the project the potential for these species to be present is not likely. No suitable habitat for smalltooth sawfish exists within the project. A probability of occurrence of **No** was assigned to this species.



SW 87th Ave
Bridge Design Over
C-100 Canal

FBB Consultation Area
and South Florida Urban
Bat Area Map

Legend

 Florida Bonneted Bat
and Urban Bat
Consultation Areas

Consultation Areas Source:
FWC 2019

2017 Basemap Source: Esri,



Figure 8

Date Prepared: Septmeber 15, 2021



4.3.1.8 Johnson's Seagrass

Johnson's seagrass is listed as Threatened by the NMFS. No Critical Habitat exists in the project footprint or surrounding area. Johnson's seagrass grows in shallow coastal lagoons and is found up to depths of approximately six (6) feet. This plant prefers coarse sand and muddy substrates in areas of turbid waters and high tidal currents. Distribution of Johnson's seagrass is heavily fragmented along the southeastern coastline from Sebastian Inlet to Biscayne Bay. Due to the limited distribution of this species, freshwater conditions in the C-100 at the location of the project, and historic dredging of the C-100 Canal, a probability of **No** was assigned to this species.

4.3.2 State Listed Species

Based on the results of the combined desktop (literature) and on-site review, the state-listed species with potential to exist within or adjacent to the project site are presented in **Table 4**. Each species was assigned a **No**, **Low**, **Moderate**, or **High** likelihood of occurrence within the study area based on the same criteria listed in Section 4.2.2.

Table 4 – State Listed Species Probability of Occurrence

Scientific Name	Common Name	Listing Status	Probability of Occurrence
REPTILES			
<i>Tantilla oolitic</i>	Rim Rock crowned snake	ST	No
<i>Gopherus polyphemus</i>	Gopher tortoise	ST/C	Low
BIRDS			
<i>Patagioenas leucocephala</i>	White-crowned pigeon	ST	No
<i>Egretta caerulea</i>	Little blue heron	ST	Moderate
<i>Egretta tricolor</i>	Tricolored heron	ST	Moderate
<i>Athene cunicularia</i>	Burrowing owl	ST	Low
PLANTS			
<i>Bouyeria cassiniifolia</i>	Smooth strongbark	SE	No
<i>Ctenitis sloanei</i>	Florida tree fern	SE	No
<i>Selaginella eatonii</i>	Eaton's spike moss	SE	No
<i>Eugenia confusa</i>	Redberry stopper	SE	No
<i>Roystonea elata</i>	Florida royal palm	SE	No
<i>Coccothrinax argentata</i>	Silver palm	ST	No
<i>Prunus myrtifolia</i>	West Indian cherry	ST	No
<i>Swietenia mahagoni</i>	West Indian mahogany	ST	Low

□□□: ST = State designated Threatened, SE = State designated Endangered; C = Candidate species for Federal listing under the ESA.

□□r□□: FWC. 2021 *Florida's Endangered Species, Threatened Species and Species of Special Concern*. Official Lists; FNAI. 2021. *Biodiversity Matrix*.

4.3.2.1 *Rim Rock crowned snake*

Rim rock crowned snake (RRCS) inhabit pine rockland and tropical hardwood hammocks near freshwater. This species is considered very rare and is currently under review for Federal listing under the Endangered Species Act by USFWS. Suitable habitat is not present and no RRCS were observed during the field review. A probability of occurrence of **No** was assigned to this species.

4.3.2.2 *Gopher tortoise*

Gopher tortoises live in well-drained sandy soils, typically with a sparse tree canopy and abundant herbaceous vegetation, such as pine flatwoods, scrub, dry prairies, coastal dunes, and disturbed uplands. Minimal habitat is present in adjacent canal banks along the corridor. No burrows or individuals of this species were observed during the field review. Note the tortoise is a candidate species for federal listing. The tortoise was assigned a **Low** probability of occurrence.

4.3.2.3 *White-crowned Pigeon*

This subtropical species occupies low lying forested areas, such as tropical hardwood hammocks and it is frugivorous. In Florida, nesting primarily occurs on mangrove-fringed islands with abundant fruit-bearing trees. No suitable habitat is present within the project. White-crowned pigeon (WCP) were not observed during the field review and a probability occurrence of **No** was assigned to this species.

4.3.2.4 *Little Blue Heron*

The little blue heron and tricolored heron are listed as threatened by FWC. Both species occupy similar habitat and have similar foraging patterns and both species have declined due to habitat loss associated draining and destruction of wetlands for agriculture and development.

This heron is a medium-sized wading bird that nests in woody vegetation and forages in shallow freshwater, saltwater, or brackish habitats. Marginal foraging habitat is present within the project corridor in the C-100 Canal. No nests of this species were observed during the field reviews. This species was assigned a **Moderate** probability of occurrence.

4.3.2.5 *Tricolored Heron*

The tricolored heron is a colorful heron with a mix of blue-gray, lavender, and white. They forage alone or at the edge of groups of mixed wading birds. This species can be found in coastal estuaries, salt marshes, mangroves, and lagoons during the breeding season. Outside the breeding season, they use coastal areas as well as freshwater marshes, canals, and lakes. They usually breed in mixed-species colonies in flooded vegetation or on islands.

The project study area is a freshwater canal with maintained grassy slopes with no mangroves or coastal vegetation such as mangroves present. However, marginal foraging habitat is present within the project corridor in the C-100 Canal. No heron species were observed during the field review. A probability occurrence of **Moderate** was assigned to the tricolored heron.

4.3.2.6 *Burrowing Owl*

The burrowing owl is listed as threatened by FWC due to continued loss of habitat including construction activities and development. These owls are one of the smallest owls in Florida, reaching a length of nine (9)

inches, and have brown feathers with patches of white spots, and a white underside with brown bar-shaped spots. Burrowing owls commonly occupy open prairies such as golf courses, airports, pastures, agricultural fields, and vacant lots. No burrows or owls were observed during the field review and there is a lack of nesting habitat and low-quality foraging habitat within the heavily developed project area. Therefore, a probability of occurrence of **Low** was assigned to this species.

4.3.2.7 Smooth Strongbark

Smooth strongbark is listed as endangered by the Florida Department of Agriculture and Consumer Services (FDACS). This species is a low-branched shrub that grows up to 10 feet tall. It produces small, solitary white tubular flowers and can be found flowering all year. It has low/no tolerance to salty wind or direct salt spray. No suitable habitat exists within the project. No smooth strongbark was observed during the field review and a probability occurrence of **No** was assigned to this species.

4.3.2.8 Florida Tree Fern

Florida tree fern (FTF) is listed as endangered by FDACS. This species is a medium to large herbaceous perennial fern. FTF can be found in hardwood hammock preserves in Miami-Dade County, the closest of which is approximately 1.5 miles from the study area. No suitable habitat exists within the project. No FTF were observed during the field review and a probability occurrence of **No** was assigned to this species.

4.3.2.9 Eaton's Spike Moss

Eaton's spike moss is listed as endangered by FDACS. This species is an herbaceous, perennial lithophyte and present in several Miami-Dade County preserves in the Homestead/Redland area. No suitable habitat exists within the project. No Eaton's spike moss was observed during the field review and a probability occurrence of **No** was assigned to this species.

4.3.2.10 Redberry Stopper

Redberry Stopper is listed as endangered by FDACS. This species is a small to medium tree that grow from 15 to 25 feet tall. It occurs in rockland hammocks and it is a common inhabitant of many Miami-Dade County parks and preserves. No redberry stopper were observed within the project limits during field reviews. No suitable habitat exists within the project and a probability of **No** was assigned to this species.

4.3.2.11 Florida Royal Palm

Florida royal palm is listed as endangered by FDACS. This species is a long-lived, tall palm growing from 50 to 100 feet tall. It occurs in hardwood hammocks and Everglades tree islands. No native Florida royal palm were observed during field reviews and a probability occurrence of **No** was assigned to this species.

4.3.2.12 Silver Palm

Silver palm is listed as threatened by FDACS. This species occurs in pine rockland, hardwood hammock habitat, and maritime hammock habitats where it can tolerate significant salty wind or spray without harm. This palm is cultivated as an ornamental and utilized in residential and commercial landscapes. Florida silver palm is present as a landscaped species near the study area. No silver palms were observed during the field review and a probability occurrence of **Low** was assigned to this species.

4.3.2.13 West Indian Cherry

West Indian cherry is listed as threatened by FDACS. This species is a long-lived perennial that grows from 25 to 35 feet tall. It occurs in pine rockland and rockland hammocks and it is a common inhabitant of many Miami-Dade County's landscaped parks. It is generally not tolerant of salty wind or spray. No suitable habitat exists within the project. No West Indian cherry were observed during field reviews and a probability occurrence of **No** was assigned to this species.

4.3.2.14 West Indian Mahogany

West Indian mahogany is listed as endangered by FDACS. This species is a long-lived tree that grows from 30 to 79 feet tall and occurs throughout south Florida in natural and urban landscapes. However, those observed in urban areas appear to be landscape material. West Indian mahogany is common in Coral Gables near the study area. No West Indian mahogany were observed during field reviews and a probability occurrence of **Low** was assigned to this species.

4.4 Incidental species

Incidental species observed throughout the project corridor during field reviews are listed in **Table 5** along with the locations observed.

Table 5 - Incidental Species Observed within the Project Area

Scientific Name	Common Name	Location	Listing Status
Reptiles			
<i>Anoles carolinensis</i>	Green anole	South side of proposed bridge along a private property wall	Not listed
Butterflies			
<i>Heliconius charithonia</i>	Zebra longwing	South side of proposed bridge	Not listed
<i>Papilio cressphontes</i>	Giant swallowtail	South side of proposed bridge	Not listed
<i>Hemiargus ceraunus</i>	Ceranus blue	North side of proposed bridge	Not listed
Birds			
<i>Ardea alba</i>	Great egret	South side of proposed bridge	Not listed; protected under MBTA
<i>Gallinula galeata</i>	Common gallinule	North side of proposed bridge	Not listed; protected under MBTA
Snails			
<i>Pomacea maculate</i>	Island apple snail	Egg mass on the concrete support of a sewer pipe above the highwater mark	Not Listed (exotic)

4.5 Listed Species Effect Determinations

The Determination of Effect for each federally listed and state listed species is summarized in **Table 6** and **Table 7**, respectively, in the following discussion.

4.5.1 Federally Listed Species

Table 6 - Federally Listed Species Determination of Effect

Scientific Name	Common Name	Listing Status	Determination of Effect
REPTILES			
<i>Drymarchon corais couperi</i>	Eastern indigo snake	FT	MANLAA
<i>Crocodylus acutus</i>	American crocodile	FT	MANLAA
<i>Caretta caretta</i>	Loggerhead sea turtle	FT	NE
<i>Chelonia mydas</i>	Green sea turtle	FE	NE
<i>Dermochelys coriacea</i>	Leatherback sea turtle	FE	NE
<i>Eretmochelys imbricata</i>	Hawksbill sea turtle	FE	NE
BIRDS			
<i>Mycteria americana</i>	Wood stork	FT	MANLAA
MAMMALS			
<i>Trichechus manatus latirostris</i>	Florida manatee	FT	MANLAA
<i>Eumops floridanus</i>	Florida bonneted bat	FE	MANLAA
FISH			
<i>Pristis pectinata</i>	Smalltooth sawfish	FE	NE
PLANTS			
<i>Halophila johnsonii</i>	Johnson's Seagrass	FT	NE

Note: FT = Federally designated Threatened; FE = Federally designated Endangered; NE = No Effect; MANLAA = May Affect, Not Likely to Adversely Affect

4.5.1.1 Eastern Indigo Snake

While disturbed, upland habitat (i.e., parks and grassy areas) is present adjacent to the project limits, no gopher tortoise/gopher tortoise burrows were observed, and no potential Eastern indigo snake habitat will be impacted. To minimize potential adverse effects to the Eastern indigo snake during construction, DTPW will adhere to the Standard Protection Measures for the Eastern Indigo Snake (USFWS August 2013, see **Appendix B**). These measures will be incorporated into the final project construction documents and DTPW will require the Contractor to abide by these guidelines. Additionally, the Programmatic Indigo Snake Key (USFWS, August 2017) was reviewed (see **Appendix B**). Based on this key, site conditions, and incorporation of standard protection measures, it is determined that the project **May Affect, Not Likely to Adversely Affect** the Eastern indigo snake.

4.5.1.2 American Crocodile

While the project is located within the USFWS Consultation Area for the American crocodile (see **Figure 6**), and foraging habitat (C-100 canal) is present, no individuals were observed during the field review and no nests have been recorded in the project area. Nesting habitat is not present in the project area. Although in-water work is proposed in the C-100 Canal, where the crocodile may forage, it is not anticipated this work would affect crocodile foraging during or post-construction. Additionally, due to the existing control structure located approximately two (2) miles east of the project the potential for these species to be present is low.

Based on the project location, minimal suitable foraging habitat, and field review results, it is determined the project **May Affect, Not Likely to Adversely Affect** the American crocodile.

4.5.1.3 Sea Turtles

The project is approximately two (2) miles west of Biscayne Bay and a water control structure, at the mouth of the C-100 Canal, limits access to the waterway. The C-100 is a freshwater canal, likely unsuitable for any sea turtle species. There are no nesting beaches within or near the project, and no foraging habitat exists. Due to the lack suitable habitat and distance from Biscayne Bay, it is determined this project will have **No Effect** on any sea turtle species.

4.5.1.4 Wood Stork

The project falls within the CFA of three (3) wood stork colonies (see **Figure 7**). There are no wetlands and/or retention ponds within the project. The C-100 Canal does not provide suitable roosting habitat but does provide marginal foraging habitat at the project location. Tape grass is existing within the C-100 Canal and may provide habitat for small fishes that the wood stork feeds on. Tape grass is anticipated to be impacted by the proposed project therefore, SFH is anticipated to be impacted and mitigation will be needed for impacts to wood stork SFH. The Wood Stork Effect Determination Key (USFWS, May 2010), and Habitat Management Guidelines for the Wood Stork in the Southeast Region (HMG) (USFWS, 1990), by reference, were reviewed for this project (see **Appendix C**). Based on the above information, it is determined that the project **May Affect, Not Likely to Adversely Affect** the wood stork.

4.5.1.5 Florida Manatee

According to the USFWS Manatee Miami Field Station Accessibility Map (see **Appendix D**), the C-100 Canal is accessible to manatees. A control structure is present in the canal approximately two (2) miles from the construction site and approximately 0.1 miles from Biscayne Bay. Tape grass (*Vallisneria americana*) is present within the project in submerged patches along the canal wall and may provide food for foraging manatees. In-water work is proposed at the C-100 Canal, however no manatees were observed during field reviews. To minimize potential adverse effects to the Florida manatee during construction, DTPW will require the Contractor to adhere to the Standard Protection Measures for the Manatee (USFWS 2011, see **Appendix D**). Based on the project location's distance from Biscayne Bay, the field review results, and in-water work proposed at the C-100 Canal, it is determined the project **May Affect, Not Likely to Adversely Affect** (Florida) manatee.

4.5.1.6 Florida Bonneted Bat

This project is located within the consultation area of the FBB as well as the South Florida Urban Bat Area. The project corridor is contained within an urban landscape with little open space, although the C-100 Canal may provide a foraging and commuting route for FBB. As stated in the Methodology Section, visual surveys of the project area were conducted to determine if potential bat roosting and foraging habitat was present. Potential roosting habitat may be found in the two (2) landscaped royal palms present within the project. Both trees had a 15" DBH and had cavities for potential nesting. These palms are not anticipated to be impacted. On the north-west property, there was a bishop wood tree that stood approximately 60 feet tall, a 30" DBH, and no cavities were observed. Open bat foraging areas are present within and around the C-100 Canal. A field review of the project was performed, and bats were not observed. Based on the above, a **May Affect, Not Likely to Adversely Affect** determination was given to the FBB.

4.5.1.7 Smalltooth sawfish

The smalltooth sawfish is known to be present in and around Biscayne Bay, which is approximately two (2) miles from the project location. The C-100 Canal at the project location is classified freshwater and nontidal and therefore provides no suitable habitat for the smalltooth sawfish. A control structure is also present at the mouth of the canal approximately two (2) miles from the project corridor. It is anticipated that the project will have **No Effect** on the smalltooth sawfish. No special conditions should be necessary during construction.

4.5.1.8 Johnson's seagrass

There is no potential for Johnson's seagrass to occur in the C-100 Canal at the project location. A benthic survey was conducted within 100 feet of the proposed bridge over the C-100 Canal (128.5 feet on either side of the proposed bridge centerline). During the survey, Johnson's seagrass was not observed. A control structure is present at the mouth of the canal, approximately two (2) miles from the project corridor and therefore the C-100 canal in this area is freshwater and nontidal. Based on the current project location and survey results, it is determined the project will have **No Effect** on Johnson's seagrass.

4.5.2 State Listed Species

Table 7 - State Listed Species Determination of Effect

Scientific Name	Common Name	Conservation Status	Determination
Reptiles and Amphibians			
<i>Tantilla oolitica</i>	Rim Rock crowned snake	ST	No Effect Anticipated
<i>Gopherus polyphemus</i>	Gopher tortoise	ST/C	No Effect Anticipated
Birds			
<i>Patagioenas leucocephala</i>	White-crowned pigeon	ST	No Effect Anticipated
<i>Egretta caerulea</i>	Little blue heron	ST	No Effect Anticipated
<i>Egretta tricolor</i>	Tricolored heron	ST	No Effect Anticipated
<i>Athene cunicularia</i>	Burrowing owl	ST	No Effect Anticipated
Plants			
<i>Bourreria cassinifolia</i>	Smooth strongbark	SE	No Effect Anticipated
<i>Ctenitis sloanei</i>	Florida tree fern	SE	No Effect Anticipated
<i>Selaginella eatonii</i>	Eaton's spike moss	SE	No Effect Anticipated
<i>Eugenia confusa</i>	Redberry stopper	SE	No Effect Anticipated
<i>Roystonea elata</i>	Florida royal palm	SE	No Effect Anticipated
<i>Coccothrinax argentata</i>	Silver palm	ST	No Effect Anticipated
<i>Prunus myrtifolia</i>	West Indian cherry	ST	No Effect Anticipated
<i>Swietenia mahagoni</i>	West Indian mahogany	ST	No Effect Anticipated

Note: ST = State designated Threatened, SE = State designated Endangered; C = Candidate species for Federal listing under the ESA.

4.5.2.1 Rim Rock Crowned Snake

A **No Effect Anticipated** determination for the rim rock crowned snake is based on no suitable habitat present. Additionally, no RRCS were observed during the field review.

4.5.2.2 Gopher Tortoise

A **No Effect Anticipated** determination for the gopher tortoise is based on the lack of available, suitable burrowing habitat within and adjacent to the ROW. No gopher tortoise or burrows were observed during the field review.

4.5.2.3 State listed birds

The **No Effect Anticipated** determination for the burrowing owl is based on the lack of nesting habitat and low-quality foraging habitat within the heavily developed project area. **No Effect Anticipated** was determined for the White-crowned pigeon based on no suitable nesting or foraging habitat. No WCP were observed during field reviews. Nesting habitat for the little blue heron and tricolored heron was not observed within the project during the field reviews and foraging, if present, is anticipated to be transient. Therefore, it was determined the project will have **No Effect Anticipated** to the little blue heron or tricolored heron.

4.5.2.4 State-listed plant species

Eight state-listed plant species were included as having no potential for being present in the project area: Smooth strongbark, Florida tree fern, Eaton's spike moss, Redberry stopper, Florida royal palm, silver palm, West Indian cherry, and West Indian mahogany. Maintenance practices, current land uses (heavily developed urban land and the C-100 Canal), and previous land uses diminish the potential for these listed plant species to be present. Based on the lack of suitable habitat for these species, site conditions, and field reviews, there is **No Effect Anticipated** for listed plant species.

4.6 Cumulative Impacts

This project is not anticipated to contribute adversely to protected species or offsite habitats. The project is surrounded by residential developments and located within urban Miami-Dade County. The intent of the project is to construct a new bridge to alleviate traffic within the Miami-Dade County grid and provide continuous traffic movement in southern Miami-Dade County and between the City of Palmetto Bay and Cutler Bay, as well as improve access for emergency response. DTPW will comply with the requirements of National Pollutant Discharge Elimination System (NPDES) and implement Best Management Practices (BMPs) during construction as well as the manatee and indigo snake provisions during construction. Based on the proposed scope of work, urban setting, surrounding development and proposed mitigation measures, no cumulative impacts to protected species or offsite habitats are anticipated for this project. Other potential short-term, temporary impacts include noise and vibration. Effects resulting from these impacts include may include temporary disturbance to fish species and other marine species such as the Florida manatee and the American crocodile.

5.0 Wetlands and Other Surface Waters

In accordance with *Presidential Executive Order 11990 entitled "Protection of Wetlands"* and *United States Department of Transportation Order 5660.1A, "Preservation of the Nation's Wetlands"*, the project was reviewed to identify, quantify, and map wetland communities located within the proposed project as well as assess any wetland impacts.

5.1 Assessment Methodology

A desktop review was performed prior to conducting the field survey to establish baseline wetland and other surface waters (OSW) information. The following resources were reviewed to determine the potential of wetlands and surface waters:

- ESRI and Google Earth aerial imagery
- FDOT's ETDM Environmental Screening Tool
- Florida Natural Areas Inventory (FNAI) Cooperative Land Cover Map
- NRCS Soil Survey for Miami-Dade County
- NRCS Web Soil Survey
- U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) Maps

Using the above-referenced information, the approximate boundaries of existing surface waters were mapped in GIS on aerial photography. Note, based on the database review, no wetlands were identified in the project area.

On August 9th, 2021, CECOS biologists familiar with Florida's natural communities conducted a field review of the project to verify surface water boundaries and land use classifications. Wetlands were assessed in overall conformance with the criteria specified in the *US Army Corps of Engineers (USACE) Wetland Delineation Manual, 1987: Regional Supplement to Atlantic and Gulf Coast Plain Region (Version 2.0)* (USACE, 2010), and the *Florida Department of Environmental Protection (FDEP) Florida Wetlands Delineation Manual* (FDEP, 1995) which is based on Chapter 62-340, F.A.C. Wetland and upland habitats were classified using the *Florida Land Use, Cover and Forms Classification System* (FLUCCS, FDOT, 1999). No wetlands were observed within the project corridor.

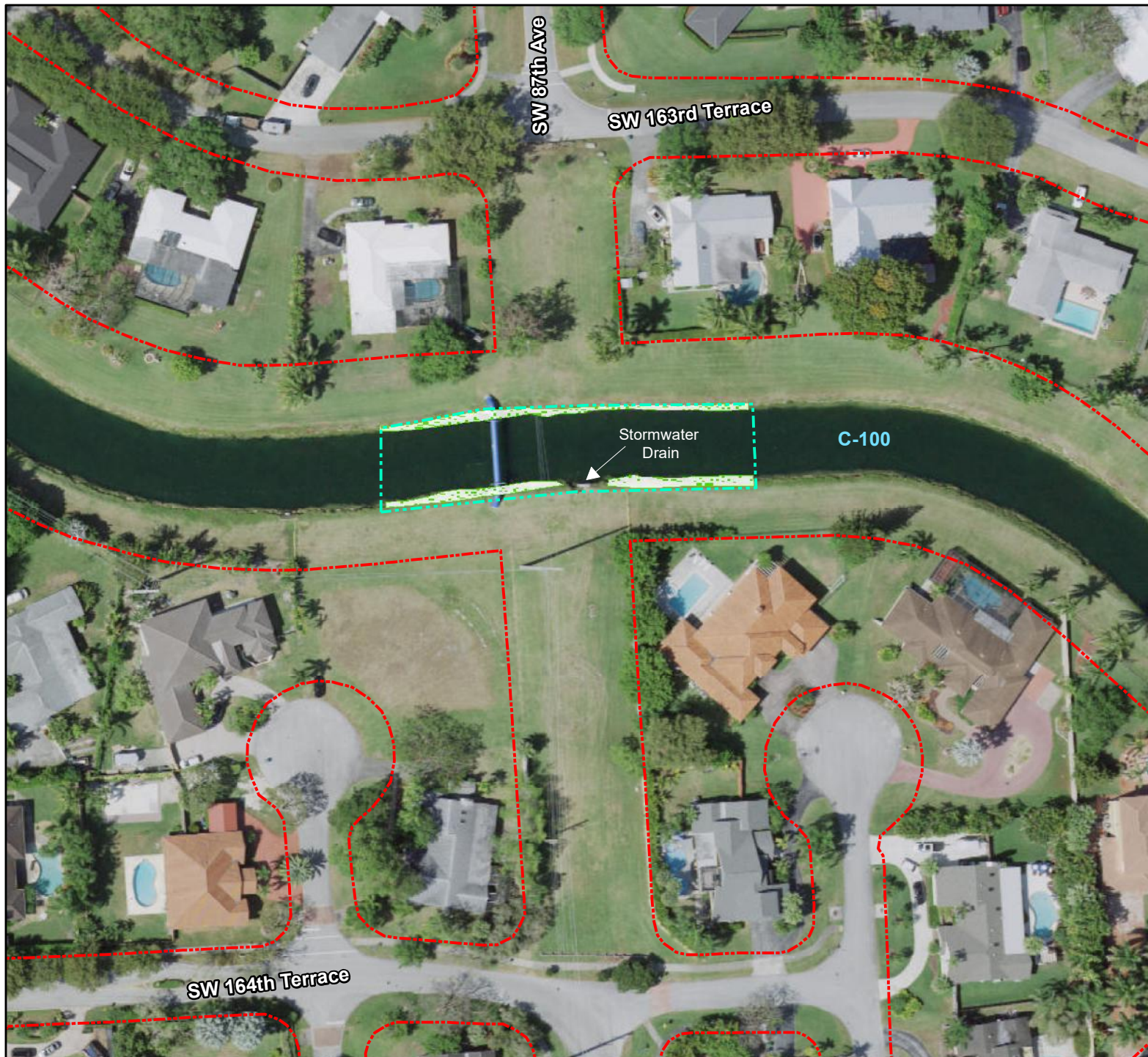
A benthic survey was performed to confirm the presence or absence of submerged aquatic vegetation (e.g., seagrass), listed fish species, or any other significant benthic resource in the vicinity of the proposed bridge. The survey was conducted by a team of CECOS biologists on August 9th, 2021, between 10:00 am and 3:30 pm. During this survey, weather conditions were sunny, air temperature was 89°F and water temperature was 85°F at the surface. There was no tide change observed during the survey and the canal appeared to be freshwater. The maximum depth of the canal was approximately 10 feet and visibility was approximately five (5) feet. Three (3) parallel transects were established within the project area and extended approximately 128.5 feet from either side of the proposed bridge centerline. Photographs from the field surveys are included in **Appendix A**.

5.2 Existing Wetlands and Other Surface Waters

Based on the NWI, land use and cover data, and the field review of the project study area, one surface water (the C-100 Canal) was identified within the project. The surface water community type identified in the project study area is classified 510 by FLUCCs.

C-100 Canal (FLUCCS 510) – The FLUCCs 510 category includes rivers, creeks, canals and other linear waterbodies. Within the project area, this habitat type includes the C-100 Canal. It is connected to Biscayne Bay, approximately two (2) miles east of the project. The S-123 control structure is located approximately two (2) miles east of the project and therefore the project area is nontidal and freshwater.

Tape grass (*Vallisneria spiralis*), a Florida native, was observed along both sides of the canal along the side slopes. **Figure 9** illustrates the locations of the tape grass. The coverage was patchy/non-continuous



SW 87th Ave □□□
 Bridge Design Over
 C-100 Canal

Wetland and Surface Waters Map

Legend

Survey Boundary
 (~128.5' East and West
 From Centerline)

Existing ROW

Vegetation

Vallisneria americana
 (Tapegrass)

Survey Conducted by CECOS
 Biologists on August 9th, 2021.

2017 Basemap Source: Esri,

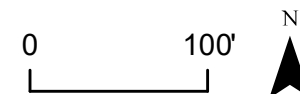


Figure 9

Date Prepared: September 15, 2021



and was found along both side slopes from approximately four (4) feet from top of bank down to a depth of eight (8) feet. Where present, coverage was approximately 50%. In addition, approximately 15 feet from either side of a storm drain on the south side of the canal, no tape grass was present. The side slopes were dominated with rocks in which the tape grass was growing intermittently along the length of the survey area. Dense patches of Indian swampweed (*Hygrophila polysperma*), an exotic nuisance benthic plant, was present on the canal bottom. Intermittent patches of fanwort (*Cabomba caroliniana*), a native, were observed along the canal bottom. Overall, the benthic substrate was sandy/silty with a cyanobacteria layer, and intermittent small rock rubble. Fish species observed include peacock bass, channel catfish, and large goldfish.

5.2.1 Potential Project Impacts

The new bridge will span the waterway with new pilings/bridge foundations in the water. Direct impacts to surface waters will occur as part of the project. The addition of pilings, in-water construction and shading will impact existing tape grass within the C-100 Canal. Based on available information, approximately 0.06 acre of direct impact is anticipated. Based on available information, secondary impacts are not anticipated. However, additional impacts may occur due to potential canal dredging. It is anticipated that mitigation will be required.

Potential temporary impacts may include increased sediment loads and turbidity in the water column due to construction activities. However, turbidity curtains and silt fencing will be used to avoid any offsite discharge and associated temporary impacts as a result of construction. A Stormwater Pollution Prevention Plan (SWPPP) will be prepared and will be implemented during construction and potential impacts can be offset by environmental protection guidelines and BMPs. BMPs include the use of silt barriers and containment structures that minimize effects to water quality by controlling potential discharge.

6.0 Essential Fish Habitat

This project was evaluated for impacts to Essential Fish Habitat (EFH) in accordance with 16 U.S.C 1801 of January 12, 2007, as amended, *Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)*. EFH is defined by the *MSFCMA of 1976, as amended in 1996* as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 USC 1802 (10)). The *MSFCMA (Public Law 94- 265, as amended)* was established, along with other goals, to promote the protection of EFH in the review of projects conducted under federal permits, licenses, or other authorizations that affect or have the potential to affect such habitat. EFH describes all waters and substrate necessary for fish to spawn, breed, feed, or grow to maturity. According to the NOAA Fisheries EFH Mapper, no EFH is present within the C-100 Canal at the location of the project. Due to the presence of the S-123 control structure approximately two (2) miles downstream of the project, by Biscayne Bay, it is unlikely managed fish species can access this canal in the vicinity of the proposed bridge.

7.0 Conclusions

This project will have minimal impacts to listed species and natural resources (i.e., tape grass). Unavoidable direct impacts to the C-100 Canal will result as part of this project. The DTPW will avoid and minimize impacts to the greatest extent practical and will continue to evaluate avoidance and minimization measures during design and permitting to the greatest extent practical. The DTPW will adhere to the permitting agencies’

general and specific conditions regarding turbidity control during construction to ensure that waters remain in compliance with water quality parameters.

It was determined the project **May Affect, Not Likely Adversely Affect** the federally listed Eastern indigo snake, American crocodile, Wood stork, Florida manatee, and FBB. The project will have **No Effect** on the Loggerhead sea turtle, Green sea turtle, Leatherback sea turtle, Hawksbill sea turtle, smalltooth sawfish, and Johnson's seagrass. No EFH is present within the corridor. The project corridor currently falls within the CFA of three wood stork colonies. It is estimated approximately 0.06 acre of tape grass will be impacted due to in water work and will require mitigation. SFH for the Wood stork is anticipated to be impacted and will require mitigation.

It was determined that **No Effect is Anticipated** for this project to the state-listed rim rock crowned snake, gopher tortoise, white-crowned pigeon, little blue heron, tricolored heron, burrowing owl, and state listed plants. However, if a gopher tortoise or burrowing owl is encountered within or adjacent to the ROW, a state relocation permit will be required, and coordination with FWC will be initiated.

8.0 References

Chafin, L.G., 2000. Field Guide to the Rare Plants of Florida. Florida Natural Areas Inventory, Tallahassee, Florida.

Code of Federal Regulations. June 3, 1986. Title 50, Chapter IV, Subchapter A, Part 402, Interagency Cooperation – Endangered Species Act of 1973, As Amended.

Code of Federal Regulations. Nov. 29, 1978. Title 40, Chapter V, Part 1508, §1508.7, Cumulative Impact.

ESRI. 2013-2015. World Imagery. ArcGIS Online. <http://www.arcgis.com>.

Florida Administrative Code. July 1, 1994. Delineation of the Landward Extent of Wetlands and Surface Waters. Department of Environmental Protection.

Florida Department of Transportation. July 20, 2020. Wetlands and Other Surface Waters. Project Development and Environment Manual. Chapter 9, Part 2.

Florida Department of Transportation. July 20, 2020. Protected Species and Habitat. Project Development and Environment Manual. Chapter 16, Part 2.

Florida Department of Transportation. July 20, 2020. Essential Fish Habitat. Project Development and Environment Manual. Chapter 17, Part 2.

Florida Department of Transportation. July 11, 2016. Efficient Transportation Decision Making Summary Report Number 14254 – #14254 I-95 from South of Hallandale Beach Boulevard to North of Hollywood Boulevard.

Florida Department of Transportation. Environmental Screening Tool (EST).

Florida Exotic Pest Plant Council, (2019), List of Invasive Plant Species.

Florida Fish and Wildlife Conservation Commission. May 2017. Florida's Endangered Species, Threatened Species and Species of Special Concern. Official Lists.

Florida Natural Areas Inventory. 2017. Biodiversity Matrix. <http://www.fnai.org/biointro.cfm>

Florida Natural Areas Inventory. Florida Conservation Lands, September 2017.

Gilbert, KM., Tobe, JD, et.al. The Florida Wetlands Delineation Manual. Florida Department of Environmental Protection.

Miami-Dade County GIS data, 2021.

NOAA. National Marine Fisheries Service. EFH Mapper, v3.0.

South Florida Water Management District. 2008. Land Cover Land Use GIS Data Catalog.

U.S. Department of Agriculture. Natural Resource Conservation Service. December 13, 2013. Web Soil Survey of Miami-Dade County Area, Florida (FL686).
<http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

U.S. Fish and Wildlife Service. August 2017. ECOS. Information for Planning and Conservation (IPaC) Trust Resources Report.

U.S. Fish and Wildlife Service. National Wetlands Inventory Mapper.
<https://www.fws.gov/wetlands/Data/Mapper.html>

U.S. Fish and Wildlife Service. September 2006. Central and Southern Florida Project Manatee Accessibility. SFWMD Miami Field Station.

U.S. Fish and Wildlife Service. May 2010. Wood Stork Effect Determination Key.

U.S. Fish and Wildlife Service. 1990. Habitat Management Guidelines for the Wood Stork in the Southeast Region (HMG).

U.S. Fish and Wildlife Service. 2013. Standard Protection Measures for the Eastern Indigo Snake.

U.S. Fish and Wildlife Service. July 2011. Standard Manatee Conditions for In-Water Work.

U.S. Fish and Wildlife Service. August 2017. Programmatic Indigo Snake Key.

U.S. Fish and Wildlife Service. October 2019. Consultation Key for the Florida Bonneted Bat; 04EF2000-I-0320-R001

APPENDIX A

Ground Level Photographs



Photo 1: From SW 87th Avenue, facing South.



Photo 2: From SW 87th Avenue, facing North.



Photo 3: C-100 Canal, facing East. Note existing drainage structure



Photo 4: C-100 Canal, facing West.



Photo 5: Potential FBB habitat.



Photo 6: Potential FBB habitat.



Photo 7: Tape grass on rocky canal wall.



Photo 8: Tape grass and fanwort.



Photo 9: Rocky canal/side slope bottom.



Photo 10: Swampweed on canal bottom.

APPENDIX B

Standard Protection Measures for Eastern Indigo Snake and Consultation Key for the Eastern Indigo Snake

STANDARD PROTECTION MEASURES FOR THE EASTERN INDIGO SNAKE
U.S. Fish and Wildlife Service
August 12, 2013

The eastern indigo snake protection/education plan (Plan) below has been developed by the U.S. Fish and Wildlife Service (USFWS) in Florida for use by applicants and their construction personnel. At least **30 days prior** to any clearing/land alteration activities, the applicant shall notify the appropriate USFWS Field Office via e-mail that the Plan will be implemented as described below (North Florida Field Office: jaxregs@fws.gov; South Florida Field Office: verobeach@fws.gov; Panama City Field Office: panamacity@fws.gov). As long as the signatory of the e-mail certifies compliance with the below Plan (including use of the attached poster and brochure), no further written confirmation or “approval” from the USFWS is needed and the applicant may move forward with the project.

If the applicant decides to use an eastern indigo snake protection/education plan other than the approved Plan below, written confirmation or “approval” from the USFWS that the plan is adequate must be obtained. At least 30 days prior to any clearing/land alteration activities, the applicant shall submit their unique plan for review and approval. The USFWS will respond via e-mail, typically within 30 days of receiving the plan, either concurring that the plan is adequate or requesting additional information. A concurrence e-mail from the appropriate USFWS Field Office will fulfill approval requirements.

The Plan materials should consist of: 1) a combination of posters and pamphlets (see **Poster Information** section below); and 2) verbal educational instructions to construction personnel by supervisory or management personnel before any clearing/land alteration activities are initiated (see **Pre-Construction Activities** and **During Construction Activities** sections below).

POSTER INFORMATION

Posters with the following information shall be placed at strategic locations on the construction site and along any proposed access roads (a final poster for Plan compliance, to be printed on 11” x 17” or larger paper and laminated, is attached):

DESCRIPTION: The eastern indigo snake is one of the largest non-venomous snakes in North America, with individuals often reaching up to 8 feet in length. They derive their name from the glossy, blue-black color of their scales above and uniformly slate blue below. Frequently, they have orange to coral reddish coloration in the throat area, yet some specimens have been reported to only have cream coloration on the throat. These snakes are not typically aggressive and will attempt to crawl away when disturbed. Though indigo snakes rarely bite, they should NOT be handled.

SIMILAR SNAKES: The black racer is the only other solid black snake resembling the eastern indigo snake. However, black racers have a white or cream chin, thinner bodies, and WILL BITE if handled.

LIFE HISTORY: The eastern indigo snake occurs in a wide variety of terrestrial habitat types throughout Florida. Although they have a preference for uplands, they also utilize some wetlands

and agricultural areas. Eastern indigo snakes will often seek shelter inside gopher tortoise burrows and other below- and above-ground refugia, such as other animal burrows, stumps, roots, and debris piles. Females may lay from 4 - 12 white eggs as early as April through June, with young hatching in late July through October.

PROTECTION UNDER FEDERAL AND STATE LAW: The eastern indigo snake is classified as a Threatened species by both the USFWS and the Florida Fish and Wildlife Conservation Commission. “Taking” of eastern indigo snakes is prohibited by the Endangered Species Act without a permit. “Take” is defined by the USFWS as an attempt to kill, harm, harass, pursue, hunt, shoot, wound, trap, capture, collect, or engage in any such conduct. Penalties include a maximum fine of \$25,000 for civil violations and up to \$50,000 and/or imprisonment for criminal offenses, if convicted.

Only individuals currently authorized through an issued Incidental Take Statement in association with a USFWS Biological Opinion, or by a Section 10(a)(1)(A) permit issued by the USFWS, to handle an eastern indigo snake are allowed to do so.

IF YOU SEE A LIVE EASTERN INDIGO SNAKE ON THE SITE:

- Cease clearing activities and allow the live eastern indigo snake sufficient time to move away from the site without interference;
- Personnel must NOT attempt to touch or handle snake due to protected status.
- Take photographs of the snake, if possible, for identification and documentation purposes.
- Immediately notify supervisor or the applicant’s designated agent, **and** the appropriate USFWS office, with the location information and condition of the snake.
- If the snake is located in a vicinity where continuation of the clearing or construction activities will cause harm to the snake, the activities must halt until such time that a representative of the USFWS returns the call (within one day) with further guidance as to when activities may resume.

IF YOU SEE A DEAD EASTERN INDIGO SNAKE ON THE SITE:

- Cease clearing activities and immediately notify supervisor or the applicant’s designated agent, **and** the appropriate USFWS office, with the location information and condition of the snake.
- Take photographs of the snake, if possible, for identification and documentation purposes.
- Thoroughly soak the dead snake in water and then freeze the specimen. The appropriate wildlife agency will retrieve the dead snake.

Telephone numbers of USFWS Florida Field Offices to be contacted if a live or dead eastern indigo snake is encountered:

North Florida Field Office – (904) 731-3336

Panama City Field Office – (850) 769-0552

South Florida Field Office – (772) 562-3909

PRE-CONSTRUCTION ACTIVITIES

1. The applicant or designated agent will post educational posters in the construction office and throughout the construction site, including any access roads. The posters must be clearly visible to all construction staff. A sample poster is attached.
2. Prior to the onset of construction activities, the applicant/designated agent will conduct a meeting with all construction staff (annually for multi-year projects) to discuss identification of the snake, its protected status, what to do if a snake is observed within the project area, and applicable penalties that may be imposed if state and/or federal regulations are violated. An educational brochure including color photographs of the snake will be given to each staff member in attendance and additional copies will be provided to the construction superintendent to make available in the onsite construction office (a final brochure for Plan compliance, to be printed double-sided on 8.5" x 11" paper and then properly folded, is attached). Photos of eastern indigo snakes may be accessed on USFWS and/or FWC websites.
3. Construction staff will be informed that in the event that an eastern indigo snake (live or dead) is observed on the project site during construction activities, all such activities are to cease until the established procedures are implemented according to the Plan, which includes notification of the appropriate USFWS Field Office. The contact information for the USFWS is provided on the referenced posters and brochures.

DURING CONSTRUCTION ACTIVITIES

1. During initial site clearing activities, an onsite observer may be utilized to determine whether habitat conditions suggest a reasonable probability of an eastern indigo snake sighting (example: discovery of snake sheds, tracks, lots of refugia and cavities present in the area of clearing activities, and presence of gopher tortoises and burrows).
2. If an eastern indigo snake is discovered during gopher tortoise relocation activities (i.e. burrow excavation), the USFWS shall be contacted within one business day to obtain further guidance which may result in further project consultation.
3. Periodically during construction activities, the applicant's designated agent should visit the project area to observe the condition of the posters and Plan materials, and replace them as needed. Construction personnel should be reminded of the instructions (above) as to what is expected if any eastern indigo snakes are seen.

POST CONSTRUCTION ACTIVITIES

Whether or not eastern indigo snakes are observed during construction activities, a monitoring report should be submitted to the appropriate USFWS Field Office within 60 days of project completion. The report can be sent electronically to the appropriate USFWS e-mail address listed on page one of this Plan.



United States Department of the Interior

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



August 1, 2017

Donnie Kinard
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Subject: Consultation Key for the Eastern Indigo Snake – Revised

Dear Mr. Kinard:

This letter revises and replaces the January 25, 2010, and August 13, 2013, letters to the U.S. Army Corps of Engineers (Corps) regarding the use of the eastern indigo snake programmatic effect determination key (Key) for projects occurring within the South Florida Ecological Service's Office (SFESO) jurisdiction. This revision supersedes all prior versions of the Key in the SFESO area. The purpose of this revision is to clarify portions of the previous keys based on questions we have been asked, specifically related to habitat and refugia used by eastern indigo snakes (*Drymarchon corais couperi*), in the southern portion of their range and within the jurisdiction of the SFESO. This Key is provided pursuant to the Service's authorities under the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C.1531 *et seq.*). This Key revision has been assigned Service Consultation Code: 41420-2009-I-0467-R001.

The purpose of this Key is to assist the Corps (or other Federal action agency) in making appropriate effects determinations for the eastern indigo snake under section 7 of the Act, and streamline informal consultation with the SFESO for the eastern indigo snake when the proposed action can be walked through the Key. The Key is a tool available to the Corps (or other Federal action agency) for the purposes of expediting section 7 consultations. There is no requirement to use the Key. There will be cases when the use of the Key is not appropriate. These include, but are not limited to: where project specific information is outside of the scope of the Key or instances where there is new biological information about the species. In these cases, we recommend the Corps (or other Federal action agency) initiates traditional consultation pursuant to section 7 of the Act, and identify that consultation is being requested outside of the Key.

This Key uses project size and home ranges of eastern indigo snakes as the basis for making determinations of "may affect, but is not likely to adversely affect" (NLAA) and "may affect, and is likely to adversely affect" (may affect). Suitable habitat for the eastern indigo snake consists of a mosaic of habitats types, most of which occur throughout South Florida. Information on home ranges for individuals is not available in specific habitats in South Florida. Therefore, the SFESO uses the information from a 26-year study conducted by Layne and Steiner (1996) at Archbold Biological Station, Lake Placid, Florida, as the best available

information. Layne and Steiner (1996) determined the average home range size for a female eastern indigo snake was 46 acres and 184 acres for a male.

Projects that would remove/destroy less than 25 acres of eastern indigo snake habitat are expected to result in the loss of a portion of an eastern indigo snakes home range that would not impair the ability of the individual to feed, breed, and shelter. Therefore, the Service finds that take would not be reasonably certain to occur due to habitat loss. However, these projects have the potential to injure or kill an eastern indigo snake if the individual is crushed by equipment during site preparation or other project aspects. The Service's *Standard Protection Measures for the Eastern Indigo Snake* (Service 2013 or most current version) and the excavation of underground refugia (where a snake could be buried, trapped and/or injured), when implemented, are designed to avoid these forms of take. Consequently, projects less than 25 acres that include the Service's *Standard Protection Measures for the Eastern Indigo Snake* (Service 2013 or most current version) and a commitment to excavate underground refugia as part of the proposed action would be expected to avoid take and thus, may affect, but are not likely to adversely affect the species.

If a proposed project would impact less than 25 acres of vegetated eastern indigo snake habitat (not urban/ human-altered) completely surrounded by urban development, and an eastern indigo snake has been observed on site, the Key should not be used. The Service recommends formal consultation for this situation because of the expected increased value of the vegetated habitat within the individual's home range.

Projects that would remove 25 acres or more of eastern indigo snake habitat could remove more than half of a female eastern indigo snakes home range. This loss of habitat within a home range would be expected to significantly impair the ability of that individual to feed, breed, and shelter. Therefore, the Service finds take through habitat loss would be reasonably certain to occur and formal consultation is appropriate. Furthermore, these projects have the potential to injure or kill an eastern indigo snake if the individual is crushed by equipment during site preparation or other project aspects. The Service's *Standard Protection Measures for the Eastern Indigo Snake* (Service 2013 or most current version) and the excavation of underground refugia (where a snake could be buried, trapped and/or injured), when implemented, are designed to avoid these forms of take.

Eastern indigo snakes use a variety of habitat and are difficult to detect. Therefore, site specific information on the land use, observations of eastern indigo snakes within the vicinity, as well as other factors, as appropriate, will all be considered by the Service when making a final recommendation on the appropriate effects determination and whether it is appropriate to conclude consultation with the Corps (or other Federal action agency) formally or informally for projects that will impact 25 acres or more of habitat. Accordingly, when the use of the Key results in a determination of "may affect," the Corps (or other Federal action agency) is advised that consultation may be concluded informally or formally, depending on the project specific effects to eastern indigo snakes. Technical assistance from the Service can assist you in making a determination prior to submitting a request for consultation. In circumstances where the Corps (or other Federal action agency) desires to proceed with a consultation request prior to receiving

additional technical assistance from the Service, we recommend the agency documents the biological rationale for their determination and proceed with a request accordingly.

If the use of the Key results in a determination of “no effect,” no further consultation is necessary with the SFESO. If the use of the Key results in a determination of “NLAA,” the SFESO concurs with this determination based on the rationale provide above, and no further consultation is necessary for the effects of the proposed action on the eastern indigo snake. For “no effect” or “NLAA” determinations, the Service recommends that the Corps (or other Federal action agency) documents the pathway used to reach your no effect or NLAA determination in the project record and proceed with other species analysis as warranted.

Eastern Indigo Snake Programmatic Effect Determination Key
Revised July 2017
South Florida Ecological Service Office

Scope of the Key

This Key should be used only in the review of permit applications for effects determinations for the eastern indigo snake (*Drymarchon corais couperi*) within the South Florida Ecological Service's Office (SFESO) area (Broward, Charlotte, Collier, De Soto, Glades, Hardee, Hendry, Highlands, Lee, Indian River, Martin, Miami-Dade, Monroe, Okeechobee, Osceola, Palm Beach, Polk, Sarasota, and St. Lucie Counties). There is no designated critical habitat for the eastern indigo snake.

This Key is subject to revision as the Corps (or other Federal action agency) and Service deem necessary and in particular whenever there is new information on eastern indigo snake biology and effects of proposed projects.

The Key is a tool available to the Corps (or other Federal action agency) for the purposes of expediting section 7 consultations. There is no requirement to use the Key. There will be cases when the use of the Key is not appropriate. These include, but are not limited to: where project specific information is outside of the scope of the Key or instances where there is new biological information about the species. In these cases, we recommend the Corps (or other Federal action agency) initiates traditional consultation pursuant to section 7 of the Act, and identify that consultation is being requested outside of the Key.

Habitat

Habitat use varies seasonally between upland and wetland areas, especially in the more northern parts of the species' range. In southern parts of their range eastern indigo snakes are habitat generalists which use most available habitat types. Movements between habitat types in northern areas of their range may relate to the need for thermal refugia (protection from cold and/or heat).

In northern areas of their range eastern indigo snakes prefer an interspersed of tortoise-inhabited sandhills and wetlands (Landers and Speake 1980). In these northern regions eastern indigo

snakes most often use forested areas rich with gopher tortoise burrows, hollowed root channels, hollow logs, or the burrows of rodents, armadillos, or land crabs as thermal refugia during cooler seasons (Lawler 1977; Moler 1985a; Layne and Steiner 1996). The eastern indigo snake in the northern region is typically classified as a longleaf-pine savanna specialist because here, in the northern four-fifths of its range, the eastern indigo snake is typically only found in vicinity of xeric longleaf-pine-turkey oak sandhills inhabited by the gopher tortoise (Means 2006).

In the milder climates of central and southern Florida, comprising the remaining one fifth of its range, thermal refugia such as those provided by gopher tortoise burrows may not be as critical to survival of indigo snakes. Consequently, eastern indigo snakes in these regions use a more diverse assemblage of 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; with highest population concentrations of eastern indigo snakes occurring in the sandhill and pineland regions of northern and central Florida (Service 1999). Eastern indigo snakes have also been found on agricultural lands with close proximity to wetlands (Zeigler 2006).

In south Florida, agricultural sites (*e.g.*, sugar cane fields and citrus groves) are occupied by eastern indigo snakes. The use of sugarcane fields by eastern indigo snakes was first documented by Layne and Steiner in 1996. In these areas there is typically an abundance of wetland and upland ecotones (due to the presence of many ditches and canals), which support a diverse prey base for foraging. In fact, some speculate agricultural areas may actually have a higher density of eastern indigo snakes than natural communities due to the increased availability of prey. Gopher tortoise burrows are absent at these locations but there is an abundance of both natural and artificial refugia. Enge and Endries (2009) reporting on the status of the eastern indigo snake included sugarcane fields and citrus groves in a Global Information Systems (GIS)-base map of potential eastern indigo snake habitat. Numerous sightings of eastern indigo snakes within sugarcane fields have been reported within south Florida (Florida Fish and Wildlife Conservation Commission Indigo Snake Database [Enge 2017]). A recent study associated with the Comprehensive Everglades Restoration Plan (CERP) (A-1 FEB Project formerly A-1 Reservoir; Service code: 41420-2006-F-0477) documented eastern indigo snakes within sugarcane fields. The snakes used artificial habitats such as piles of limerock, construction debris, and pump stations. Recent studies also associated with the CERP at the C-44 Project (Service code: 41420-2009-FA-0314), and C-43 Project (Service code: 41420-2007-F-0589) documented eastern indigo snakes within citrus groves. The snakes used artificial habitats such as boards, sheets of tin, construction debris, pipes, drain pipes in abandoned buildings and septic tanks.

In extreme south Florida (*i.e.*, the Everglades and Florida Keys), eastern indigo snakes also utilize tropical hardwood hammocks, pine rocklands, freshwater marshes, abandoned agricultural land, coastal prairie, mangrove swamps, and human-altered habitats. Though eastern indigo snakes have been found in all available habitats of south Florida it is thought 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).

Even though thermal stress may not be a limiting factor throughout the year in south Florida, eastern indigo snakes still seek and use underground refugia. On the sandy central ridge of central Florida, eastern indigo snakes use gopher tortoise burrows more (62 percent) than other underground refugia (Layne and Steiner 1996). Other underground refugia used include armadillo (*Dasyurus novemcinctus*) burrows near citrus groves, cotton rat (*Sigmodon hispidus*) burrows, and land crab (*Cardisoma guanhumi*) burrows in coastal areas (Layne and Steiner 1996; Wilson and Porras 1983). Natural ground holes, hollows at the base of trees or shrubs, ground litter, trash piles, and crevices of rock-lined ditch walls are also used (Layne and Steiner 1996). These refugia are used most frequently where tortoise burrows are not available, principally in low-lying areas off the central and coastal ridges.

Minimization Measures

The Service developed protection measures for the eastern indigo snake “Standard Protection Measures for the Eastern Indigo Snake” (Service 2013) located at: https://www.fws.gov/verobeach/ReptilesPDFs/20130812_EIS%20Standard%20Protection%20Measures_final.pdf. These protection measures (or the most updated version) are considered a minimization measure for projects proposed within eastern indigo snake habitat.

Determinations

If the use of this Key results in a determination of “**no effect**,” no further consultation is necessary with the SFESO.

If the use of this Key results in a determination of “**NLAA**,” the SFESO concurs with this determination and no further consultation is necessary for the effects of the proposed action on the eastern indigo snake.

For no effect or NLAA determinations, the Corps (or other Federal action agency) should make a note in the project file indicating the pathway used to reach your no effect or NLAA determination.

If a proposed project would impact less than 25 acres of vegetated eastern indigo snake habitat (not urban/ human-altered) completely surrounded by urban development, and an eastern indigo snake has been observed on site, the subsequent Key should not be used. The Service recommends formal consultation for this situation because of the expected increased value of the vegetated habitat within the individual’s home range.

If the use of this Key results in a determination of “**may affect**,” consultation may be concluded informally or formally depending on project effects to eastern indigo snakes. Technical assistance from the Service can assist you in making a determination prior to submitting a request for consultation. In circumstances where the Corps desires to proceed with a consultation request prior to receiving additional technical assistance from the Service, we recommend the Corps document the biological rationale for their determination and proceed with a request accordingly.

- A. Project is not located in open water or salt marsh.....go to B

Project is located solely in open water or salt marsh.....no effect

- B. Permit will be conditioned for use of the Service's most current guidance for Standard Protection Measures For The Eastern Indigo Snake (currently 2013) during site preparation and project construction.....go to C

Permit will not be conditioned as above for the eastern indigo snake, or it is not known whether an applicant intends to use these measures and consultation with the Service is requested.....may affect

- C. The project will impact less than 25 acres of eastern indigo snake habitat (e.g., sandhill, scrub, pine flatwoods, pine rocklands, scrubby flatwoods, high pine, dry prairie, coastal prairie, mangrove swamps, tropical hardwood hammocks, hydric hammocks, edges of freshwater marshes, agricultural fields [including sugar cane fields and active, inactive, or abandoned citrus groves], and coastal dunes).....go to D

The project will impact 25 acres or more of eastern indigo snake habitat (e.g., sandhill, scrub, pine flatwoods, pine rocklands, scrubby flatwoods, high pine, dry prairie, coastal prairie, mangrove swamps, tropical hardwood hammocks, hydric hammocks, edges of freshwater marshes, agricultural fields [including sugar cane fields and active, inactive, or abandoned citrus groves], and coastal dunes).....may affect

- D. The project has no known holes, cavities, active or inactive gopher tortoise burrows, or other underground refugia where a snake could be buried, trapped and/or injured during project activities.....NLAA

The project has known holes, cavities, active or inactive gopher tortoise burrows, or other underground refugia where a snake could be buried, trapped and /or injured.....go to E

- E. Any permit will be conditioned such that all gopher tortoise burrows, active or inactive, will be excavated prior to site manipulation in the vicinity of the burrow¹. If an eastern indigo snake is encountered, the snake must be allowed to vacate the area prior to additional site manipulation in the vicinity. Any permit will also be conditioned such that holes, cavities, and snake refugia other than gopher tortoise burrows will be inspected each morning before planned site manipulation of a particular area, and, if occupied by an eastern indigo snake, no work will commence until the snake has vacated the vicinity of proposed work.....NLAA²

Permit will not be conditioned as outlined above.....may affect

End Key

¹ If excavating potentially occupied burrows, active or inactive, individuals must first obtain state authorization via a Florida Fish and Wildlife Conservation Commission Authorized Gopher Tortoise Agent permit. The excavation method selected should also minimize the potential for injury of an indigo snake. Applicants should follow the excavation guidance provided within the most current Gopher Tortoise Permitting Guidelines found at <http://myfwc.com/gophertortoise>.

² Please note, if the proposed project will impact less than 25 acres of vegetated eastern indigo snake habitat (not urban/ human-altered) completely surrounded by urban development, and an eastern indigo snake has been observed on site, NLAA is not the appropriate conclusion. The Service recommends formal consultation for this situation because of the expected increased value of the vegetated habitat within the individual's home range

Working with the Fish and Wildlife Foundation of Florida, the Service has established a fund to support conservation and recovery for the eastern indigo snake. Any project that has the potential to affect the eastern indigo snake and/or its habitat is encouraged to make a voluntary contribution to this fund. If you would like additional information about how to make a contribution and how these monies are used to support eastern indigo snake recovery please contact Ashleigh Blackford, Connie Cassler, or José Rivera at 772-562-3559.

This revised Key is effective immediately upon receipt by the Corps. Should circumstances change or new information become available regarding the eastern indigo snake and/or implementation of the Key, the determinations herein may be reconsidered and this Key further revised or amended.

Thank you for your continued cooperation in the effort to conserve fish and wildlife resources. If you have any questions or comments regarding this Key, please contact the SFESO at 772-562-3909.

Sincerely,



Roxanna Hinzman
Field Supervisor
South Florida Ecological Services

Cc:

Corps, Jacksonville, Florida (Dale Beter, Muriel Blaisdell, Ingrid Gilbert, Angela Ryan,
Irene Sadowski, Victoria White, Alisa Zarbo)
Service, Athens, Georgia (Michelle Elmore)
Service, Jacksonville, Florida (Annie Dziergowski)
Service, Panama City, Florida (Sean Blomquist)

LITERATURE CITED

- Enge K. M. 2017. Personal communication. Email from Kevin Enge, Florida Fish and Wildlife Conservation Commission, Gainesville, Florida to Steve Mortellaro, U.S. Fish and Wildlife Service, Vero Beach, Florida, July 5, 2017. Locations of Eastern Indigo Snake (*Drymarchon couperi*).
- Enge K. M. and M. J. Endries. 2009. Status of the Eastern Indigo Snake (*Drymarchon couperi*) in Florida. Southeast Partners in Amphibian and Reptile Conservation Meeting.
- Landers, J. L. and D.W. Speake. 1980. Management Needs of Sandhill Reptiles in Southern Georgia. Proceedings Annual Conference of Southeastern Association of Fish and Wildlife Agencies. 34: 515-529.
- 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.
- Lawler, H.E. 1977. The status of *Drymarchon corais couperi* (Holbrook), the eastern indigo snake, in the southeastern U.S.A. *Herpetological Review* 8(3):76-79.
- Means, D. B. 2006. Vertebrate faunal diversity of longleaf pine ecosystems. In *The Longleaf Pine Ecosystem* pp. 157-213. Springer New York.
- Molar, 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 Fresh Water Fish Commission; Tallahassee, Florida.
- 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 (Service). 1999. South Florida multi-species recovery plan. 23 pp.
- U.S. Fish and Wildlife Service (Service). 2013. Standard Protection Measures for the Eastern Indigo Snake. August 12, 2013. U.S. Fish and Wildlife Service, South Florida Ecological Services Office; Vero Beach, Florida.
- Wilson, L.D. and L. Porras. 1983. The ecological impact of man on the south Florida herpetofauna. *University of Kansas Museum of Natural History Special Publication* 9:1-89.
- 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.

APPENDIX C

Wood Stork Effect Key and Determination and Habitat Management Guidelines



United States Department of the Interior

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



May 18, 2010

Donnie Kinard
Chief, Regulatory Division
Jacksonville District Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Service Federal Activity Code: 41420-2007-FA-1494
Service Consultation Code: 41420-2007-I-0964
Subject: South Florida Programmatic
Concurrence
Species: Wood Stork

Dear Mr. Kinard:

This letter addresses minor errors identified in our January 25, 2010, wood stork key and as such, supplants the previous key. The key criteria and wood stork biomass foraging assessment methodology have not been affected by these minor revisions.

The Fish and Wildlife Service's (Service) South Florida Ecological Services Office (SFESO) and the U.S. Army Corps of Engineers Jacksonville District (Corps) have been working together to streamline the consultation process for federally listed species associated with the Corps' wetland permitting program. The Service provided letters to the Corps dated March 23, 2007, and October 18, 2007, in response to a request for a multi-county programmatic concurrence with a criteria-based determination of "may affect, not likely to adversely affect" (NLAA) for the threatened eastern indigo snake (*Drymarchon corais couperi*) and the endangered wood stork (*Mycteria americana*) for projects involving freshwater wetland impacts within specified Florida counties. In our letters, we provided effect determination keys for these two federally listed species, with specific criteria for the Service to concur with a determination of NLAA.

The Service has revisited these keys recently and believes new information provides cause to revise these keys. Specifically, the new information relates to foraging efficiencies and prey base assessments for the wood stork and permitting requirements for the eastern indigo snake. This letter addresses the wood stork key and is submitted 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 eastern indigo snake key will be provided in a separate letter.

Wood stork

Habitat

The wood stork is primarily associated with freshwater and estuarine habitats that are used for nesting, roosting, and foraging. Wood storks typically construct their nests in medium to tall



trees that occur in stands located either in swamps or on islands surrounded by relatively broad expanses of open water (Ogden 1991, 1996; Rodgers et al. 1996). Successful colonies are those that have limited human disturbance and low exposure to land-based predators. Nesting colonies protected from land-based predators are characterized as those surrounded by large expanses of open water or where the nest trees are inundated at the onset of nesting and remain inundated throughout most of the breeding cycle. These colonies have water depths between 0.9 and 1.5 meters (3 and 5 feet) during the breeding season.

Successful nesting generally involves combinations of average or above-average rainfall during the summer rainy season and an absence of unusually rainy or cold weather during the winter-spring breeding season (Kahl 1964; Rodgers et al. 1987). This pattern produces widespread and prolonged flooding of summer marshes, which maximize production of freshwater fishes, followed by steady drying that concentrate fish during the season when storks nest (Kahl 1964). Successful nesting colonies are those that have a large number of foraging sites. To maintain a wide range of foraging sites, a variety of wetland types should be present, with both short and long hydroperiods. The Service (1999) describes a short hydroperiod as a 1 to 5-month wet/dry cycle, and a long hydroperiod as greater than 5 months. During the wet season, wood storks generally feed in the shallow water of the short-hydroperiod wetlands and in coastal habitats during low tide. During the dry season, foraging shifts to longer hydroperiod interior wetlands as they progressively dry-down (though usually retaining some surface water throughout the dry season).

Wood storks occur in a wide variety of wetland habitats. Typical foraging sites for the wood stork include freshwater marshes and stock ponds, shallow, seasonally flooded roadside and agricultural ditches, narrow tidal creeks and shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs. Because of their specialized feeding behavior, wood storks forage most effectively in shallow-water areas with highly concentrated prey. Through tactolocation, or grope feeding, wood storks in south Florida feed almost exclusively on fish between 2 and 25 centimeters [cm] (1 and 10 inches) in length (Ogden et al. 1976). Good foraging conditions are characterized by water that is relatively calm, uncluttered by dense thickets of aquatic vegetation, and having a water depth between 5 and 38 cm (5 and 15 inches) deep, although wood storks may forage in other wetlands. Ideally, preferred foraging wetlands would include a mosaic of emergent and shallow open-water areas. The emergent component provides nursery habitat for small fish, frogs, and other aquatic prey and the shallow, open-water areas provide sites for concentration of the prey during seasonal dry-down of the wetland.

Conservation Measures

The Service routinely concurs with the Corps' "may affect, not likely to adversely affect" determination for individual project effects to the wood stork when project effects are insignificant due to scope or location, or if assurances are given that wetland impacts have been avoided, minimized, and adequately compensated such that there is no net loss in foraging potential. We utilize our *Habitat Management Guidelines for the Wood Stork in the Southeast Region* (Service 1990) (Enclosure 1) (HMG) in project evaluation. The HMG is currently under review and once final will replace the enclosed HMG. There is no designated critical habitat for the wood stork.

The SFESO recognizes a 29.9 kilometer [km] (18.6-mile) core foraging area (CFA) around all known wood stork colonies in south Florida. Enclosure 2 (to be updated as necessary) provides locations of colonies and their CFAs in south Florida that have been documented as active within the last 10 years. The Service believes loss of suitable wetlands within these CFAs may reduce foraging opportunities for the wood stork. To minimize adverse effects to the wood stork, we recommend compensation be provided for impacts to foraging habitat. The compensation should consider wetland type, location, function, and value (hydrology, vegetation, prey utilization) to ensure that wetland functions lost due to the project are adequately offset. Wetlands offered as compensation should be of the same hydroperiod and located within the CFAs of the affected wood stork colonies. The Service may accept, under special circumstances, wetland compensation located outside the CFAs of the affected wood stork nesting colonies. On occasion, wetland credits purchased from a "Service Approved" mitigation bank located outside the CFAs could be acceptable to the Service, depending on location of impacted wetlands relative to the permitted service area of the bank, and whether or not the bank has wetlands having the same hydroperiod as the impacted wetland.

In an effort to reduce correspondence in effect determinations and responses, the Service is providing the Wood Stork Effect Determination Key below. If the use of this key results in a Corps determination of "no effect" for a particular project, the Service supports this determination. If the use of this Key results in a determination of NLAA, the Service concurs with this determination¹. This Key is subject to revisitation as the Corps and Service deem necessary.

The Key is as follows:

A. Project within 0.76 km (0.47 mile)² of an active colony site³ "may affect"⁴

Project impacts Suitable Foraging Habitat (SFH)⁵ at a location greater than 0.76 km (0.47 mile) from a colony site..... "go to B"

¹ With an outcome of "no effect" or "NLAA" as outlined in this key, and the project has less than 20.2 hectares (50 acres) of wetland impacts, the requirements of section 7 of the Act are fulfilled for the wood stork and no further action is required. For projects with greater than 20.2 hectares (50 acres) of wetland impacts, written concurrence of NLAA from the Service is necessary.

² Within the secondary zone (the average distance from the border of a colony to the limits of the secondary zone is 0.76 km (2,500 feet, or 0.47 mi).

³ An active colony is defined as a colony that is currently being used for nesting by wood storks or has historically over the last 10 years been used for nesting by wood storks.

⁴ Consultation may be concluded informally or formally depending on project impacts.

⁵ Suitable foraging habitat (SFH) includes wetlands that typically have shallow-open water areas that are relatively calm and have a permanent or seasonal water depth between 5 to 38 cm (2 to 15 inches) deep. Other shallow non-wetland water bodies are also SFH. SFH supports and concentrates, or is capable of supporting and concentrating small fish, frogs, and other aquatic prey. Examples of SFH include, but are not limited to freshwater marshes, small ponds, shallow, seasonally flooded roadside or agricultural ditches, seasonally flooded pastures, narrow tidal creeks or shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs.

Project does not affect SFH.....“no effect”.

B. Project impact to SFH is less than 0.20 hectare (one-half acre)⁶.....NLAA¹”

Project impact to SFH is greater in scope than 0.20 hectare (one-half acre).....go to C

C. Project impacts to SFH not within the CFA (29.9 km, 18.6 miles) of a colony sitego to D

Project impacts to SFH within the CFA of a colony sitego to E

D. Project impacts to SFH have been avoided and minimized to the extent practicable; compensation (Service approved mitigation bank or as provided in accordance with Mitigation Rule 33 CFR Part 332) for unavoidable impacts is proposed in accordance with the CWA section 404(b)(1) guidelines; and habitat compensation replaces the foraging value matching the hydroperiod⁷ of the wetlands affected and provides foraging value similar to, or higher than, that of impacted wetlands. See Enclosure 3 for a detailed discussion of the hydroperiod foraging values, an example, and further guidance⁸..... NLAA¹”

Project not as above..... “may affect⁴”

E. Project provides SFH compensation in accordance with the CWA section 404(b)(1) guidelines and is not contrary to the HMG; habitat compensation is within the appropriate CFA or within the service area of a Service-approved mitigation bank; and habitat compensation replaces foraging value, consisting of wetland enhancement or restoration matching the hydroperiod⁷ of the wetlands affected, and provides foraging value similar

⁶ On an individual basis, SFH impacts to wetlands less than 0.20 hectare (one-half acre) generally will not have a measurable effect on wood storks, although we request that the Corps require mitigation for these losses when appropriate. Wood storks are a wide ranging species, and individually, habitat change from impacts to SFH less than one-half acre are not likely to adversely affect wood storks. However, collectively they may have an effect and therefore regular monitoring and reporting of these effects are important.

⁷ Several researchers (Flemming et al. 1994; Ceilley and Bortone 2000) believe that the short hydroperiod wetlands provide a more important pre-nesting foraging food source and a greater early nestling survivor value for wood storks than the foraging base (grams of fish per square meter) than long hydroperiod wetlands provide. Although the short hydroperiod wetlands may provide less fish, these prey bases historically were more extensive and met the foraging needs of the pre-nesting storks and the early-age nestlings. Nest productivity may suffer as a result of the loss of short hydroperiod wetlands. We believe that most wetland fill and excavation impacts permitted in south Florida are in short hydroperiod wetlands. Therefore, we believe that it is especially important that impacts to these short hydroperiod wetlands within CFAs are avoided, minimized, and compensated for by enhancement/restoration of short hydroperiod wetlands.

⁸ For this Key, the Service requires an analysis of foraging prey base losses and enhancements from the proposed action as shown in the examples in Enclosure 3 for projects with greater than 2.02 hectares (5 acres) of wetland impacts. For projects with less than 2.02 hectares (5 acres) of wetland impacts, an individual foraging prey base analysis is not necessary although type for type wetland compensation is still a requirement of the Key.

to, or higher than, that of impacted wetlands. See Enclosure 3 for a detailed discussion of the hydroperiod foraging values, an example, and further guidance⁸ "NLAA"¹"

Project does not satisfy these elements "may affect"⁴"

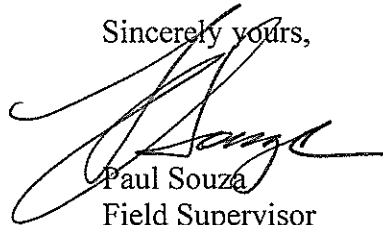
This Key does not apply to Comprehensive Everglades Restoration Plan projects, as they will require project-specific consultations with the Service.

Monitoring and Reporting Effects

For the Service to monitor cumulative effects, it is important for the Corps to monitor the number of permits and provide information to the Service regarding the number of permits issued where the effect determination was: "may affect, not likely to adversely affect." We request that the Corps send us an annual summary consisting of: project dates, Corps identification numbers, project acreages, project wetland acreages, and project locations in latitude and longitude in decimal degrees.

Thank you for your cooperation and effort in protecting federally listed species. If you have any questions, please contact Allen Webb at extension 246.

Sincerely yours,



Paul Souza
Field Supervisor
South Florida Ecological Services Office

Enclosures

cc: w/enclosures (electronic only)
Corps, Jacksonville, Florida (Stu Santos)
EPA, West Palm Beach, Florida (Richard Harvey)
FWC, Vero Beach, Florida (Joe Walsh)
Service, Jacksonville, Florida (Billy Brooks)

LITERATURE CITED

- Ceilley, D.W. and S.A. Bortone. 2000. A survey of freshwater fishes in the hydric flatwoods of flint pen strand, Lee County, Florida. Proceedings of the 27th Annual Conference on Ecosystems Restoration and Creation, 70-91. Hillsborough Community College; Hillsborough County, Florida.
- Flemming, D.M., W.F. Wolff, and D.L. DeAngelis. 1994. Importance of landscape heterogeneity to wood storks. Florida Everglades Management 18: 743-757.
- Kahl, M.P., Jr. 1964. Food ecology of the wood stork (*Mycteria americana*) in Florida. Ecological Monographs 34:97-117.
- Ogden, J.C. 1991. Nesting by wood storks in natural, altered, and artificial wetlands in central and northern Florida. Colonial Waterbirds 14:39-45.
- Ogden, J.C., J.A. Kushlan, and J.T. Tilmant. 1976. Prey selectivity by the wood stork. Condor 78(3):324-330.
- Ogden, J.C. 1996. Wood Stork in J.A. Rodgers, H. Kale II, and H.T. Smith, eds. Rare and endangered biota of Florida. University Press of Florida; Gainesville, Florida.
- Rodgers, J.A. Jr., A.S. Wenner, and S.T. Schwikert. 1987. Population dynamics of wood storks in northern and central Florida, USA. Colonial Waterbirds 10:151-156.
- Rodgers, J.A., Jr., S.T. Schwikert, and A. Shapiro-Wenner. 1996. Nesting habitat of wood storks in north and central Florida, USA. Colonial Waterbirds 19:1-21.
- U.S. Fish and Wildlife Service. 1990. Habitat management guidelines for the wood stork in the southeast region. Prepared by John C. Ogden for the Southeast Region U.S. Fish and Wildlife Service; Atlanta, Georgia.
- U.S. Fish and Wildlife Service. 1999. South Florida multi-species recovery plan. Fish and Wildlife Service; Atlanta, Georgia. Available from: <http://verobeach.fws.gov/Programs/Recovery/vbms5.html>.

HABITAT MANAGEMENT GUIDELINES FOR THE WOOD STORK IN THE SOUTHEAST REGION



**HABITAT MANAGEMENT GUIDELINES
FOR THE WOOD STORK IN THE
SOUTHEAST REGION**

Prepared by

John C. Ogden
Acting Program Manager
Wildlife Research
Everglades National Park

for the

Southeast Region
U.S. Fish and Wildlife Service

Cover design by
Florida Power & Light Company
Miami, Florida

HABITAT MANAGEMENT GUIDELINES FOR THE WOOD STORK IN THE SOUTHEAST REGION

Introduction

A number of Federal and state laws and/or regulations prohibit, cumulatively, such acts as harrassing, disturbing, harming, molesting, pursuing, etc., wood storks, or destroying their nests (see Section VII). Although advisory in nature, these guidelines represent a biological interpretation of what would constitute violations of one or more of such prohibited acts. Their purpose is to maintain and/or improve the environmental conditions that are required for the survival and well-being of wood storks in the southeastern United States, and are designed essentially for application in wood stork/human activity conflicts (principally land development and human intrusion into stork use sites). The emphasis is to avoid or minimize detrimental human-related impacts on wood storks. These guidelines were prepared in consultations with state wildlife agencies and wood stork experts in the four southeastern states where the wood stork is listed as Endangered (Alabama, Florida, Georgia, South Carolina).

General

The wood stork is a gregarious species, which nests in colonies (rookeries), and roosts and feeds in flocks, often in association with other species of long-legged water birds. Storks that nest in the southeastern United States appear to represent a distinct population, separate from the nearest breeding population in Mexico. Storks in the southeastern U.S. population have recently (since 1980) nested in colonies scattered throughout Florida, and at several central-southern Georgia and coastal South Carolina sites. Banded and color-marked storks from central and southern Florida colonies have dispersed during non-breeding seasons as far north as southern Georgia, and the coastal counties in South Carolina and southeastern North Carolina, and as far west as central Alabama and northeastern Mississippi. Storks from a colony in south-central Georgia have wintered between southern Georgia and southern Florida. This U.S. nesting population of wood storks was listed as endangered by the U.S. Fish and Wildlife Service on February 28, 1984 (*Federal Register* 49(4):7332-7335).

Wood storks use freshwater and estuarine wetlands as feeding, nesting, and roosting sites. Although storks are not habitat specialists, their needs are exacting enough, and available habitat is limited enough, so that nesting success and the size of regional populations are closely regulated by year-to-year differences in the quality and quantity of suitable habitat. Storks are especially sensitive to environmental conditions at feeding sites; thus, birds may fly relatively long distances either daily or between regions annually, seeking adequate food resources.

All available evidence suggests that regional declines in wood stork numbers have been largely due to the loss or degradation of essential wetland habitat. An understanding of the qualities of good stork habitat should help to focus protection efforts on those sites

that are seasonally important to regional populations of wood storks. Characteristics of feeding, nesting, and roosting habitat, and management guidelines for each, are presented here by habitat type.

I. Feeding habitat.

A major reason for the wood stork decline has been the loss and degradation of feeding habitat. Storks are especially sensitive to any manipulation of a wetland site that results in either reduced amounts or changes in the timing of food availability.

Storks feed primarily (often almost exclusively) on small fish between 1 and 8 inches in length. Successful foraging sites are those where the water is between 2 and 15 inches deep. Good feeding conditions usually occur where water is relatively calm and uncluttered by dense thickets of aquatic vegetation. Often a dropping water level is necessary to concentrate fish at suitable densities. Conversely, a rise in water, especially when it occurs abruptly, disperses fish and reduces the value of a site as feeding habitat.

The types of wetland sites that provide good feeding conditions for storks include: drying marshes or stock ponds, shallow roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, and depressions in cypress heads or swamp sloughs. In fact, almost any shallow wetland depression where fish tend to become concentrated, either through local reproduction or the consequences of area drying, may be used by storks.

Nesting wood storks do most of their feeding in wetlands between 5 and 40 miles from the colony, and occasionally at distances as great as 75 miles. Within this colony foraging range and for the 110-150 day life of the colony, and depending on the size of the colony and the nature of the surrounding wetlands, anywhere from 50 to 200 different feeding sites may be used during the breeding season.

Non-breeding storks are free to travel much greater distances and remain in a region only for as long as sufficient food is available. Whether used by breeders or non-breeders, any single feeding site may at one time have small or large numbers of storks (1 to 100+), and be used for one to many days, depending on the quality and quantity of available food. Obviously, feeding sites used by relatively large numbers of storks, and/or frequently used areas, potentially are the more important sites necessary for the maintenance of a regional population of birds.

Differences between years in the seasonal distribution and amount of rainfall usually mean that storks will differ between years in where and when they feed. Successful nesting colonies are those that have a large number of feeding site options, including sites that may be suitable only in years of rainfall extremes. To maintain the wide range of feeding site options requires that many different wetlands, with both relatively short and long annual hydroperiods, be preserved. For example, protecting only the larger wetlands, or those with longer annual hydroperiods, will result in the eventual loss of smaller, seemingly less important wetlands. However, these small scale wetlands are crucial as the only available feeding sites during the wetter periods when the larger habitats are too deeply flooded to be used by storks.

II. Nesting habitat.

Wood storks nest in colonies, and will return to the same colony site for many years so long as that site and surrounding feeding habitat continue to supply the needs of the birds. Storks require between 110 and 150 days for the annual nesting cycle, from the period of courtship until the nestlings become independent. Nesting activity may begin as early as December or as late as March in southern Florida colonies, and between late February and April in colonies located between central Florida and South Carolina. Thus, full term colonies may be active until June-July in south Florida, and as late as July-August at more northern sites. Colony sites may also be used for roosting by storks during other times of the year.

Almost all recent nesting colonies in the southeastern U.S. have been located either in woody vegetation over standing water, or on islands surrounded by broad expanses of open water. The most dominant vegetation in swamp colonies has been cypress, although storks also nest in swamp hardwoods and willows. Nests in island colonies may be in more diverse vegetation, including mangroves (coastal), exotic species such as Australian pine (*Casuarina*) and Brazilian Pepper (*Schinus*), or in low thickets of cactus (*Opuntia*). Nests are usually located 15-75 feet above ground, but may be much lower, especially on island sites when vegetation is low.

Since at least the early 1970's, many colonies in the southeastern U.S. have been located in swamps where water has been impounded due to the construction of levees or roadways. Storks have also nested in dead and dying trees in flooded phosphate surface mines, or in low, woody vegetation on mounded, dredge islands. The use of these altered wetlands or completely "artificial" sites suggests that in some regions or years storks are unable to locate natural nesting habitat that is adequately flooded during the normal breeding season. The readiness with which storks will utilize water impoundments for nesting also suggests that colony sites could be intentionally created and maintained through long-term site management plans. Almost all impoundment sites used by storks become suitable for nesting only fortuitously, and therefore, these sites often do not remain available to storks for many years.

In addition to the irreversible impacts of drainage and destruction of nesting habitat, the greatest threats to colony sites are from human disturbance and predation. Nesting storks show some variation in the levels of human activity they will tolerate near a colony. In general, nesting storks are more tolerant of low levels of human activity near a colony when nests are high in trees than when they are low, and when nests contain partially or completely feathered young than during the period between nest construction and the early nestling period (adults still brooding). When adult storks are forced to leave their nests, eggs or downy young may die quickly (<20 minutes) when exposed to direct sun or rain.

Colonies located in flooded environments must remain flooded if they are to be successful. Often water is between 3 and 5 feet deep in successful colonies during the nesting season. Storks rarely form colonies, even in traditional nesting sites, when they are dry, and may abandon nests if sites become dry during the nesting period. Flooding in colonies may be most important as a defense against mammalian predators. Studies of stork colonies in Georgia and

Florida have shown high rates of raccoon predation when sites dried during the nesting period. A reasonably high water level in an active colony is also a deterrent against both human and domestic animal intrusions.

Although nesting wood storks usually do most feeding away from the colony site (>5 miles), considerable stork activity does occur close to the colony during two periods in the nesting cycle. Adult storks collect almost all nesting material in and near the colony, usually within 2500 feet. Newly fledged storks, near the end of the nesting cycle, spend from 1-4 weeks during the fledging process flying locally in the colony area, and perched in nearby trees or marshy spots on the ground. These birds return daily to their nests to be fed. It is essential that these fledging birds have little or no disturbance as far out as one-half mile within at least one or two quadrants from the colony. Both the adults, while collecting nesting material, and the inexperienced fledglings, do much low, flapping flight within this radius of the colony. At these times, storks potentially are much more likely to strike nearby towers or utility lines.

Colony sites are not necessarily used annually. Regional populations of storks shift nesting locations between years, in response to year-to-year differences in food resources. Thus, regional populations require a range of options for nesting sites, in order to successfully respond to food availability. Protection of colony sites should continue, therefore, for sites that are not used in a given year.

III. Roosting habitat.

Although wood storks tend to roost at sites that are similar to those used for nesting, they also use a wider range of site types for roosting than for nesting. Non-breeding storks, for example, may frequently change roosting sites in response to changing feeding locations, and in the process, are inclined to accept a broad range of relatively temporary roosting sites. Included in the list of frequently used roosting locations are cypress "heads" or swamps (not necessarily flooded if trees are tall), mangrove islands, expansive willow thickets or small, isolated willow "islands" in broad marshes, and on the ground either on levees or in open marshes.

Daily activity patterns at a roost vary depending on the status of the storks using the site. Non-breeding adults or immature birds may remain in roosts during major portions of some days. When storks are feeding close to a roost, they may remain on the feeding grounds until almost dark before making the short flight. Nesting storks traveling long distances (>40 miles) to feeding sites may roost at or near the latter, and return to the colony the next morning. Storks leaving roosts, especially when going long distances, tend to wait for mid-morning thermals to develop before departing.

IV. Management zones and guidelines for feeding sites.

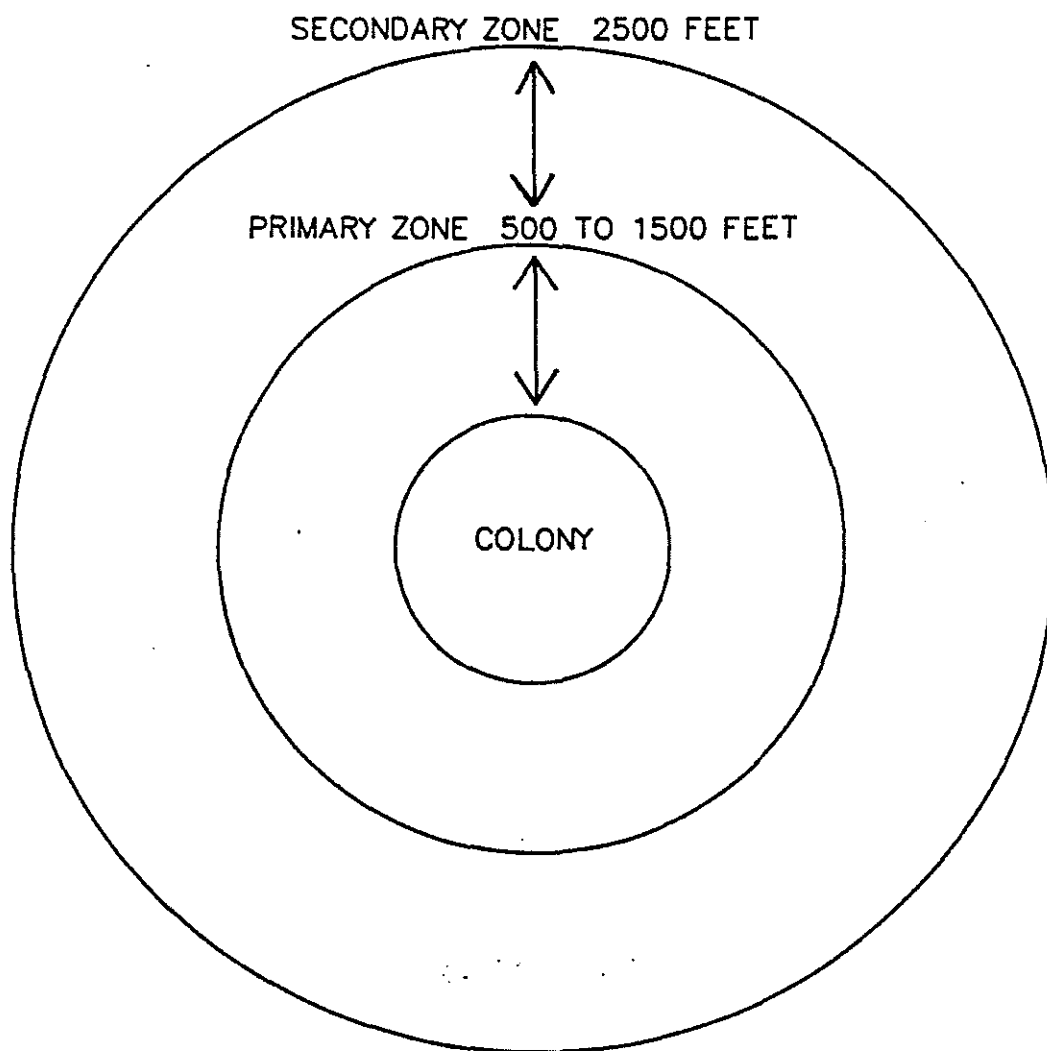
To the maximum extent possible, feeding sites should be protected by adherence to the following protection zones and guidelines:

- A. There should be no human intrusion into feeding sites when storks are present. Depending upon the amount of screening vegetation, human activity should be no closer than between 300 feet (where solid vegetation screens exist) and 750 feet (no vegetation screen).

- B. Feeding sites should not be subjected to water management practices that alter traditional water levels or the seasonally normal drying patterns and rates. Sharp rises in water levels are especially disruptive to feeding storks.
- C. The introduction of contaminants, fertilizers, or herbicides into wetlands that contain stork feeding sites should be avoided, especially those compounds that could adversely alter the diversity and numbers of native fishes, or that could substantially change the characteristics of aquatic vegetation. Increase in the density and height of emergent vegetation can degrade or destroy sites as feeding habitat.
- D. Construction of tall towers (especially with guy wires) within three miles, or high power lines (especially across long stretches of open country) within one mile of major feeding sites should be avoided.

V. Management zones and guidelines for nesting colonies.

- A. Primary zone: This is the most critical area, and must be managed according to recommended guidelines to insure that a colony site survives.
 - 1. Size: The primary zone must extend between 1000 and 1500 feet in all directions from the actual colony boundaries when there are no visual or broad aquatic barriers, and never less than 500 feet even when there are strong visual or aquatic barriers. The exact width of the primary zone in each direction from the colony can vary within this range, depending on the amount of visual screen (tall trees) surrounding the colony, the amount of relatively deep, open water between the colony and the nearest human activity, and the nature of the nearest human activity. In general, storks forming new colonies are more tolerant of existing human activity, than they will be of new human activity that begins after the colony has formed.
 - 2. Recommended Restrictions:
 - a. Any of the following activities within the primary zone, at any time of the year, are likely to be detrimental to the colony:
 - (1) Any lumbering or other removal of vegetation, and
 - (2) Any activity that reduces the area, depth, or length of flooding in wetlands under and surrounding the colony, except where periodic (less than annual) water control may be required to maintain the health of the aquatic, woody vegetation, and
 - (3) The construction of any building, roadway, tower, power line, canal, etc.
 - b. The following activities within the primary zone are likely to be detrimental to a colony if they occur when the colony is active:
 - (1) Any unauthorized human entry closer than 300 feet of the colony, and



- (2) Any increase or irregular pattern in human activity anywhere in the primary zone, and
 - (3) Any increase or irregular pattern in activity by animals, including livestock or pets, in the colony, and
 - (4) Any aircraft operation closer than 500 feet of the colony.
- B. Secondary Zone: Restrictions in this zone are needed to minimize disturbances that might impact the primary zone, and to protect essential areas outside of the primary zone. The secondary zone may be used by storks for collecting nesting material, for roosting, loafing, and feeding (especially important to newly fledged young), and may be important as a screen between the colony and areas of relatively intense human activities.
- 1. Size: The secondary zone should range outward from the primary zone 1000-2000 feet, or to a radius of 2500 feet of the outer edge of the colony.
 - 2. Recommended Restrictions:
 - a. Activities in the secondary zone which may be detrimental to nesting wood storks include:
 - (1) Any increase in human activities above the level that existed in the year when the colony first formed, especially when visual screens are lacking, and
 - (2) Any alteration in the area's hydrology that might cause changes in the primary zone, and
 - (3) Any substantial (>20 percent) decrease in the area of wetlands and woods of potential value to storks for roosting and feeding.
 - b. In addition, the probability that low flying storks, or inexperienced, newly-fledged young will strike tall obstructions, requires that high-tension power lines be no closer than one mile (especially across open country or in wetlands) and tall transmission towers no closer than 3 miles from active colonies. Other activities, including busy highways and commercial and residential buildings may be present in limited portions of the secondary zone at the time that a new colony first forms. Although storks may tolerate existing levels of human activities, it is important that these human activities not expand substantially.

VI. Roosting site guidelines.

The general characteristics and temporary use-patterns of many stork roosting sites limit the number of specific management recommendations that are possible:

- A. Avoid human activities within 500-1000 feet of roost sites during seasons of the year and times of the day when storks may be present. Nocturnal activities in active roosts may be especially disruptive.

- B. Protect the vegetative and hydrological characteristics of the more important roosting sites--those used annually and/or used by flocks of 25 or more storks. Potentially, roosting sites may, some day, become nesting sites.

VII. Legal Considerations.

A. Federal Statutes

The U.S. breeding population of the wood stork is protected by the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act). The population was listed as endangered on February 28, 1984 (49 Federal Register 7332); wood storks breeding in Alabama, Florida, Georgia, and South Carolina are protected by the Act.

Section 9 of the Endangered Species Act of 1973, as amended, states that it is unlawful for any person subject to the jurisdiction of the United States to take (defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.") any listed species anywhere within the United States.

The wood stork is also federally protected by its listing (50 CFR 10.13) under the Migratory Bird Treaty Act (167 U.S.C. 703-711), which prohibits the taking, killing or possession of migratory birds except as permitted.

B. State Statutes

1. State of Alabama

Section 9-11-232 of Alabama's Fish, Game, and Wildlife regulations curtails the possession, sale, and purchase of wild birds. "Any person, firm, association, or corporation who takes, catches, kills or has in possession at any time, living or dead, any protected wild bird not a game bird or who sells or offers for sale, buys, purchases or offers to buy or purchase any such bird or exchange same for anything of value or who shall sell or expose for sale or buy any part of the plumage, skin, or body of any bird protected by the laws of this state or who shall take or willfully destroy the nests of any wild bird or who shall have such nests or eggs of such birds in his possession, except as otherwise provided by law, shall be guilty of a misdemeanor..."

Section 1 of the Alabama Nongame Species Regulation (Regulation 87-GF-7) includes the wood stork in the list of nongame species covered by paragraph (4). "It shall be unlawful to take, capture, kill, possess, sell, trade for anything of monetary value, or offer to sell or trade for anything of monetary value, the following nongame wildlife species (or any parts or reproductive products of such species) without a scientific collection permit and written permission from the Commissioner, Department of Conservation and Natural Resources..."

2. State of Florida

Rule 39-4.001 of the Florida Wildlife Code prohibits "taking, attempting to take, pursuing, hunting, molesting, capturing, or killing (collectively defined as "taking"), transporting, storing, serving, buying, selling,

possessing, or wantonly or willingly wasting any wildlife or freshwater fish or their nests, eggs, young, homes, or dens except as specifically provided for in other rules of Chapter 39, Florida Administrative Code.

Rule 39-27.011 of the Florida Wildlife Code prohibits "killing, attempting to kill, or wounding any endangered species." The "Official Lists of Endangered and Potentially Endangered Fauna and Flora in Florida" dated 1 July 1988, includes the wood stork, listed as "endangered" by the Florida Game and Fresh Water Fish Commission.

3. State of Georgia

Section 27-1-28 of the Conservation and Natural Resources Code states that "Except as otherwise provided by law, rule, or regulation, it shall be unlawful to hunt, trap, fish, take, possess, or transport any nongame species of wildlife..."

Section 27-1-30 states that, "Except as otherwise provided by law or regulation, it shall be unlawful to disturb, mutilate, or destroy the dens, holes, or homes of any wildlife; "

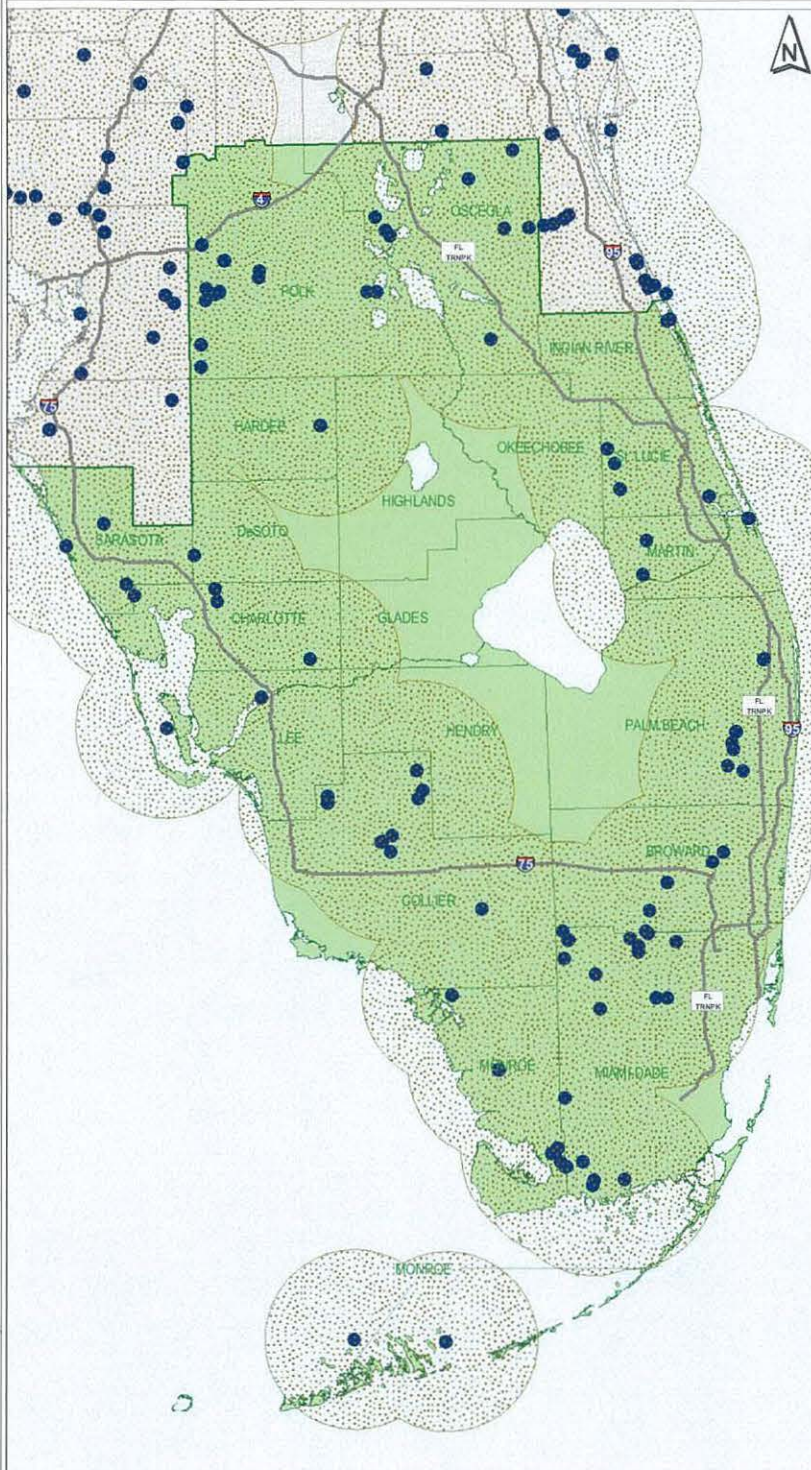
Section 27-3-22 states, in part, "It shall be unlawful for any person to hunt, trap, take, possess, sell, purchase, ship, or transport any hawk, eagle, owl, or any other bird or any part, nest, or egg thereof..."

The wood stork is listed as endangered pursuant to the Endangered Wildlife Act of 1973 (Section 27-3-130 of the Code). Section 391-4-13-.06 of the Rules and Regulations of the Georgia Department of Natural Resources prohibits harassment, capture, sale, killing, or other actions which directly cause the death of animal species protected under the Endangered Wildlife Act. The destruction of habitat of protected species on public lands is also prohibited.

4. State of South Carolina

Section 50-15-40 of the South Carolina Nongame and Endangered Species Conservation Act states, "Except as otherwise provided in this chapter, it shall be unlawful for any person to take, possess, transport, export, process, sell, or offer of sale or ship, and for any common or contract carrier knowingly to transport or receive for shipment any species or subspecies of wildlife appearing on any of the following lists: (1) the list of wildlife indigenous to the State, determined to be endangered within the State...(2) the United States' List of Endangered Native Fish and Wildlife... (3) the United States' List of Endangered Foreign Fish and Wildlife ..."

Wood Stork



Nesting Colonies Core Foraging Areas

1999 to 2005

- Colony Location
- Core Foraging Area
- South Florida Service Area



Produced by:
South Florida Ecological Services Office
<http://verobeach.fws.gov>
Phone: 772.562.3909



Enclosure 3

Wood Stork Foraging Analysis: Excerpts of concepts and procedure as presented by the Service in this appendix may be viewed in detail in any one of our recent Biological Opinions for project related impacts to the wood stork. These documents can be found at the internet website address <http://www.fws.gov/filedownloads/ftp%5verobeach>.

Foraging Habitat

Researchers have shown that wood storks forage most efficiently and effectively in habitats where prey densities are high and the water shallow and canopy open enough to hunt successfully (Ogden et al. 1978, Browder 1984, Coulter 1987). Prey availability to wood storks is dependent on a composite variable consisting of density (number or biomass/m²) and the vulnerability of the prey items to capture (Gawlik 2002). For wood storks, prey vulnerability appears to be largely controlled by physical access to the foraging site, water depth, the density of submerged vegetation, and the species-specific characteristics of the prey. For example, fish populations may be very dense, but not available (vulnerable) because the water depth is too deep (greater than 30 cm) for storks or the tree canopy at the site is too dense for storks to land. Calm water, about 5-40 cm (2-16 in) in depth, and free of dense aquatic vegetation is ideal (Coulter and Bryan 1993).

Coulter and Bryan's (1993) study suggested that wood storks preferred ponds and marshes, and visited areas with little or no canopy more frequently. Even in foraging sites in swamps, the canopy tended to be sparse. They suggested that open canopies may have contributed to detection of the sites and more importantly may have allowed the storks to negotiate landing more easily than at closed-canopy sites. In their study, the median amount of canopy cover where wood stork foraging was observed was 32 percent. Other researchers (P.C. Frederick, University of Florida, personal communication 2006; J.A. Rodgers, FWC, personal communication 2006) also confirm that wood storks will forage in woodlands, though the woodlands have to be fairly open and vegetation not very dense. Furthermore, the canopies must be open enough for wood storks to take flight quickly to avoid predators.

Melaleuca-infested Wetlands: As discussed previously, wetland suitability for wood stork foraging is partially dependent on vegetation density. Melaleuca is a dense-stand growth plant species, effectively producing a closed canopy and dense understory growth pattern that generally limits a site's accessibility to foraging by wading birds. However, O'Hare and Dalrymple (1997) suggest moderate infestations of melaleuca may have little effect on some species' productivity (*i.e.*, amphibians and reptiles) as long as critical abiotic factors such as hydrology remain. They also note as the levels of infestation increase, usage by wetland dependent species decreases. Their studies also showed that the number of fish species present in a wetland system remain stable at certain levels of melaleuca. However, the availability of the prey base for wood storks and other foraging wading birds is reduced by the restriction of access caused from dense and thick exotic vegetation. Wood storks and other wading birds can forage in these systems in open area pockets (*e.g.*, wind blow-downs), provided multiple conditions are optimal (*e.g.*, water depth, prey density). In O'Hare and Dalrymple's study (1997), they identify five cover types (Table 1) and

provide information on the number of wetland dependent bird species and the number of individuals observed within each of these vegetation classes (Table 2).

Table 1: Vegetation classes

DMM	75-100 percent mature dense melaleuca coverage
DMS or (SDM)	75-100 percent sapling dense melaleuca coverage
P75	50-75 percent melaleuca coverage
P50	0-50 percent melaleuca coverage
MAR (Marsh)	0-10 percent melaleuca coverage

The number of wetland-dependent species and individuals observed per cover type is shown below in columns 1, 2, and 3 (Table 2). To develop an estimate of the importance a particular wetland type may have (based on density and aerial coverage by exotic species) to wetland dependent species, we developed a foraging suitability value using observational data from O'Hare and Dalrymple (1997). The Foraging Suitability Value as shown in column 5 (Table 2) is calculated by multiplying the number of species by the number of individuals and dividing this value by the maximum number of species and individuals combined ($12 \times 132 = 1584$). The results are shown below for each of the cover types in O'Hare and Dalrymple (1997) study (Table 1). As an example, for the P50 cover type, the foraging suitability is calculated by multiplying 11 species times 92 individuals for a total of 1,012. Divide this value by 1,584, which is the maximum number of species times the maximum number of individuals ($12 \times 132 = 1,584$). The resultant is 0.6389 or 64 percent ($11 \times 92 = 1012 / 1584 \times 100 = 63.89$).

Table 2: Habitat Foraging Suitability

Cover Type	# of Species (S)	# of Individuals (I)	S*I	Foraging Suitability
DMM	1	2	2	0.001
DMS	4	10	40	0.025
P75	10	59	590	0.372
P50	11	92	1,012	0.639
MAR	12	132	1,584	1.000

This approach was developed to provide us with a method of assessing wetland acreages and their relationship to prey densities and prey availability. We consider wetland dependent bird use to be a general index of food availability. Based on this assessment we developed an exotic foraging suitability index (Table 3):

Table 3. Foraging Suitability Percentages

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

In our assessment however, we consider DMM to represent all exotic species densities between 90 and 100 percent and DMS to represent all exotic species densities between 75 and 90 percent. In our evaluation of a habitat's suitability, the field distinction between an exotic coverage of

90 percent and 100 percent in many situations is not definable, therefore unless otherwise noted in the field reports and in our analysis; we consider a suitability value of 3 percent to represent both densities.

Hydroperiod: The hydroperiod of a wetland can affect the prey densities in a wetland. For instance, research on Everglades fish populations using a variety of quantitative sampling techniques (pull traps, throw traps, block nets) have shown that the density of small forage fish increases with hydroperiod. Marshes inundated for less than 120 days of the year average ± 4 fish/m²; whereas, those flooded for more than 340 days of the year average ± 25 fish/m² (Loftus and Eklund 1994, Trexler et al. 2002).

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

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

Table 4. SFWMD Hydroperiod Classes – Everglades Protection Area

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

Fish Density per Hydroperiod: In the Service's assessment of project related impacts to wood storks, the importance of fish data specific to individual hydroperiods is the principle basis of our assessment. In order to determine the fish density per individual hydroperiod, the Service relied on the number of fish per hydroperiod developed from throw-trap data in Trexler et al.'s (2002) study and did not use the electrofishing data also presented in Trexler et al.'s study that defined fish densities in catch per unit effort, which is not hydroperiod specific. Although the throw-trap sampling generally only samples fish 8 cm or less, the Service believes the data can be used as a surrogate representation of all fish, including those larger than 8 cm, which are typically sampled by either electrofishing or block net sampling.

We base this evaluation on the following assessment. Trexler et al.'s (2002) study included electrofishing data targeting fish greater than 8 cm, the data is recorded in catch per unit effort and in general is not hydroperiod specific. However, Trexler et al. (2002) notes in their assessment of the electrofishing data that in general there is a correlation with the number of fish per unit effort per changes in water depth. In literature reviews of electrofishing data by Chick et

al. (1999 and 2004), they note that electrofishing data provides a useful index of the abundance of larger fish in shallow, vegetated habitat, but length, frequency, and species compositional data should be interpreted with caution. Chick et al. (2004) also noted that electrofishing data for large fish (> 8cm) provided a positive correlation of the number of fish per unit effort (abundance) per changes in hydroperiod. The data in general show that as the hydroperiod decreases, the abundance of larger fishes also decreases.

Studies by Turner et al. (1999), Turner and Trexler (1997), and Carlson and Duever (1979) also noted this abundance trend for fish species sampled. We also noted in our assessment of prey consumption by wood storks in the Ogden et al. (1976) study (Figure 4) (discussed below), that the wood stork's general preference is for fish measuring 1.5 cm to 9 cm, although we also acknowledged that wood storks consume fish larger than the limits discussed in the Ogden et al. (1976) study. A similar assessment is reference by Trexler and Goss (2009) noting a diversity of size ranges of prey available for wading birds to consume, with fish ranging from 6 to 8 cm being the preferred prey for larger species of wading birds, particularly wood storks (Kushlan et al. 1975).

Therefore, since data were not available to quantify densities (biomass) of fish larger than 8 cm to a specific hydroperiod, and Ogden et al.'s (1976) study notes that the wood stork's general preference is for fish measuring 1.5 cm to 9 cm, and that empirical data on fish densities per unit effort correlated positively with changes in water depth, we believe that the Trexler et al. (2002) throw-trap data represents a surrogate assessment tool to predict the changes in total fish density and the corresponding biomass per hydroperiod for our wood stork assessment.

In consideration of this assessment, the Service used the data presented in Trexler et al.'s (2002) study on the number of fish per square-meter per hydroperiod for fish 8 cm or less to be applicable for estimating the total biomass per square-meter per hydroperiod for all fish. In determining the biomass of fish per square-meter per hydroperiod, the Service relied on the summary data provided by Turner et al. (1999), which provides an estimated fish biomass of 6.5 g/m² for a Class 7 hydroperiod for all fish and used the number of fish per square-meter per hydroperiod from Trexler et al.'s data to extrapolate biomass values per individual hydroperiods.

Trexler et al.'s (2002) studies in the Everglades provided densities, calculated as the square-root of the number of fish per square meter, for only six hydroperiods; although these cover the same range of hydroperiods developed by the SFWMD. Based on the throw-trap data and Trexler et al.'s (2002) hydroperiods, the square-root fish densities are:

Table 5. Fish Densities per Hydroperiod from Trexler et al. (2002)

Hydroperiod Class	Days Inundated	Fish Density
Class 1	0-120	2.0
Class 2	120-180	3.0
Class 3	180-240	4.0
Class 4	240-300	4.5
Class 5	300-330	4.8
Class 6	330-365	5.0

Trexler et al.'s (2002) fish densities are provided as the square root of the number of fish per square meter. For our assessment, we squared these numbers to provide fish per square meter, a simpler calculation when other prey density factors are included in our evaluation of adverse effects to listed species from the proposed action. We also extrapolated the densities over seven hydroperiods, which is the same number of hydroperiods characterized by the SFWMD. For example, Trexler et al.'s (2002) square-root density of a Class 2 wetland with three fish would equate to a SFWMD Model Class 3 wetland with nine fish. Based on the above discussion, the following mean annual fish densities were extrapolated to the seven SFWMD Model hydroperiods:

Table 6. Extrapolated Fish Densities for SFWMD Hydroperiods

Hydroperiod Class	Days Inundated	Extrapolated Fish Density
Class 1	0-60	2 fish/m ²
Class 2	60-120	4 fish/m ²
Class 3	120-180	9 fish/m ²
Class 4	180-240	16 fish/m ²
Class 5	240-300	20 fish/m ²
Class 6	300-330	23 fish/m ²
Class 7	330-365	25 fish/m ²

Fish Biomass per Hydroperiod: A more important parameter than fish per square-meter in defining fish densities is the biomass these fish provide. In the ENP and WCA-3, based on studies by Turner et al. (1999), Turner and Trexler (1997), and Carlson and Duever (1979), the standing stock (biomass) of large and small fishes combined in unenriched Class 5 and 6 hydroperiod wetlands averaged between 5.5 to 6.5 grams-wet-mass/m². In these studies, the data was provided in g/m² dry-weight and was converted to g/m² wet-weight following the procedures referenced in Kushlan et al. (1986) and also referenced in Turner et al. (1999). The fish density data provided in Turner et al. (1999) included both data from samples representing fish 8 cm or smaller and fish larger than 8 cm and included summaries of Turner and Trexler (1997) data, Carlson and Duever (1979) data, and Loftus and Eklund (1994) data. These data sets also reflected a 0.6 g/m² dry-weight correction estimate for fish greater than 8 cm based on Turner et al.'s (1999) block-net rotenone samples.

Relating this information to the hydroperiod classes developed by the SFWMD, we estimated the mean annual biomass densities per hydroperiod. For our assessment, we considered Class 7 hydroperiod wetlands based on Turner et al. (1999) and Trexler et al. (2002) studies to have a mean annual biomass of 6.5 grams-wet-mass/m² and to be composed of 25 fish/m². The remaining biomass weights per hydroperiod were determined as a direct proportion of the number of fish per total weight of fish for a Class 7 hydroperiod (6.5 grams divided by 25 fish equals 0.26 grams per fish).

For example, given that a Class 3 hydroperiod has a mean annual fish density of 9 fish/m², with an average weight of 0.26 grams per fish, the biomass of a Class 3 hydroperiod would be 2.3 grams/m² (9*0.26 = 2.3). Based on the above discussion, the biomass per hydroperiod class is:

Table 7. Extrapolated Mean Annual Fish Biomass for SFWMD Hydroperiods

Hydroperiod Class	Days Inundated	Extrapolated Fish Biomass
Class 1	0-60	0.5 gram/m ²
Class 2	60-120	1.0 gram/m ²
Class 3	120-180	2.3 grams/m ²
Class 4	180-240	4.2 grams/m ²
Class 5	240-300	5.2 grams/m ²
Class 6	300-330	6.0 grams/m ²
Class 7	330-365	6.5 grams/m ²

Wood stork suitable prey size: Wood storks are highly selective in their feeding habits and in studies on fish consumed by wood storks, five species of fish comprised over 85 percent of the number and 84 percent of the biomass of over 3,000 prey items collected from adult and nestling wood storks (Ogden et al. 1976). Table 8 lists the fish species consumed by wood storks in Ogden et al. (1976).

Table 8. Primary Fish Species consumed by Wood Storks from Ogden et al. (1976)

Common name	Scientific name	Percent Individuals	Percent Biomass
Sunfishes	<i>Centrarchidae</i>	14	44
Yellow bullhead	<i>Italurus natalis</i>	2	12
Marsh killifish	<i>Fundulus confluentus</i>	18	11
Flagfish	<i>Jordenella floridae</i>	32	7
Sailfin molly	<i>Poecilia latipinna</i>	20	11

These species were also observed to be consumed in much greater proportions than they occur at feeding sites, and abundant smaller species [e.g., mosquitofish (*Gambusia affinis*), least killifish (*Heterandria formosa*), bluefin killifish (*Lucania goodei*)] are under-represented, which the researchers believed was probably because their small size did not elicit a bill-snapping reflex in these tactile feeders (Coulter et al. 1999). Their studies also showed that, in addition to selecting larger species of fish, wood storks consumed individuals that are significantly larger (>3.5 cm) than the mean size available (2.5 cm), and many were greater than 1-year old (Ogden et al. 1976, Coulter et al. 1999). However, Ogden et al. (1976) also found that wood storks most likely consumed fish that were between 1.5 and 9.0 cm in length (Figure 4 in Ogden et al. 1976).

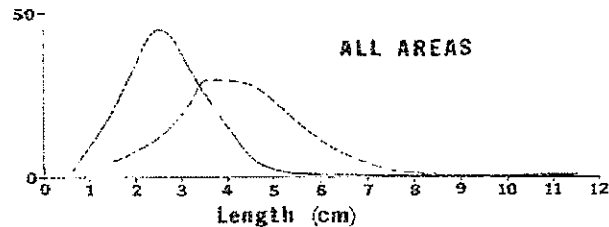


FIGURE 4. Length frequency distribution of fish available to and consumed by Wood Storks in different habitats.

In Ogden et al.'s (1976) Figure 4, the dotted line is the distribution of fish consumed and the solid line is the available fish. Straight interpretation of the area under the dotted line curve

represents the size classes of fish most likely consumed by wood storks and is the basis of our determination of the amount of biomass that is within the size range of fish most likely consumed by wood storks, which in this example is a range size of 1.5 to 9.0 cm in length.

Wood stork suitable prey base (biomass per hydroperiod): To estimate that fraction of the available fish biomass that might be consumed by wood storks, the following analysis was conducted. Trexler et al.'s (2002) 2-year throw trap data of absolute and relative fish abundance per hydroperiod distributed across 20 study sites in the ENP and the WCAs was considered to be representative of the Everglades fish assemblage available to wood storks ($n = 37,718$ specimens of 33 species). Although Trexler et al.'s (2002) data was based on throw-trap data and representative of fish 8 cm or smaller, the Service believes the data set can be used to predict the biomass/m² for total fish (those both smaller and larger than 8 cm). This approach is also supported, based on our assessment of prey consumption by wood storks in Ogden et al.'s (1976) study (Figure 4), that the wood storks general preference is for fish measuring 1.5 cm to 9 cm and is generally inclusive of Trexler et al.'s (2002) throw-trap data of fish 8 cm or smaller.

To estimate the fraction of the fish biomass that might be consumed by wood storks, the Service, using Trexler et al.'s (2002) throw-trap data set, determined the mean biomass of each fish species that fell within the wood stork prey size limits of 1.5 to 9.0 cm. The mean biomass of each fish species was estimated from the length and wet mass relationships for Everglades' ichthyofauna developed by Kushlan et al. (1986). The proportion of each species that was outside of this prey length and biomass range was estimated using the species mean and variance provided in Table 1 in Kushlan et al. (1986). These biomass estimates assumed the length and mass distributions of each species was normally distributed and the fish biomass could be estimated by eliminating that portion of each species outside of this size range. These biomass estimates of available fish prey were then standardized to a sum of 6.5 g/m² for Class 7 hydroperiod wetlands (Service 2009).

For example, Kushlan et al. (1986) lists the warmouth (*Lepomis gulosus*) with a mean average biomass of 36.76 g. In fish samples collected by Trexler et al. (2002), this species accounted for 0.048 percent ($18/37,715=0.000477$) of the Everglades freshwater ichthyofauna. Based on an average biomass of 36.76 g (Kushlan et al. 1986), the 0.048 percent representation from Trexler et al. (2002) is equivalent to an average biomass of 1.75 g ($36.76*0.048$) or 6.57 percent ($1.75/26.715$) of the estimated average biomass (26.715 g) of Trexler et al.'s (2002) samples (Service 2009).

Standardizing these data to a sample size of 6.5 g/m², the warmouth biomass for long hydroperiod wetlands would be about 0.427 g (Service 2009). However, the size frequency distribution (assumed normal) for warmouth (Kushlan et al. 1986) indicate 48 percent are too large for wood storks and 0.6 percent are too small (outside the 1.5 cm to 9 cm size range most likely consumed), so the warmouth biomass within the wood stork's most likely consumed size range is only 0.208 g ($0.427*(0.48+0.006)=0.2075$) in a 6.5 g/m² sample. Using this approach summed over all species in long hydroperiod wetlands, only 3.685 g/m² of the 6.5 g/m² sample consists of fish within the size range likely consumed by wood storks or about 57 percent ($3.685/6.5*100=56.7$) of the total biomass available.

An alternative approach to estimate the available biomass is based on Ogden et al. (1976). In their study (Table 8), the sunfishes and four other species that accounted for 84 percent of the biomass eaten by wood storks totaled 2.522 g of the 6.5 g/m² sample (Service 2009). Adding the remaining 16 percent from other species in the sample, the total biomass would suggest that 2.97 g of a 6.5 g/m² sample are most likely to be consumed by wood storks or about 45.7 percent ($2.97/6.5=0.4569$)

The mean of these two estimates is 3.33g/m² for long hydroperiod wetlands ($3.685 + 2.97 = 6.655 / 2 = 3.33$). This proportion of available fish prey of a suitable size ($3.33 \text{ g/m}^2 / 6.5 \text{ g/m}^2 = 0.51$ or 51 percent) was then multiplied by the total fish biomass in each hydroperiod class to provide an estimate of the total biomass of a hydroperiod that is the appropriate size and species composition most likely consumed by wood storks.

As an example, a Class 3 SFWMD model hydroperiod wetland with a biomass of 2.3 grams/m², adjusted by 51 percent for appropriate size and species composition, provides an available biomass of 1.196 grams/m². Following this approach, the biomass per hydroperiod potentially available to predation by wood storks based on size and species composition is:

Table 9. Wood Stork Suitable Prey Base (fish biomass per hydroperiod)

Hydroperiod Class	Days Inundated	Fish Biomass
Class 1	0-60	0.26 gram/m ²
Class 2	60-120	0.52 gram/m ²
Class 3	120-180	1.196 grams/m ²
Class 4	180-240	2.184 grams/m ²
Class 5	240-300	2.704 grams/m ²
Class 6	300-330	3.12 grams/m ²
Class 7	330-365	3.38 grams/m ²

Wood Stork-Wading Bird Prey Consumption Competition: In 2006, (Service 2006), the Service developed an assessment approach that provided a foraging efficiency estimate that 55 percent of the available biomass was actually consumed by wood storks. Since the implementation of this assessment approach, the Service has received comments from various sources concerning the Service's understanding of Fleming et al.'s (1994) assessment of prey base consumed by wood storks versus prey base assumed available to wood stork and the factors included in the 90 percent prey reduction value.

In our original assessment, we noted that, "*Fleming et al. (1994) provided an estimate of 10 percent of the total biomass in their studies of wood stork foraging as the amount that is actually consumed by the storks. However, the Fleming et al. (1994) estimate also includes a second factor, the suitability of the foraging site for wood storks, a factor that we have calculated separately. In their assessment, these two factors accounted for a 90 percent reduction in the biomass actually consumed by the storks. We consider these two factors as equally important and are treated as equal components in the 90 percent reduction; therefore, we consider each factor to represent 45 percent of the reduction. In consideration of this approach, Fleming et al.'s (1994) estimate that 10 percent of the biomass would actually be consumed by the storks would be added to the 45 percent value for an estimate that 55 percent (10 percent plus the remaining 45 percent) of the available biomass would actually be consumed by the storks and is the factor we believe represents the amount of the prey base that is actually consumed by the stork.*"

In a follow-up review of Fleming et al.'s (1994) report, we noted that the 10 percent reference is to prey available to wood storks, not prey consumed by wood storks. We also noted the 90 percent reduction also includes an assessment of prey size, an assessment of prey available by water level (hydroperiod), an assessment of suitability of habitat for foraging (openness), and an assessment for competition with other species, not just the two factors considered originally by the Service (suitability and competition). Therefore, in re-evaluating of our approach, we identified four factors in the 90 percent biomass reduction and not two as we previously considered. We believe these four factors are represented as equal proportions of the 90 percent reduction, which corresponds to an equal split of 22.5 percent for each factor. Since we have accounted previously for three of these factors in our approach (prey size, habitat suitability, and hydroperiod) and they are treated separately in our assessment, we consider a more appropriate foraging efficiency to represent the original 10 percent and the remaining 22.5 percent from the 90 percent reduction discussed above. Following this revised assessment, our competition factor would be 32.5 percent, not the initial estimate of 55 percent.

Other comments reference the methodology's lack of sensitivity to limiting factors, i.e., is there sufficient habitat available across all hydroperiods during critical life stages of wood stork nesting and does this approach over emphasize the foraging biomass of long hydroperiod wetlands with a corresponding under valuation of short hydroperiod wetlands. The Service is aware of these questions and is examining alternative ways to assess these concerns. However, until further research is generated to refine our approach, we continue to support the assessment tool as outlined.

Following this approach, Table 10 has been adjusted to reflect the competition factor and represents the amount of biomass consumed by wood storks and is the basis of our effects assessments (Class 1 hydroperiod with a biomass 0.26 g, multiplied by 0.325, results in a value of 0.08 g [$0.26 \times 0.325 = 0.08$]) (Table 10).

Table 10 Actual Biomass Consumed by Wood Storks

Hydroperiod Class	Days Inundated	Fish Biomass
Class 1	0-60	0.08 gram/m ²
Class 2	60-120	0.17 gram/m ²
Class 3	120-180	0.39 grams/m ²
Class 4	180-240	0.71 grams/m ²
Class 5	240-300	0.88 grams/m ²
Class 6	300-330	1.01 grams/m ²
Class 7	330-365	1.10 grams/m ²

Sample Project of Biomass Calculations and Corresponding Concurrence Determination

Example 1:

An applicant is proposing to construct a residential development with unavoidable impacts to 5 acres of wetlands and is proposing to restore and preserve 3 acres of wetlands onsite. Data on the onsite wetlands classified these systems as exotic impacted wetlands with greater than 50

percent but less than 75 percent exotics (Table 3) with an average hydroperiod of 120-180 days of inundation.

The equation to calculate the biomass lost is: The number of acres, converted to square-meters, times the amount of actual biomass consumed by the wood stork (Table 10), times the exotic foraging suitability index (Table 3), equals the amount of grams lost, which is converted to kg.

Biomass lost $(5 \times 4,047 \times 0.39 \text{ (Table 10)} \times 0.37 \text{ (Table 3)}) = 2,919.9 \text{ grams or } 2.92 \text{ kg}$

In the example provided, the 5 acres of wetlands, converted to square-meters ($1 \text{ acre} = 4,047 \text{ m}^2$) would provide 2.9 kg of biomass ($5 \times 4,047 \times 0.39 \text{ (Table 10)} \times 0.37 \text{ (Table 3)} = 2,919.9 \text{ grams or } 2.9 \text{ kg}$), which would be lost from development.

The equation to calculate the biomass from the preserve is the same, except two calculations are needed, one for the existing biomass available and one for the biomass available after restoration.

Biomass Pre: $(3 \times 4,047 \times 0.39 \text{ (Table 10)} \times 0.37 \text{ (Table 3)}) = 1,751.95 \text{ grams or } 1.75 \text{ kg}$

Biomass Post: $(3 \times 4,047 \times 0.39 \text{ (Table 10)} \times 1 \text{ (Table 3)}) = 4,734.99 \text{ grams or } 4.74 \text{ kg}$

Net increase: $4.74 \text{ kg} - 1.75 \text{ kg} = 2.98 \text{ kg Compensation Site}$

Project Site Balance $2.98 \text{ kg} - 2.92 \text{ kg} = 0.07 \text{ kg}$

The compensation proposed is 3 acres, which is within the same hydroperiod and has the same level of exotics. Following the calculations for the 5 acres, the 3 acres in its current habitat state, provides 1.75 kg ($3 \times 4,047 \times 0.39 \text{ (Table 10)} \times 0.37 \text{ (Table 3)} = 1,751.95 \text{ grams or } 1.75 \text{ kg}$) and following restoration provides 4.74 kg ($3 \times 4,047 \times 0.39 \text{ (Table 10)} \times 1 \text{ (Table 3)} = 4,734.99 \text{ grams or } 4.74 \text{ kg}$), a net increase in biomass of 2.98 kg ($4.74 - 1.75 = 2.98$).

Example 1: 5 acre wetland loss, 3 acre wetland enhanced – same hydroperiod - NLAA

Hydroperiod	Existing Footprint		On-site Preserve Area				Net Change*	
			Pre Enhancement		Post Enhancement			
	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams
Class 1 - 0 to 60 Days								
Class 2 - 60 to 120 Days								
Class 3 - 120 to 180 Days	5	2.92	3	1.75	3	4.74	(5)	0.07
Class 4 - 180 to 240 Days								
Class 5 - 240 to 300 Days								
Class 6 - 300 to 330 Days								
Class 7 - 330 to 365 days								
TOTAL	5	2.92	3	1.75	3	4.74	(5)	0.07

*Since the net increase in biomass from the restoration provides 2.98 kg and the loss is 2.92 kg, there is a positive outcome (4.74-1.75-2.92=0.07) in the same hydroperiod and Service concurrence with a NLAA is appropriate.

Example 2:

In the above example, if the onsite preserve wetlands were a class 4 hydroperiod, which has a value of 0.71. grams/m² instead of a class 3 hydroperiod with a 0.39 grams/m² [Table 10]), there would be a loss of 2.92 kg of short hydroperiod wetlands (as above) and a net gain of 8.62 kg of long-hydroperiod wetlands.

Biomass lost: $(5 \times 4,047 \times 0.39 \text{ (Table 10)}) \times 0.37 \text{ (Table 3)} = 2,919.9 \text{ grams or } 2.92 \text{ kg}$

The current habitat state of the preserve provides 3.19 kg $(3 \times 4,047 \times 0.71 \text{ (Table 10)}) \times 0.37 \text{ (Table 3)} = 3,189.44 \text{ grams or } 3.19 \text{ kg}$ and following restoration the preserve provides 8.62 kg $(3 \times 4,047 \times 0.71 \text{ (Table 10)}) \times 1 \text{ (Table 3)} = 8,620.11 \text{ grams or } 8.62 \text{ kg}$, thus providing a net increase in class 4 hydroperiod biomass of 5.43 kg $(8.62 - 3.19 = 5.43)$.

Biomass Pre: $(3 \times 4,047 \times 0.71 \text{ (Table 10)}) \times 0.37 \text{ (Table 3)} = 3,189.44 \text{ grams or } 3.19 \text{ kg}$

Biomass Post: $(3 \times 4,047 \times 0.71 \text{ (Table 10)}) \times 1 \text{ (Table 3)} = 8,620.11 \text{ grams or } 8.62 \text{ kg}$

Net increase: $8.62 \text{ kg} - 3.19 \text{ kg} = 5.43 \text{ kg}$

Project Site Balance $5.43 \text{ kg} - 2.92 \text{ kg} = 2.51 \text{ kg}$

Example 2: 5 acre wetland loss, 3 acre wetland enhanced – different hydroperiod – May Affect

Hydroperiod	Existing Footprint		On-site Preserve Area				Net Change*	
			Pre Enhancement		Post Enhancement			
	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams	Acres	Kgrams
Class 1 - 0 to 60 Days								
Class 2 - 60 to 120 Days								
Class 3 - 120 to 180 Days	5	2.92					(5)	-2.92
Class 4 - 180 to 240 Days			3	3.19	3	8.62	0	5.43
Class 5 - 240 to 300 Days								
Class 6 - 300 to 330 Days								
Class 7 - 330 to 365 days								
TOTAL	5	2.92	3	3.19	3	8.62	(5)	2.51

In this second example, even though there is an overall increase in biomass, the biomass loss is a different hydroperiod than the biomass gain from restoration, therefore, the Service could not concur with a NLAA and further coordination with the Service is appropriate.

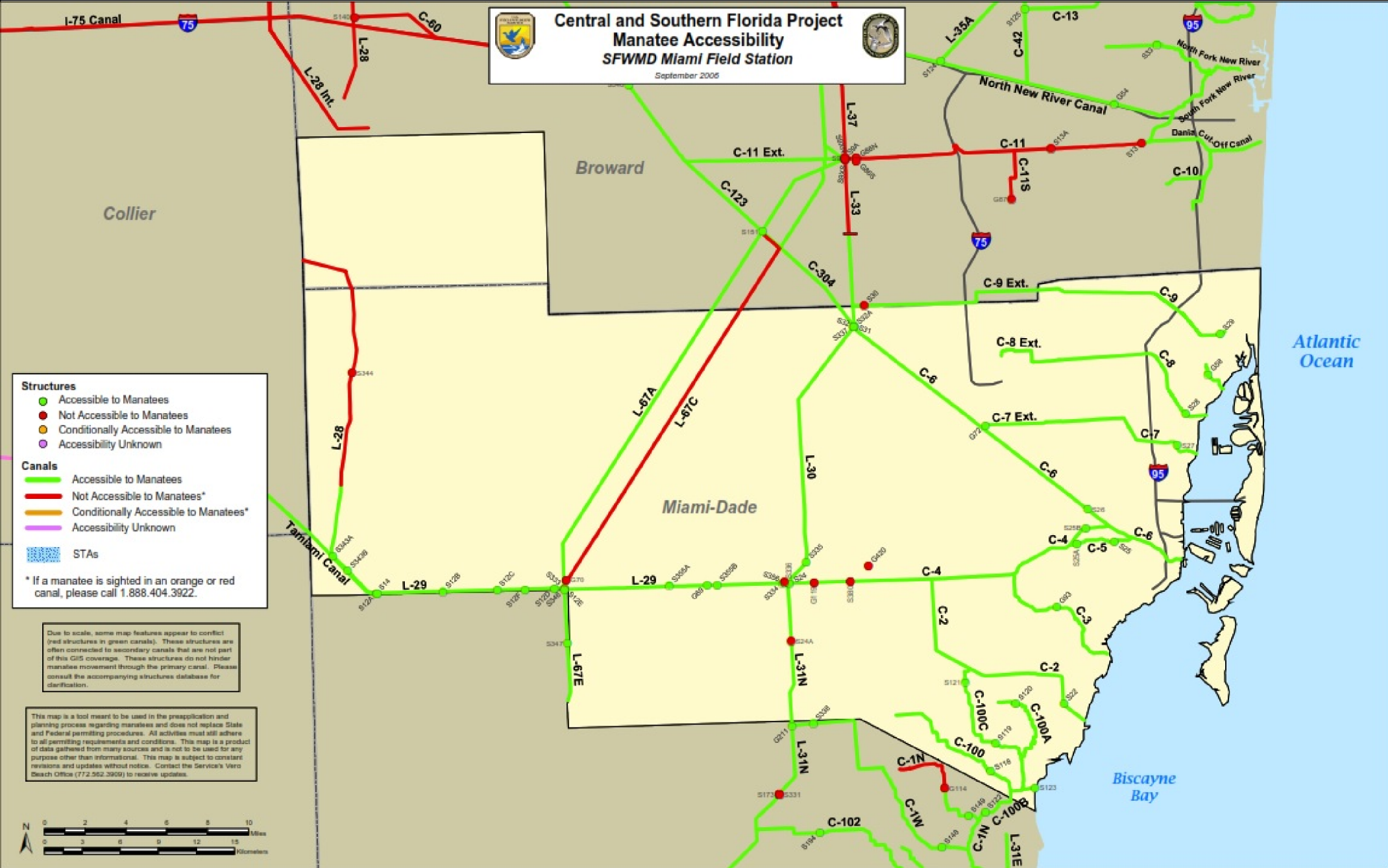
LITERATURE CITED

- Browder, J.S. 1984. Wood stork feeding areas in southwest Florida. *Florida Field Naturalist* 12:81-96.
- Carlson, J.E., and M.J. Duever. 1979. Seasonal fish population fluctuation in south Florida swamps. *Proceedings of Annual Conference of Southeastern Association of Fish and Wildlife Agencies* 31:603-611.
- Chick, J. H., C. R. Ruetz III, and J. C. Trexler. 2004. Spatial Scale and abundance patterns of large fish communities in freshwater marshes of the Florida Everglades. *Wetlands*. 24 (3):652-644. *American Journal of Fisheries Management* 19: 957-967.
- Chick, J. H., S. Coyns, and J. C. Trexler. 1999. Effectiveness of airboat electrofishing for sampling fishes in shallow, vegetated habitats. *North American Journal of Fisheries Management* 19: 957-967.
- Coulter, M.C. 1987. Foraging and breeding ecology of wood storks in east-central Georgia. Pages 21-27 in *Proceedings of the Third Southeastern Nongame and Endangered Wildlife Symposium* (R.R. Odom, K.A. Riddleberger, and J.C. Ozier, eds.). Georgia Department of Natural Resources, Atlanta, Georgia.
- Coulter, M.C., and A.L. Bryan, Jr. 1993. Foraging ecology of wood storks (*Mycteria americana*) in east-central Georgia: I. Characteristics of foraging sites. *Colonial Waterbirds* 16(1):59-70.
- Coulter, M.C., J.A. Rodgers, J.C. Ogden, and F.C. Depkin. 1999. Wood stork (*Mycteria americana*). *The Birds of North America*, Issue No. 409 (A. Poole, ed.). Cornell Lab of Ornithology, Ithaca, New York.
- Fleming, D.M., W.F. Wolff, and D.L. DeAngelis. 1994. Importance of landscape heterogeneity to wood storks in Florida Everglades. *Environmental Management* 18(5):743-757.
- Gawlik, D.E. 2002. The effects of prey availability on the numerical response of wading birds. *Ecological Monographs* 72(3):329-346.
- Kushlan, J.A., S.A. Voorhees, W.F. Loftus, and P.C. Frohling. 1986. Length, mass and caloric relationships of Everglades animals. *Florida Scientist* 49(2):65-79.
- Loftus, W.F., and A.M. Eklund. 1994. Long-term dynamics of an Everglades small-fish assemblage. Pages 461-484 in *Everglades: the ecosystem and its restoration* (S.M. Davis and J.C. Ogden, eds.). St. Lucie Press, Delray, Florida.
- O'Hare, N.K., and G.H. Dalrymple. 1997. Wildlife in southern Everglades invaded by melaleuca (*Melaleuca quinquenervia*). *Bulletin of the Florida Museum of Natural History* 41(1):1-68. University of Florida, Gainesville, Florida.

- Ogden, J.C., J.A. Kushlan, and J.T. Tilmant. 1976. Prey selectivity by the wood stork. *The Condor* 78(3):324-330.
- Ogden, J.C., J.A. Kushlan, and J.T. Tilmant. 1978. The food habits and nesting success of wood storks in Everglades National Park in 1974. U.S. Department of the Interior, National Park Service, Natural Resources Report No. 16.
- Trexler, J. C., and C. W. Goss. 2009. Aquatic Fauna as Indicators for Everglades Restoration: Applying Dynamic Targets in Assessments. *Ecological Indicators*. Vol 9: 108-119.
- Trexler, J.C., W.F. Loftus, F. Jordan, J.H. Chick, K.L. Kandl, T.C. McElroy, and O.L. Bass. 2002. Ecological scale and its implications for freshwater fishes in the Florida Everglades. Pages 153-182 in *The Everglades, Florida Bay, and Coral Reefs of the Florida Keys: An ecosystem sourcebook* (J.W. Porter and K.G. Porter, eds.). CRC Press, Boca Raton, Florida.
- Turner, A., and J. C. Trexler. 1997. Sampling invertebrates from the Florida Everglades: a comparison of alternative methods. *Journal of the North American Benthological Society* 16:694-709
- Turner, A.W., J.C. Trexler, C.F. Jordan, S.J. Slack, P. Geddes, J.H. Chick, and W.F. Loftus. 1999. Targeting ecosystem features for conservation: standing crops in the Florida Everglades. *Conservation Biology* 13(4):898-911.
- U.S. Fish and Wildlife Service. 2006. August 31, 2006, Lake Belt Mining Region of Miami-Dade County Biological Opinion. South Florida Ecological Services Office; Vero Beach, Florida
- U.S. Fish and Wildlife Service. 2009. February 12, 2009, Fort Myers Mine No 2 Biological Opinion. South Florida Ecological Services Office, Vero Beach, Florida.
<http://www.fws.gov/filedownloads/ftp%5verobeach>

APPENDIX D

Manatee Accessibility Map and Standard Protection Measures



SW 87th Ave
Bridge Design Over
C-100 Canal

Manatee
Accessibility Map

Appendix D

Date Prepared: September 15, 2021

STANDARD MEASURES TO REDUCE IMPACTS OF CONSTRUCTION WORK
2011

The permittee shall comply with the following conditions intended to protect manatees from direct project effects:

- a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.
- b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.
- c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.
- d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.
- e. Any collision with or injury to a manatee shall be reported immediately to the Florida Fish and Wildlife Conservation Commission (FWC) Hotline at 1-888-404-3922. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-731-3336) for north Florida or in Vero Beach (1-772-562-3909) for south Florida, and emailed to FWC at ImperiledSpecies@myFWC.com.
- f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Temporary signs that have already been approved for this use by the FWC must be used. One sign which reads *Caution: Boaters* must be posted. A second sign measuring at least 8½" by 11" explaining the requirements for "Idle Speed/No Wake" and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities. These signs can be viewed at http://www.myfwc.com/WILDLIFEHABITATS/manatee_sign_vendors.htm. Questions concerning these signs can be forwarded to the email address listed above.

CAUTION: MANATEE HABITAT

All project vessels

IDLE SPEED / NO WAKE

When a manatee is within 50 feet of work
all in-water activities must

SHUT DOWN

Report any collision with or injury to a manatee:



Wildlife Alert:

1-888-404-FWCC(3922)

cell *FWC or #FWC