ANNEX A
FISH AND WILDLIFE COORDINATION ACT AND ENDANGERED SPECIES ACT COMPLIANCE

TABLE OF CONTENTS

A FISH AND WILDLIFE COORDINATION ACT AND ENDANGERED SPECIES ACT COMPLIANCE

This annex outlines the coordination and compliance under the Fish and Wildlife Coordination Act and Endangered Species Act (ESA).

A.1 Coordination Act Reports

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Florida Ecological Services Field Office

November 17, 2023

James L. Booth, Colonel
District Commander
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Service Consultation Code: 2023-0096775
Project: North of Lake Okeechobee Storage Reservoir (LOCAR) Section 203 Study

Dear Colonel Booth:

The enclosed report is a final Fish and Wildlife Coordination Act (FWCA) report on the North of Lake Okeechobee Storage Reservoir (LOCAR) Section 203 Study for your review. This final FWCA report was based on the Tentatively Selected Plan as described and analyzed in the U.S. Army Corps of Engineers' (Corps') 2023 Draft Environmental Impact Statement (EIS). This report is provided by the U.S. Fish and Wildlife Service (Service) in accordance with the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*) and, in part, the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*). This FWCA report provides the Service's continuing guidance and recommendations for the benefit of fish and wildlife resources related to the LOCAR and the associated ecosystems affected by the project.

This report does not constitute a Biological Opinion (BO) as described under section 7 of the ESA. The Service is currently consulting with the Corps on federally listed species for this project, which will address the project's likely beneficial or adverse effects on the Eastern black rail (*Laterallus jamaicensis ssp. jamaicensis*), Eastern indigo snake (*Drymarchon couperi*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*) and its critical habitat, Florida bonneted bat (*Eumops floridanus*), Florida grasshopper sparrow (*Ammodramus savannarum floridanus*), Florida panther (*Felis* [=*Puma*] *concolor coryi*), Audubon's crested caracara (*Polyborus plancus audubonii*), Okeechobee gourd (*Cucurbita okeechobeensis*), West Indian manatee (*Trichechus manatus*), and wood stork (*Mycteria americana*). Additionally, in accordance with section 7(a)(4) of the ESA, the Corps has requested to conference on the action's effects to the tricolored bat (*Perimyotis subflavus*), a species proposed on September 14, 2022, to be listed as endangered. After ESA consultation is concluded, if significant modifications are made to the selected plan or if additional information involving potential impacts to listed species becomes available, reinitiation of consultation may be necessary.

On September 13, 2023, we provided the Corps with the draft FWCA report, and we also solicited comments from the Department of Interior's Office of Everglades Restoration Initiatives, the Florida Fish and Wildlife Conservation Commission, the South Florida Water

Management District, the National Marine Fisheries Service, and the Seminole Tribe of Florida. Comments received from those agencies have been incorporated as appropriate; therefore, this report constitutes the Secretary of the Interior's recommendations for the LOCAR, in accordance with section 2(b) of the FWCA. The Service expects the Corps will incorporate the final FWCA report and recommendations into the final PIR for full consideration, public review, and comment in accordance with the provisions of the National Environmental Policy Act.

Thank you for your cooperation and effort in protecting federally listed species and fish and wildlife resources. If you have any questions regarding this project, please contact Andrew Eastwick at 772-226-8142.

Sincerely,

Bonnie Irving
Everglades Program Supervisor
Florida Ecological Services Office, Vero Beach

Enclosure

cc: electronic w/enclosure
Corps, Jacksonville, Florida (Angela Dunn, Gretchen Ehlinger)
District, West Palm Beach, Florida (Jennifer Leeds, Elizabeth Caneja)
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FWC, Okeechobee, Florida (Alyssa Jordan, Tyler Beck)
FWC, Tallahassee, Florida (FWC-CPS)
FWC, West Palm Beach, Florida (James Erskine)
NOAA Fisheries, St. Petersburg, Florida (Adam Brame)
Seminole Tribe of Florida, Hollywood, Florida (Karli Eckel, Stacy Myers)
Service, Vero Beach, Florida (Larry Williams, Kathleen Burchett, Timothy Breen, Lori Miller, Andrew Eastwick)

Final Fish and Wildlife Coordination Act Report

NORTH OF LAKE OKEECHOBEE STORAGE RESERVOIR SECTION 203 STUDY

Submitted to:

Jacksonville District
U.S. Army Corps of Engineers
Jacksonville, Florida

Prepared by:

U.S. Fish and Wildlife Service
Florida Ecological Services Office
Vero Beach, Florida

November 17, 2023

EXECUTIVE SUMMARY

The Fish and Wildlife Coordination Act represents one of the earliest and most significant indications of the intent of Congress that fish and wildlife considerations were to be a major component of the analysis of projects affecting bodies of water and were to receive equal consideration with other traditional project purposes such as navigation and flood damage reduction. The purpose of this report is to ensure that fish and wildlife issues and recommendations are heard and considered through the decision-making chain up to the Administration and Congress. This report assesses the potential benefits and adverse impacts on fish and wildlife resources from the North of Lake Okeechobee Storage Reservoir (LOCAR) Section 203 Study.

The U.S. Fish and Wildlife Service (Service) recognizes the limitations of the current infrastructure surrounding Lake Okeechobee in dealing with extremes in climate and the inherent tradeoffs among competing project purposes. The primary purpose of the LOCAR is to capture and store freshwater flows from the watershed at times when excess flows are available and may be otherwise ecologically damaging. Another purpose of the project is to restore downstream wetlands for fish and wildlife habitat. This action would serve to improve the ecological health of Lake Okeechobee and the downstream estuaries while at the same time maintain or increase the amount of water available for agricultural and residential uses.

The Service recognizes the expertise and diligence of the U.S. Army Corps of Engineers (Corps) and South Florida Water Management District (District) staff in this accelerated planning process. We recognize the complexity in siting a large above-ground water storage feature upstream of Lake Okeechobee and applaud the team's efforts to attempt to build consensus with stakeholders. We recognize this project as another important step towards balancing water resource use around Lake Okeechobee and the St. Lucie and Caloosahatchee Estuaries.

However, we caution that there are still potential adverse effects that will need additional evaluation. These include the effects of the LOCAR on fish and wildlife resources including federally listed species within the project's reservoir footprint. We have provided recommendations at the end of this report regarding our most substantial fish and wildlife resource concerns.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS USED IN THE TEXT

AAHU	average annual habitat unit(s)
ac	acre(s)
ASR	Aquifer Storage and Recovery
C&SF	Central and Southern Florida
CERP	Comprehensive Everglades Restoration Plan
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
District	South Florida Water Management District
EAA	Everglades Agricultural Area
ECB23L	Existing Condition Baseline
EIS	Environmental Impact Statement
ESA	Endangered Species Act of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*)
FDEP	Florida Department of Environmental Protection
FWC	Florida Fish and Wildlife Conservation Commission
FWCA	Fish and Wildlife Coordination Act
FWOL	Future Without Project (LOCAR)
HAB	Harmful Algal Blooms
HU	habitat unit(s)
km	kilometer(s)
LORS	Lake Okeechobee Regulation Schedule
LOWRP	Lake Okeechobee Watershed Restoration Project
m	meter(s)
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum 29
NOAA	National Oceanographic and Atmospheric Administration
NWR	National Wildlife Refuge
PDT	Project Delivery Team
POR	Period of Record
ppb	parts per billion
ppt	parts per thousand (salinity)
SAV	Submerged Aquatic Vegetation
Service	U.S. Fish and Wildlife Service
SFER	South Florida Environmental Report
SLE	Saint Lucie Estuary
SSC	Species of Special Concern
TP	Total Phosphorus
TSP	Tentatively Selected Plan
ug/L	microgram per liter
WCA(s)	Water Conservation Area(s)
WRDA	Water Resources Development Act
WY	Water Year

I. PURPOSE, SCOPE, AND AUTHORITY

A. Introduction

The Comprehensive Everglades Restoration Plan (CERP) was approved as a framework for the restoration of the natural system under Section 601 of the Water Resources Development Act (WRDA) of 2000. The CERP consists of 68 components to restore, preserve, and protect the South Florida Ecosystem while providing for other water-related needs of the region. Together, these components should benefit the ecology of more than 2.4 million acres of the south Florida ecosystem by improving and restoring the proper quantity, quality, timing, and distribution of water made available for the natural system while also addressing urban and agricultural water supply concerns and maintaining the existing levels of flood protection.

Previous ecosystem restoration and water supply planning efforts, including the Central and Southern Florida (C&SF) Comprehensive Review Study, Final Integrated Feasibility Report and Programmatic Environmental Impact Statement (Restudy) (U.S. Army Corps of Engineers [Corps] and South Florida Water Management District [District] 1999), have established the need for and the beneficial effects of additional storage in the watershed upstream of Lake Okeechobee as part of the comprehensive plan to achieve restoration objectives. The North of Lake Okeechobee Storage Reservoir (LOCAR) is one of the CERP, "Yellow Book" projects upstream of Lake Okeechobee.

B. Purpose and Scope of Project

During the last century, much of the land within the LOCAR study area was converted from dry prairie, pine flatwoods, wet prairie, and freshwater marsh to primarily agriculture, and a lesser extent, residential use. This fragmentation or loss of native habitats combined with anthropogenic nutrient pollution has resulted in a reduction in the quality and quantity of native plants and animals in the watershed. The draining of wetland habitat, including the channelization of the Kissimmee River, Fisheating Creek, and other streams has created a flashier hydroperiod that promotes drainage (improved flood control) but also results in rapid stage ascensions in Lake Okeechobee and greater stormwater flows into the northern estuaries. As a result, the integrity of native ecosystems in these areas also suffer. During the dry season, less water is available on the landscape and consequences of drought are more severe. These hydrologic and nutrient changes result in greater colonization of pollution tolerant and exotic invasive species in the watershed, lake, and estuaries.

Lake Okeechobee is constrained by the Herbert Hoover Dike. Lake water levels are currently regulated by the Corps and District under the Lake Okeechobee Regulation Schedule for water supply, flood protection, navigation, and the natural environment. If lake water levels rise (or are predicted to rise) too high, discharges are made to the northern estuaries where they can be problematic depending on the conditions there. If the lake water levels drop too low, water supply may be reduced. Consensus amongst the LOCAR team members and stakeholders is that additional water storage is needed to keep the lake from staying either too high or too low for too long. Improved stage management would not only result in increased habitat benefits within

Lake Okeechobee, but also reduce the frequency of damaging freshwater releases to downstream estuaries.

The geographic scope of the analysis of the alternatives includes the watersheds north of Lake Okeechobee, Lake Okeechobee, and the St. Lucie and Caloosahatchee estuaries (Figure 1).

The goal of the LOCAR is to construct Component A of the CERP, a storage reservoir north of Lake Okeechobee, to address Everglades-related water resource issues identified in the C&SF Project Comprehensive Review Study (Restudy) for the northern portion of the Lake Okeechobee Watershed, Lake Okeechobee, and Caloosahatchee and St. Lucie Estuaries (Northern Estuaries) (Corps 1999). Similar above-ground storage reservoirs are being constructed to the east, south, and west of Lake Okeechobee.

The purpose of the LOCAR is to detain water during wet periods for later use during dry periods for Lake Okeechobee. Increased storage capacity would reduce the duration and frequency of both high and low water levels in Lake Okeechobee that are stressful to the lake's littoral ecosystems and cause large discharges from the lake that are damaging to the downstream estuary ecosystems.

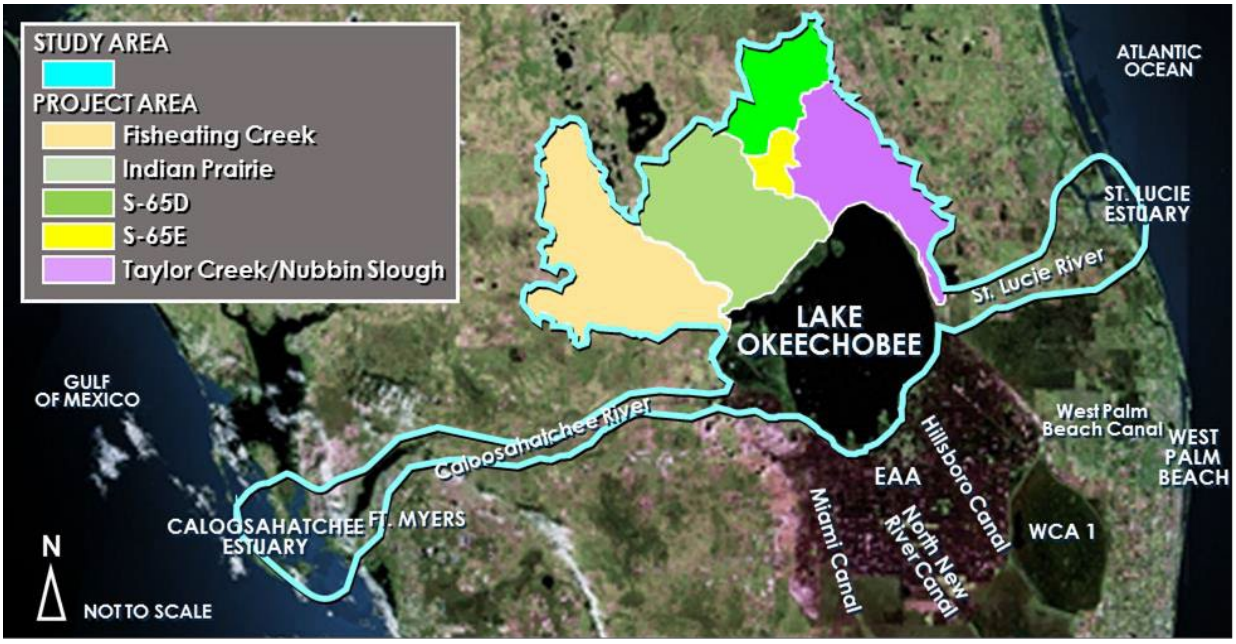


Figure 1. North of Lake Okeechobee Storage Reservoir (LOCAR) study area.

C. Authorities

The Corps has prepared a draft Environmental Impact Statement (EIS) to document the effects of implementing an aboveground storage reservoir north of Lake Okeechobee (LOCAR). The District prepared a Feasibility Study (FS) pursuant to Section 203 of the Water Resources Development Act (WRDA) of 1986, as amended, for submission to the Assistant Secretary of the Army for Civil Works (ASA[CW]). The Corps, as the federal agency, prepared the National Environmental Policy Act (NEPA, Title 40 of the Code of Federal Regulations, Chapter V, Parts

1500 through 1508) assessment to support the ASA(CW) review of the District's FS. The District initiated the LOCAR FS in early 2023 as the non-federal interest in response to Florida Governor's Executive Order (EO) 23-06.

This final Fish and Wildlife Coordination Act (FWCA) report constitutes the report of the Secretary of the Interior as required by section 2(b) of the FWCA of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq.*), which establishes fish and wildlife conservation as a co-equal purpose or objective of federally funded or permitted water resource development projects. The FWCA allows for reports and recommendations from the Service and the State agency exercising administration over wildlife resources (in this case, the Florida Fish and Wildlife Conservation Commission [FWC]) to be integrated into the Corps' reports seeking authorization for the Federal action. The FWCA also grants authority to the Corps to include fish and wildlife conservation measures within these projects. Other authorities relevant to Service participation in the planning process for this project include the Endangered Species Act of 1973, as amended (ESA) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*), the National Environmental Policy Act of 1969, as amended (NEPA) (42 U.S.C. 4321 *et seq*.), and the Migratory Bird Treaty Act (MBTA) (16 U.S.C. § 703 *et seq*.).

II. PREVIOUS SERVICE INVOLVEMENT WITH THE NORTH OF LAKE OKEECHOBEE STORAGE RESERVOIR

The Service has participated (and continues to) in a number of CERP and non-CERP initiatives in the Lake Okeechobee and Kissimmee River watersheds. These initiatives serve some of the same functions as the LOCAR (*i.e.,* wetlands restoration, habitat conservation, and water storage). Our responsibilities include providing project planning and operations recommendations regarding fish, wildlife, and plant resources, and ESA consultations. The Service was an important member of the first iteration of the Lake Okeechobee Watershed Restoration Project (LOWRP) Project Delivery Team (PDT; 2001-2006) which included another CERP project, the Lake Istokpoga Regulation Schedule, as well as the LOWRP restart (PDT; 2016-2019), where the Component A Reservoir was known as the K-42 Reservoir in the alternatives. As part of that initial effort, we identified targets and an evaluation process for the assessment of potential wetlands in need of restoration. The Service has also been an important member of the Regional Aquifer Storage and Recovery (ASR) project team – a technology that is part of the LOWRP. The Service has also participated on project teams and provided input on the Kissimmee River Restoration project, Herbert Hoover Dike Rehabilitation project, and various Lake Okeechobee regulation schedules.

III. AREA SETTING

A. Project Location

The planning area for this project included Lake Okeechobee, and the following drainage basins: Fisheating Creek; Indian Prairie; Kissimmee River (Pools D and E); Taylor Creek; and Nubbin Slough. This included portions of Glades, Highlands, Okeechobee, and Martin Counties. The surrounding downstream areas that were also evaluated for project impacts and benefits included the St. Lucie and Caloosahatchee (Hendry and Lee Counties) Estuaries.

B. Description of Study Area

1. Hydrological Description

a. Lake Okeechobee

The name of the lake derives from the Seminole Indian language, in which "oki" is water and "chubi" is big. Lake Okeechobee is located 30 miles west of the Atlantic Ocean and 60 miles east of the Gulf of Mexico, in the central part of the Florida peninsula. Lake Okeechobee (maximum surface area of 1,732 km^2 or 428,000 acres) is a shallow (mean depth of 2.7 meters or 8.8 feet) subtropical lake that is now surrounded (except at the mouth of Fisheating Creek) by the Herbert Hoover Dike. Lake Okeechobee inflows and outflows are controlled by an extensive system of levees, canals, water control structures, and large pump stations. Water flows into the lake primarily from the Kissimmee River (C-38), Fisheating Creek, Nubbin Slough, Taylor Creek, and various canals. Water may flow out of the west side of the lake via S-77 through the Caloosahatchee River (C-43) to the Caloosahatchee Estuary; out of the east side via S-308 through the St. Lucie Canal (C-44) to the St. Lucie Estuary; and out of other structures to West Palm Beach Canals. The Hillsboro, North New River, and Miami Canals drain the lake to the south into the Everglades Agricultural Area (EAA), Stormwater Treatment Areas (STAs), A-1 Flow Equalization Basin, Water Conservation Areas (WCAs), Lower East Coast, remnant Everglades, and Florida Bay.

Water levels in Lake Okeechobee are managed according to a regulation schedule that tries to achieve multiple-use purposes as well as provide seasonal lake level fluctuations. The schedule was designed to maintain a lower lake stage to provide both storage capacity and flood protection for surrounding areas during the wet season. The schedule is also a guide for the management of high lake stages that might threaten the integrity of the Herbert Hoover Dike and thereby risk flooding of downstream lands. During the winter, lake water levels may be increased to store water for the upcoming dry season. This is facilitated by holding water that flows into the lake from the Kissimmee River Basin and occasionally by back-pumping excess storm water from the City of Clewiston, the EAA, or through other structures on the "southern half" of the lake.

Water quality data indicate that Lake Okeechobee is in a eutrophic condition, primarily due to excessive nutrient loads from the agricultural sources both north and south of the lake. This condition has been exacerbated by the recent hurricanes. In the late 1960s and early 1970s, total phosphorus (TP) concentrations as low as 50 µg/L were routinely measured. Today, the total phosphorus in-lake goal is 40 µg/L, but actual TP concentrations are much higher. According to the South Florida Environmental Report (SFER) (District and FDEP 2023), "in WY2022, the in-lake TP concentration was 142 µg/L, 3% lower than the WY2021 value of 147 µg/L. These in-lake TP concentration values exceed the TP in-lake goal of 40 µg/L. The current five-year (WY2018–WY2022) moving average TP concentration is 158 µg/L, which is higher than the pre-hurricane (pre-2004) range of 57 to 127 µg/L." It is likely that historic in-lake turbidity was much lower than current conditions as well.

b. Northern Basins of Lake Okeechobee

The Lake Okeechobee watershed is a shallow trough that drains south from the City of Orlando to the Florida Everglades and is bounded by sand hills of the Lake Wales Ridge on the west and upland marshes of the Osceola Plain to the east. The LOCAR did not encompass all northern basins that flow into Lake Okeechobee. The study team was constrained to the area shown in Figure 1. This area includes the basins of Fisheating Creek, Indian Prairie, the Kissimmee River (Pools D and E only), Taylor Creek, Mosquito Creek, Nubbin Slough, Henry Creek, and Lettuce Creek. Surface water flows in most of the northern watershed are regulated by water control structures.

The roughly 2 million-acre Kissimmee River drainage basin lies north of the lake and provides most of the surface water inflow to the lake (1.33 million acre-feet; Table 1). Fisheating Creek basin encompasses 318,042 acres and flows from the Lake Wales Ridge into the west side of the lake. Indian Prairie is the area drained by the Harney Pond and Indian Prairie canals. Average annual surface flow contributions to the lake are about the same for Fisheating Creek and Indian Prairie basin (both just under 300,000 acre-feet; Table 1). Taylor Creek flows into the north end of the lake but east of the Kissimmee River; however, flows may bypass the City of Okeechobee via the L-63 canal system. The historic confluence of Taylor Creek with the lake today conveys smaller flows mainly comprised of runoff from the city. Mosquito Creek, Nubbin Slough, Henry Creek, and Lettuce Creek all flow into the east side of the lake and drain smaller areas. There are times when these smaller watersheds have little or no flow.

Table 1. Five-year average (WY2018-WY2022) and WY2022 surface water inflows, TP loads, TP FWMC, and TP UALs from the drainage basins to Lake Okeechobee.

Source	Area (ac)	WY2018–WY2022				WY2022			
		Flow (ac-ft)	TP Load (t)	TP UAL (lb/ac)	TP FWMC (µg/L)	Flow (ac-ft)	TP Load (t)	TP UAL (lb/ac)	TP FWMC (µg/L)
East Lake Okeechobee Subwatershed	**239,013**	**102,000**	**23.3**	**0.21**	**185**	**65,000**	**11.3**	**0.10**	**141**
C-44/S-153/Basin 8 (S-308 at St. Lucie Canal)	132,572	46,300	15.0	0.25	262	19,300	5.7	0.09	238
L-8 Basin (Culvert 10A)	106,440	55,500	8.3	0.17	121	45,800	5.7	0.12	100
Fisheating Creek Subwatershed	**318,042**	**193,000**	**51.1**	**0.35**	**215**	**157,000**	**30.5**	**0.21**	**158**
Fisheating Creek at Lakeport/L-61W Basin	298,713	193,000	51.1	0.38	215	157,000	30.5	0.23	158
Nicodemus Slough North (Culvert 5)	19,329	0	0.0	0.00	no flow	0	0.0	0.00	no flow
Indian Prairie Subwatershed	**276,577**	**227,000**	**71.0**	**0.57**	**240**	**168,000**	**41.5**	**0.33**	**192**
C-40 Basin [(S-72) – w*(S-72)] [b]	24,076	14,400	7.6	0.70	428	20,400	6.7	0.61	266
C-41 Basin [(S-71) – w*(S-71)] [b]	112,880	37,700	23.0	0.45	495	29,800	14.1	0.27	383
C-41A Basin [(S-84) – w*(S-84)] [b]	57,748	118,000	25.1	0.96	172	81,900	14.7	0.56	145
L-48 Basin (S-127 total)	20,798	11,400	2.5	0.26	175	14,800	2.3	0.24	125
L-49 Basin (S-129 total)	11,966	9,170	0.5	0.09	42	9,920	0.4	0.08	36
L-59E Basin [(G-33) + (G-34)]	12,589	5,590	1.7	0.30	246	0	0.0	0.00	no flow
L-59W Basin (G-74)	6,596	13,300	3.4	1.15	209	0	0.0	0.00	no flow
L-60E Basin (G-75)	4,944	7,840	1.8	0.81	187	0	0.0	0.00	no flow
L-60W Basin (G-76)	3,453	3,950	0.6	0.37	119	0	0.0	0.00	no flow
L-61E Basin [c]	14,407	no flow	4.0	0.62	N/A	no flow	1.7	0.27	N/A
S-131 Basin	7,122	6,130	0.9	0.27	117	10,800	1.6	0.50	122
Taylor Creek/Nubbin Slough Subwatershed	**197,795**	**159,000**	**88.9**	**0.99**	**454**	**122,000**	**42.5**	**0.47**	**283**
S-133 Basin	25,626	26,000	8.1	0.70	253	29,400	6.9	0.59	190
S-135 Basin	17,756	33,600	6.6	0.83	160	45,900	8.3	1.04	147
S-154 Basin	31,815	22,400	15.7	1.09	567	24,400	12.4	0.86	412
S-154C Basin	2,134	2,020	1.8	1.85	720	1,170	1.0	1.03	696
S-191 Basin	120,464	74,600	56.7	1.04	616	21,100	13.9	0.25	534

Source	Area (ac)	WY2018–WY2022				WY2022			
		Flow (ac-ft)	TP Load (t)	TP UAL (lb/ac)	TP FWMC (µg/L)	Flow (ac-ft)	TP Load (t)	TP UAL (lb/ac)	TP FWMC (µg/L)
South Lake Okeechobee Subwatershed	**363,141**	**62,400**	**21.0**	**0.13**	**273**	**27,200**	**6.3**	**0.04**	**189**
715 Farms (Culvert 12A)	3,353	0	0.0	0.00	no flow	0	0.0	0.00	no flow
East Beach Drainage District (Culvert 10)	6,657	134	0.1	0.05	888	0	0.0	0.00	no flow
East Shore Drainage District (Culvert 12)	8,409	0	0.0	0.00	no flow	0	0.0	0.00	no flow
Industrial Canal (S-310 in S-4 Basin)	13,024	22,800	6.6	1.12	234	16,200	2.6	0.43	127
S-2 Basin	106,274	18,500	5.8	0.12	256	1,440	0.3	0.01	150
S-3 Basin	63,134	9,420	2.5	0.09	214	969	0.1	0.00	102
S-4 Basin	29,121	10,900	5.7	0.43	427	8,560	3.4	0.26	321
South Florida Conservancy Drainage District (S-236)	9,931	263	0.1	0.01	195	0	0.0	0.00	no flow
South Shore/South Bay Drainage District (Culvert 4A)	4,036	76	0.0	0.01	282	0	0.0	0.00	no flow
S-5A Basin (S-352 West Palm Beach Canal)	119,202	379	0.1	0.00	274	0	0.0	0.00	no flow
West Lake Okeechobee Subwatershed	**204,094**	**378**	**0.0**	**0.00**	**94**	**0**	**0.0**	**0.00**	**no flow**
East Caloosahatchee Basin (S-77)	198,178	378	0.0	0.00	94	0	0.0	0.00	no flow
Nicodemus Slough South (Culvert 5A)	5,916	0	0.0	0.00	no flow	0	0.0	0.00	no flow
Lake Istokpoga Subwatershed (S-68)	**394,203**	**326,000**	**38.9**	**0.22**	**97**	**282,000**	**30.0**	**0.17**	**86**
Lower Kissimmee Subwatershed [(S-65E) - (S-65)]	**429,188**	**337,000**	**118.3**	**0.61**	**285**	**101,000**	**17.7**	**0.09**	**142**
Upper Kissimmee Subwatershed (S-65)	1,028,421	826,000	83.5	0.18	82	690,000	70.2	0.15	83
Totals from Lake Okeechobee Watershed	**3,450,475**	**2,232,000**	**496**			**1,611,000**	**250**		
Watershed-wide Average Values				0.32	180			0.16	125
Atmospheric Deposition			35				35		
Total Loads to Lake Okeechobee			**531**				**285**		

a. Values shown in this table only account for contributions from the basins to Lake Okeechobee. It does not capture contributions from these basins to other basins or other surface waters.

b. Weighting factor (w) = S-68/[(S-71) + (S-72) + (S-84)]. It was estimated based on annual values.

c. TP loads from the L-61E Basin were estimated for the WY2019–WY2022 period. Since flow was not available for the last four water years, loads for these water years were not included when computing the subwatershed- and watershed-wide FWMCs. The total loads and UALs included data from the last three water years.

c. Northern Estuaries

The St. Lucie Estuary (SLE) is located east of Lake Okeechobee, and connects to the lake via the St. Lucie Canal (C-44), which discharges into the South Fork of the SLE (if the S-80 structure is open). The SLE flows into the Indian River Lagoon and then Atlantic Ocean via the St. Lucie Inlet. The Caloosahatchee Estuary is located southwest of Lake Okeechobee on the Gulf of Mexico coast. The Caloosahatchee River (C-43) extends from Lake Okeechobee to the Franklin Lock and Dam (S-79) where it empties into the estuary.

Surface water releases from the lake into the SLE are generally lower than into the Caloosahatchee Estuary. For example, water managers operating under the Lake Okeechobee Regulation Schedule (LORS), may send more than twice as much flow to the C-43, as to the C-44 Canal. These freshwater flows may be problematic if they drive salinities too low for the estuarine plants and animals in those areas. Conversely, some low freshwater flows are beneficial in the C-43 to maintain an oligohaline zone from the S-79 downstream to Fort Myers. Occasionally, surface water may gravity back-flow through open locks into Lake Okeechobee from the C-44 and C-43 Canals, but lake levels need to be lower than 14.5 and 11.5 feet National Geodetic Vertical Datum 29 (NGVD), respectively (District and FDEP 2018).

2. Ecological Description

The Service has provided summaries of the hydrologic and biological resource values of Lake Okeechobee in several previous FWCA reports to the Corps. Extensive scientific literature and other publications intended for the layman are available. Aumen and Wetzel (1995) edited a thorough compendium of scientific papers that were assembled as a special issue of *Archiv für Hydrobiologie* (45) dedicated exclusively to Lake Okeechobee. In that compendium, Aumen (1995) provides an excellent general description of Lake Okeechobee and the resource issues in the lake. The Corps (1999) issued a final report entitled "Wildlife Utilization and Habitat Utilization Study of Western Littoral Zone, Lake Okeechobee, Florida." The following sections provide brief summaries of the hydrologic and biological characteristics of Lake Okeechobee.

a. Lake Okeechobee

In the late 1860s, Lake Okeechobee was much larger than after 1880 (due to the first local dredging efforts), with an extensive wetland littoral zone along the shoreline. Water levels fluctuated between 17 feet and 23 feet NGVD, and periodically flooded the exposed areas of the low-gradient marsh. Under both high and low conditions, there was abundant submerged and exposed habitat for fish and other wildlife. Today the lake is constrained within the Herbert Hoover Dike, and the littoral zone is much smaller (400 km^2, ~99,000 ac). As a result, when water levels are above 15 feet NGVD, the entire littoral zone is flooded; leaving little habitat for wildlife that requires exposed ground. When lake stages are below 11 feet NGVD, there is little if any surface water on the marsh and therefore, not readily available as habitat for fish and other aquatic life.

At least 40 different fish species exist in Lake Okeechobee. Bull et al. (1995) evaluated fish distribution in Lake Okeechobee using a semi-balloon trawl net between July 1987 and January

1991. They reported that 98 percent of the total catch, in terms of numbers and biomass, was composed of seven species: threadfin shad (*Dorosoma petense*), black crappie (*Pomoxis nigromaculatus*), Florida gar (*Lepisosteus platyrhincus*), gizzard shad (*Dorosoma cepedianum*), white catfish (*Ameiurus catus*), redear sunfish (*Lepomis microlophus*), and bluegill (*Lepomis macrochirus*). In the 1980's, the commercial fisheries generated $6.3 million annually, and consisted of a trotline fishery for catfish (*Ameiurus* spp. and *Ictalurus* spp.), and a haul seine fishery for catfish and bream (*Lepomis* spp.) (Bell 1987). During the same period, the recreational fishery generated $22.1 million annually and had an estimated asset value of $100 million (Bell 1987).

Prior to the 2004 and 2005 hurricane seasons, the lake provided nationally known, high-quality largemouth bass (*Micropterus salmoides*) and black crappie fisheries. Over 500 fishing tournaments were permitted by the FWC in 2003. The lake also supports a commercial fishery dominated by catfish species. As a result of high lake stages and storm-water inputs associated with the 2004-2006 hurricanes, the fisheries deteriorated, but since then are gradually improving.

As summarized in the 2023 SFER (District and FDEP), 36 different fish species were collected from the lake via nearshore electrofishing. "The most abundant fish (> 5% of the composition) were threadfin shad, gizzard shad, bluegill sunfish, largemouth bass, Florida gar, and eastern mosquitofish (*Gambusia holbrooki*). These six species collectively comprised 79% of the catch by number. Five dominant species (comprising 69 percent of the catch), were Florida gar, largemouth bass, blue tilapia (*Oreochromis aureus*), gizzard shad, and vermiculated sailfin catfish (*Pterygoplichthys disjunctivus*). Blue tilapia and vermiculated sailfin catfish are invasive exotic species." Trawl sampling in the pelagic zone collected mostly threadfin shad, black crappie, and white catfish (District and FDEP 2023).

Lake Okeechobee is also a critical concentration point for overwintering waterfowl and other migratory birds along the Atlantic flyway and supports feeding and nesting of wading birds. According to the 2018 SFER (District and FDEP), as water levels receded in 2017, foraging wading birds became abundant on the lake and included two of the highest single survey numbers in late April and mid-May. "The March to May surveys averaged 10,656 each, totaling the highest number of foraging wading birds recorded since the monitoring program started" (District and FDEP 2018). Despite the high number of wading birds on the lake, the 2017 nesting effort was only average (since the implementation of the LORS in 2008). Lower lake levels, resulting in limited nesting substrate and reduced foraging areas, was implicated in the lower than expected nesting effort (District and FDEP 2018).

Another wading bird, the federally threatened wood stork (*Mycteria americana*) also forages in Lake Okeechobee. There is one active wood stork rookery (named Brighton) about two miles north of the confluence of the Harney Pond Canal and Lake Okeechobee. There is another wood stork rookery in St. Lucie County at Cypress Creek. Wood storks from both these sites could forage in the lake during the nesting season.

Another important avian resource of Lake Okeechobee is the Everglade snail kite (*Rostrhamus sociabilis plumbeus*). Prior to 2010, snail kites would only nest in the lake during spring; however, after 2010 with the coincident increase of exotic apple snails (*Pomacea maculata*),

snail kites frequently breed in summer as well (depending on lake stages). Lake Okeechobee has recently ranked among the most productive in terms of number of snail kites fledged (Fletcher et al. 2014, 2016a, and 2016b). The 2016 nesting effort was the largest observed recently with 221 known-fate snail kite nests (*i.e.,* confirmed to have been successful or failed). In 2017, snail kite nesting success was reduced due to the effects of drought followed by Hurricane Irma, but Lake Okeechobee still accounted for the highest fledgling production (Fletcher et al. 2018). No snail kite nesting occurred in 2019 or 2020 due to substantially lower than normal lake stages. Higher lake stages in 2021 provided more suitable nesting conditions where the most significant nesting effort (26%) for snail kites occurred for the year (Fletcher et al. 2022). However, due to high recession rates during the nesting season the apparent nest success (34 successful of 150 total nests) was lower (23%) compared to the range-wide average (37%) (Fletcher et al. 2022). Similar suitable nesting conditions on Lake Okeechobee persisted in 2022 where the lake was the second highest contributor (10%) for range-wide nesting efforts that year (Fletcher et al. 2023). In 2022, the apparent nest success of 15 out of 43 total nests on Lake Okeechobee was again lower (35%) compared to range-wide (43%) (Fletcher et al. 2023).

Lake Okeechobee is also of particular importance since it serves as a critical stopover point as snail kites traverse the network of wetlands within their range. A loss of suitable habitat and refugia, especially during droughts and low water in the lake, may have significant demographic consequences (Takekawa and Beissinger 1989; Kitchens et al. 2002; Martin et al. 2006). The south and western littoral zones of the lake comprise part of the designated critical habitat for the snail kite.

Another federally listed species, the threatened West Indian (Florida) manatee (*Trichechus manatus*), may also be found in Lake Okeechobee. The manatee is further protected as a depleted subpopulation under the Marine Mammal Protection Act (16 U.S.C. 1361-1407). The species was reclassified from "endangered" to "threatened" on March 30, 2017, due to an increased population estimate and improvements in their habitat. Manatees may occupy any inland and coastal waters of south Florida including estuaries, bays, rivers, creeks, and canals (Service 2001) where water control structures allow. According to the Service's geographic information system database, they have been recently observed within Lake Okeechobee and its rim canal (*i.e.,* L-47 Canal), the Kissimmee River (*i.e.,* C-38 Canal), and the C-44 and C-43 Canals. The two most significant threats to the Florida manatee population statewide are collisions with watercraft and the loss of warm water habitat (Runge et al. 2007). Other threats include crushing or entrapment in gates and locks; entanglement in ropes, lines, and nets; ingestion of fishing gear or debris; vandalism; poaching; and exposure to red tide brevetoxin (Bossart et al. 1998). However, in 2021 many manatee mortalities occurred along the east coast of Florida which resulted in the Service declaring an Unusual Mortality Event (UME). Researchers have attributed this UME to starvation due to the lack of seagrasses in the Indian River Lagoon. In recent years, poor water quality in this area has led to harmful algal blooms (HAB) and widespread seagrass loss.

Manatees may occur year-round in Lake Okeechobee depending on water temperature. From 2000 through 2012 there were 64 manatee mortalities reported from the Lake Okeechobee area. There are no synoptic surveys for manatees in the lake; therefore, the Service relies on mortality reports as a way to indicate manatee occurrence in the lake. The extent and health of submerged

aquatic vegetation (SAV; an important forage for the manatee) can dictate the distribution of this species within the lake, canals, and estuaries.

One federally listed plant, the endangered Okeechobee gourd (*Cucurbita okeechobeensis* ssp. *okeechobeensis*) is present along the shoreline of Lake Okeechobee. The Okeechobee gourd is an annual or perennial vine endemic to Florida, known to occur in natural and man-made islands around the northwestern and southern portions of Lake Okeechobee. In Lake Okeechobee, the most stable colonies occur in the southeastern quadrant on Torry, Kreamer, and Ritta Islands. Lake water levels can affect this plant's success by drowning out individual plants (if too deep) or may facilitate seed dispersal.

b. Northern Basins of Lake Okeechobee

When Hamilton Disston signed the drainage contract with the State of Florida in 1881, he not only received title to 4 million acres of Florida real estate, but he was also committed to reclaiming much of that acreage. One of the first tasks was to dredge a navigable waterway from the cow camp that would become the town of Kissimmee down the twisting and turning Kissimmee River to Lake Okeechobee. As of 2017, the Corps and District had spent about $732 million of the total estimated $759 million needed to reverse Disston's improvements and recover a good portion of the hydrologic and ecologic integrity of the Kissimmee River. The 2018 SFER (District and FDEP) identifies the restoration successes to date and boasts improvements to wading bird abundance and nesting, waterfowl abundance, and dissolved oxygen concentration in the river channel (for improved fisheries).

Wetland restoration (via Natural Resources Conservation Service programs) has been ongoing in the upper Fisheating Creek basin recently. The middle portion of the basin has some of the best forested habitats in the study area; unfortunately, the downstream-most 5 or 6 miles (as the crow flies) is surrounded by improved pasture and likely contributes considerable sediment and nutrients to the lake during storm events. The habitat in the Indian Prairie Basin outside of the Brighton Reservation of the Seminole Tribe of Florida is primarily pasture and rangeland with some wetlands characterized by various amounts of drainage. Habitat for plants and animals is better within the Brighton Reservation as noted by the stronger wetland signature on the landscape. Habitat in the Taylor Creek and Nubbin Slough basins is 60 percent pasture (improved, unimproved, and woodland types) with equal amounts of wetlands and residential land uses (both about 9 percent).

The increase in acres of pasture habitats around Lake Okeechobee has likely improved the baseline condition for one federally listed species, the threatened Audubon's crested caracara (*Polyborus plancus audubonii*). The caracara is a resident, non-migratory falcon that occupies grassland, dry prairie, and pasture habitats in central Florida, southwestern United States, and Central America. The caracara is most abundant in a five-county area that includes Glades, DeSoto, Highlands, Okeechobee, and Osceola Counties, and therefore, almost the entire LOCAR study area.

c. Northern Estuaries

The St. Lucie and Caloosahatchee Estuaries have some of the most important ecological, recreational, and commercial lands in the study area. Estuaries, just by their nature of being in a transitional zone between salt water and fresh water, harbor many different plant and animal species and are nursery areas for important marine fish and shellfish species. The Indian River Lagoon (where the SLE discharges) has been touted as the most biologically diverse estuary in North America. Both the St. Lucie and Caloosahatchee Estuaries support ecologically valuable oyster and seagrass beds. These areas provide the base for much of the estuarine diversity; however, they are at increasing risk due to poor water quality that includes high nutrient concentrations and salinity imbalances.

3. Fish and Wildlife Resources

a. Federally Listed and Candidate Species

In 2023, the Service identified one plant and nine federally listed species that may occur within or around the LOCAR component footprints or otherwise be affected by the project. Consultation under the ESA for the LOCAR is ongoing. The federally listed species potentially affected by LOCAR are:

- endangered Okeechobee gourd (*Cucurbita okeechobeensis* ssp. *okeechobeensis*)
- endangered Florida panther [*Felis (=Puma) concolor coryi*]
- threatened West Indian (Florida) manatee (*Trichechus manatus*)
- endangered Florida bonneted bat (*Eumops floridanus*)
- endangered Everglade snail kite (*Rostrhamus sociabilis plumbeus*)
- threatened wood stork (*Mycteria americana*)
- endangered Florida grasshopper sparrow (*Ammodramus savannarum floridanus*)
- threatened Audubon's crested caracara (*Polyborus plancus audubonii*)
- threatened eastern indigo snake (*Drymarchon corais couperi*)
- threatened eastern black rail (*Lateralus jamaicensis jamaicensis*)

In addition to the above species, the tricolored bat (*Perimyotis subflavus*), which is proposed to be listed as endangered, also may occur within the LOCAR footprints. Another species, the whooping crane (*Grus americana*) is present in Florida as an experimental population only, and therefore, is not protected in Florida under the ESA, but is still protected under the MBTA. As of spring 2017, the Florida whooping crane population includes 14 birds (4 males, 8 females, 2 unknowns), including 4 pairs (data available at https://ebird.org/home).

Additionally, critical habitat for the snail kite (see 50 CFR 17.95) is present within the study area along the western edge of Lake Okeechobee from the S-310 structure near the town of Clewiston to the point of confluence of the Kissimmee River (C-38) with Lake Okeechobee. Critical habitat for the manatee is also present in the St. Lucie and Caloosahatchee Estuaries.

In addition to those species regulated by the Service, we encourage the Corps to consult with National Oceanographic and Atmospheric Administration (NOAA) Fisheries regarding possible

effects of the project on listed species under their jurisdiction. These could include, but are not limited to, giant manta ray (*Manta birostris*), smalltooth sawfish (*Pristis pectinata*), and sea turtles.

b. State-listed Species

The State of Florida lists the following species as Endangered (E), Threatened (T), or Species of Special Concern (SSC) and are expected to occur in the general study area:

- American alligator (*Alligator mississippiensis*), T – for similarity of appearance to the federally threatened American crocodile (*Crocodylus acutus*)
- Florida pine snake (*Pituophis melanoleucus mugitus*), T
- gopher tortoise (*Gopherus polyphemus*), T
- short-tailed snake (*Stilosoma extenuatum*), T
- black skimmer (*Rynchops niger*), T
- Florida burrowing owl (*Athene cunicularia floridana*), T
- Florida sandhill crane (*Grus canadensis pratensis*), T
- least tern (*Sternula antillarum*) T
- little blue heron (*Egretta caerulea*), T
- roseate spoonbill (*Ajaia ajaja*), T
- southeastern American kestrel (*Falco sparverius paulus*), T
- tricolored heron (*Egretta tricolor*), T

c. Other Fish and Wildlife Resources

Lake Okeechobee provides habitat for fish and wildlife resources of direct monetary value (commercial and recreational fisheries, waterfowl hunting, alligator hunting) and of inestimable indirect value in terms of tourism, quality of life, and the survival of many threatened, endangered, and rare species. Furse and Fox (1994) estimated the value of five different vegetative communities in the lake in supporting the commercial and recreational fisheries, which they then estimated to have a "total economic value" in excess of $480 million. The economic effect of a healthy lake ecosystem on non-consumptive recreational activities in the lake may be more difficult to measure, but it is becoming more significant. Examples of non-consumptive uses of the lake include airboat tours, birding expeditions, and educational field trips. According to FWC data, the number of annual permitted fishing tournaments on Lake Okeechobee averaged 464 over five years (2013 to 2017) with a maximum of 493 tournaments in 2015.

Hydrologic changes along with additional nutrient inputs have fostered the rapid expansion of nuisance exotic plants in the watershed and lake littoral zone. Exotic plant species in the lake include water hyacinth (*Eichhornia crassipes*), tropical American watergrass (*Luziola subintegra*), melaleuca (*Melaleuca quinquenervia*), torpedo grass (*Panicum repens*), and water primroses (*Ludwigia* spp.). Cattails (*Typha* sp.) have expanded in areas of the littoral marsh directly in contact with phosphorus-enriched water. As a result, more frequent fire and herbicide treatments are needed to control exotic or nuisance plant growth.

In addition to exotic plants, the lake now also contains a large and growing number of exotic animals, including an Asiatic clam (*Corbicula fluminea*), purple swamphen (*Porphyrio porphyrio*), and several species of fish (*e.g.,* sucker mouth catfish [*Hypostomus plecostomus*], blue tilapia [*Oreochromis aureus*], and Mayan cichlid [*Cichlasoma urophthalmus*]), whose negative impacts have not yet been documented.

IV. FISH AND WILDLIFE RESOURCE CONCERNS

A. Introduction

The Service expects this project to be beneficial to the management of water resources within Lake Okeechobee as well as the St. Lucie and Caloosahatchee Estuaries. We appreciate the importance of this project to improve water quality and timing of surface flows from the basins into Lake Okeechobee. The principal focus of this report is the protection, conservation, and enhancement of fish and wildlife habitats in the region, consistent with the project purposes. The restoration goal for Lake Okeechobee is the attainment of a resilient, productive, lacustrine ecosystem supporting a diverse assemblage of fish and wildlife while providing for the water supply needs of the region.

Historically, Florida lakes had a natural, rainfall-driven rising and lowering of lake stage. These intra-annual fluctuations have become more extreme due to drainage of the landscape for flood protection of residential and agricultural lands. The wetland "sponge" that once soaked up the rainy season's precipitation, and then slowly supplied downstream areas with water throughout the dry season are greatly reduced in spatial extent. Approximately 65 percent of historical wetlands in the LOCAR study area north of Lake Okeechobee are completely gone.

Lake Okeechobee's depth and water quality have implications for fish and wildlife values throughout south Florida. Adverse effects of drought or wet seasons with extremely high rainfall can affect the lake for either short periods or for durations of two or more years. Regulatory releases from the lake can have dramatically adverse consequences in the St. Lucie and Caloosahatchee Estuaries. The influence of water management in the lake's watershed can also affect hydro patterns and water quality in the Greater Everglades. The Lake Okeechobee conceptual model (Havens and Gawlik 2005) demonstrates the complex interactions among various environmental stressors affecting the lake.

B. Resource Concerns

1. Effects of Lake Stages on Lake Okeechobee

Prior to the hurricane season of 2004, the littoral zone of Lake Okeechobee was highly productive and sustained a good diversity of fish and wildlife. It is the area most affected by changes to lake stages (as dictated by the regulation schedule). Variations in water depth and the duration of inundation control the vegetative communities of the littoral zone, the total area of the lake available as habitat for aquatic animals, and the availability of aquatic prey for higher consumers, particularly wading birds. Havens et al. (1996b) found that the littoral zone had a greater trophic complexity than open water habitats. Many of the additional species in the littoral zone that are not found in the pelagic zone are large predators (14 species of adult fish and 14 species of birds), but the majority of the additional taxa (54) are macroinvertebrates.

Extremely low lake levels desiccate the littoral zone. When lake levels drop to 11 feet, approximately 94 percent of the littoral marsh is dry and no longer functions as habitat for fish and other aquatic-dependent wildlife (District 2000). Additionally, a dry littoral zone may facilitate the spread of exotic invasive species such as torpedo grass and Melaleuca. One of the ecologically valuable, aquatic communities that becomes dry when the lake drops below 11 feet is dominated by spike rush (*Eleocharis cellulosa*). This community is of particular concern because it supports the population of native apple snails (*Pomacea paludosa*) - food for the endangered snail kite. Spike rush is particularly valuable habitat for foraging snail kites because its moderate stem density accommodates the bird's visual hunting behavior. Maintaining clear water and a sandy-bottom littoral habitat with emergent vegetation is necessary to support a healthy native apple snail population (Darby et al. 2004). The western littoral zone of Lake Okeechobee is also an important habitat for the snail kite and is designated critical habitat.

During periods of extreme high lake levels (>17 feet), wind and erosion cause emergent and submerged plants to be torn loose from their substrates, resulting in a loss of important fish and wildlife habitat. When lake levels exceeded 17 feet in 1995 and 2004, large sections of bulrush (*Scirpus californicus* and *S. validus*) were lost. These plants occur at the interface between the pelagic and littoral zones where they are exposed to wave action and constitute prime habitat for largemouth bass and black crappie, two of the most important recreational fishes in the lake (Furse and Fox 1994). According to Steinman et al. (2002) at least three other adverse ecological effects can result from extended periods of high water levels within Lake Okeechobee:

- less light reaches the bottom of the lake, resulting in loss of submerged vegetation;
- phosphorus concentrations increase to unacceptable levels in the nearshore regions, as sediments are transported from the central mud zone toward the littoral zone; and
- more favorable conditions result for the spread of exotic, invasive species in the lake's marsh zone.

Milleson (1987) correctly predicted that prolonged inundation of the littoral zone by stages over 15 feet would reduce the diversity of the marsh vegetation and would adversely affect waterfowl, wading birds, reptiles, fish, and other species that depend on the lake's littoral and nearshore

zones. Bull et al. (1995) found significant negative correlations between water depth at sample sites in the lake's pelagic zone and the abundance of threadfin shad and bluegill, while increased depth was positively correlated with abundance of white catfish and black crappie. Additional study is needed on the effect of lake stage on the standing stock and reproductive success of fish in the littoral zone.

2. Effects of Poor Water Quality on Lake Okeechobee

Havens (1997) provided a review of ecological changes in Lake Okeechobee caused by cultural eutrophication and discussed the relationships between higher lake stages and increased total phosphorus concentrations in the pelagic zone of the lake. Janus et al. (1990) and Maceina (1993) hypothesized that higher lake stages increase the incidence of algal blooms. On July 2, 2016, NASA recorded a cyanobacteria bloom in Lake Okeechobee (https://earthobservatory.nasa.gov/IOTD/view.php?id=88311), and subsequent discharge of that water to the SLE was implicated in thick masses of floating algae that blocked waterways and necessitated human health advisories.

The concentration of total phosphorus in the lake nearly doubled from 49 parts per billion (ppb) in 1973 to 98 ppb in 1984 (Janus et al. 1990). Despite some progress in reducing phosphorus loading rates to the lake through implementation of Best Management Practices upstream of the lake, the 40 ppb (or μg/L) target (total phosphorus concentration) is still not being met. Recently, the Blue-Green Algae Task Force recommended increased compliance, improved data collection and record keeping, promoting transparency and accountability for agricultural Best Management Practices (FDEP 2019). Even with reduction of phosphorus loading from external sources, internal phosphorus loading from re-suspension of phosphorus-rich sediments that have built up in the lake may affect water quality in the lake for several decades (Havens et al. 1996a; Steinman et al. 1998).

Warren et al. (1995) found that the benthic invertebrate communities of Lake Okeechobee's sublittoral zone were of relatively poor quality and that shifts toward dominance of more undesirable species (indicative of highly eutrophic conditions) have occurred at a rapid rate. Higher lake stages are likely to increase the transport of nutrient-rich water from the pelagic zone to the littoral zone, which would ultimately reduce the diversity of the invertebrate community in the littoral zone, which has a higher diversity of benthic invertebrates than the sublittoral zone (Havens et al. 1996b).

Havens and James (1999) suggested that observed declines in water transparency could be explained by the migration of mud sediments from mid-lake towards the littoral zone along the southwestern shore. This migration of sediment would be more likely to occur under extended periods of high water and could have severe impacts on the primary productivity of the littoral zone. The reduction in water clarity, which is more likely to occur with a combination of high average water stages and storms, can have an adverse effect not only on SAV, but also the extremely important periphyton community. Similar to the Everglades, a healthy littoral zone in Lake Okeechobee sustains periphyton, which is a nutritious food base for grazing invertebrates and fishes, such as grass shrimp (*Palaemonetes paludosus*), apple snails, flagfish (*Jordanella floridae*), and sailfin mollies (*Poecilia latipinna*). These fish and invertebrates rely on the

primary production of periphyton and form a key linkage in the food chain to commercially and recreationally important fish and wildlife. The remaining bulrush stems on the outer edge of the littoral zone have been largely lacking periphyton (Fox 2007), likely due to a combination of physical scouring of the stems and the lack of light penetration, both of which can be correlated with high water levels. The increased turbidity following the 2004 and 2005 hurricane seasons has also seemed to retard regrowth of periphyton on the stems of emergent vegetation that survived physical damage from the storms. The effects of water regulation (stage and water quality) in the lake on phytoplankton, periphyton, and benthic invertebrates are passed through the food web to readily observable losses in biodiversity at higher trophic levels.

3. Loss or Fragmentation of Habitat in the Watershed

Historically, the natural vegetation of the Lake Okeechobee watershed was a mix of wet and dry prairies, freshwater marshes, hardwood swamps, cypress swamps, mesic temperate hammocks, and pine flatwoods. These habitats for native plants and animals have been substantially altered by human activities. These activities include the removal of native vegetation and soil disturbance for various agricultural or residential purposes, and construction of ditches, canals, and water control structures that may rapidly drain water into Lake Okeechobee.

Today, the largest land use in the watershed is agriculture (about 60 percent). Approximately, 85 percent of this is improved pasture, and indicates cow-calf operations. Urban, residential, and commercial land uses comprise about 5 percent of the project area and are primarily in and around the City of Okeechobee, or distributed along the northern shore of Lake Okeechobee. Roughly, one-third of the watershed remains as natural lands or open water.

Some wetlands have been irretrievably lost due to drainage and land use conversion. There has been an approximate 65 percent loss in wetland spatial extent across the study area. Many more wetlands, even though they still exist, have lost some functionality. Most notably was the channelization of the Kissimmee River. The loss of forested riverine wetland systems has degraded corridors, which hampers the ability of wildlife to move across the landscape. The loss of isolated wetlands has adversely affected amphibian populations. All these changes provide opportunities for the colonization of the watershed by problematic exotic plants and animals.

The reservoir footprint is located both within the Florida Wildlife Corridor (Florida Wildlife Corridor Foundation 2023) and within lands that were identified by Thatcher et al. (2009) as a potential connection between major patches of Florida panther habitat associated with Fisheating Creek in Glades County and Avon Park Air Force Range (APAFR) in Polk and Highlands counties. This linkage connects an area of Fisheating Creek under conservation easement with a system of public lands owned by the District along the Kissimmee River that ultimately connect to APAFR. This ‘corridor’ contains habitat used by many species such as the Florida panther, swallow-tailed kite (*Elanoides forficatus*), crested caracara, Everglade snail kite, Florida sandhill crane (*Grus canadensis*), Florida black bear (*Ursus americanus floridanus*), Florida mottled duck (*Anas fulvigula*), short-tailed hawk (*Buteo brachyurus*), and bald eagle (*Haliaeetus leucocephalus*).

4. Chemical Contamination in the Watershed

In residential and agricultural areas of the Lake Okeechobee watershed, the historical use of pesticides and other synthetic organic compounds may result in chemical residues in soils, ground water, surface water, and sediments. Sediments can be particularly important because many of these organic compounds selectively adsorb to sediment particles. As a result, these materials have the potential to adversely affect aquatic benthic communities and the food web, or can be suspended and directly affect the quality of surface waters.

For example, during a 2006 evaluation of a property in the Paradise Run area of the LOCAR footprint, District contractors found contamination by selenium, 4,4′ DDD, 4,4′ DDE, and chlordane in a former tomato farming area. In addition, extremely low levels of the pesticides 2,4-DB, endosulfan I, endosulfan sulfate, endrin aldehyde, endrin keytone, heptachlor, heptachlor epoxide, and paraquat were detected. Selenium was also detected in canal sediment. Total recoverable petroleum hydrocarbons and several polycyclic aromatic hydrocarbons were found in soils near pump stations. In cattle pen areas, arsenic, organochlorine and organophosphate pesticides, toxaphene, lindane, coumaphos, endosulfan sulfate, and endrin keytone were found. Ground water sampling detected dieldrin, arsenic, and MCPA ([2-methyl-4-chlorophenoxy] acetic acid). Many of these areas may be remediated by soil removal. Other areas may require different remediation techniques before they are suitable for water storage or restoration features. Fortunately, there are cross-agency chemical sampling and assessment procedures that have been adopted to minimize or avoid potential exposure pathways to the regional fish and wildlife communities in south Florida (Service 2008).

5. Effects to Northern Estuaries

Water management of Lake Okeechobee can directly affect estuarine health due to the relationship between regulatory lake releases and the salinity within the estuaries. Maintaining desired estuarine salinities to support the wide range of plant and animal communities requires a balance of water management and seasonal rainfall fluctuations. During the dry season, freshwater flow to the estuaries should be reduced, or even eliminated, which results in a rise in salinity within the estuarine systems. For the SLE, local basin runoff is enough to maintain minimal freshwater input into the estuary, except in the driest years; however, the Caloosahatchee estuary depends on fresh water releases from Lake Okeechobee or the local basin to maintain a healthy ecosystem during the dry season, particularly during drought conditions. Conversely, during the wet season, excessive flows of fresh water from the lake to both estuaries lower the salinity to damaging, and sometimes destructive, levels. Current performance measures use freshwater flow inputs as a surrogate measure for desirable salinity conditions within the estuaries.

a. Caloosahatchee Estuary

The natural and historic gradient of salinity zones within the Caloosahatchee Estuary and San Carlos Bay serve as important nursery, feeding, and refugia areas for juvenile stages of desirable sport and commercial fishes. At least 70 percent of Florida's recreationally sought fishes depend on estuaries for at least part of their life histories (Lindall 1973; Harris et al. 1983; Estevez

1998). Excessive variation in fresh water flows and salinity force estuarine biota into a constant flux between those favoring higher salinity and those favoring lower salinity (Bulger et al. 1990). Consequently, optimal salinity conditions may not last long enough for organisms to complete their life cycle and the estuary can become devoid of some populations, even keystone species that support major ecosystem components along an estuary's salinity gradient such as fresh and salt water SAV and/or oysters.

Tape grass (*Vallisneria americana*; also called eel grass) is the dominant oligohaline SAV in the upper Caloosahatchee estuary, including 40 acres of the Caloosahatchee National Wildlife Refuge (NWR). It occurs in well-defined beds in shallow water and is important habitat for a variety of freshwater and estuarine invertebrate and vertebrate species, including some commercially and recreationally important fishes (Bortone and Turpin 1999) and migratory waterfowl. During times of extended low inflow conditions, when salinity is too high, tape grass becomes very sparse or can disappear (District 2000; Chamberlain et al. 1995; Doering et al. 2002).

A substantial loss in the extent of seagrass coverage has occurred in the lower estuary (Harris et al. 1983). Each species of SAV has a specific temperature and salinity tolerance range and their tolerance towards variations in salinity are similar to their tolerances for temperature. Furthermore, estuarine plants and animals are well adapted to and depend upon natural seasonal changes in salinity. When salinity falls outside of these normal and seasonal ranges, it may result in a reduction in densities and shifts in distribution of SAV species and organisms dependent upon these productive habitats (Chamberlain and Doering 1998).

Salinity is also important in determining the distribution of coastal and estuarine bivalves, such as oysters. Short pulses of freshwater inflow can greatly benefit oyster populations by killing predators, while excessive freshwater inflows may kill entire populations of oysters (Gunter 1953; Schlesselman 1955; MacKenzie 1977). Although a substantial oyster population still exists within the lower Caloosahatchee Estuary, historical accounts of the river indicate that oysters were once a more prominent feature in the area upstream (Sackett 1888). As individual oysters die, they leave empty compartments for various estuarine residents. Volety et al. (2003) found that a greater abundance of decapods and fishes were associated with clusters of live oysters compared to dead-articulated clusters, while the structure provided by both living and dead oyster shells supported a greater abundance of these estuarine organisms than no shells at all.

b. St. Lucie Estuary

The ecological problems within the SLE are very similar to those experienced by the Caloosahatchee in terms of damage to estuarine plant and animal communities. Ecological harm from high flows to the SLE causes serious public concern. The North Fork of the St. Lucie River, which normally averages 18 parts per thousand (ppt) salinity decreases to 0 ppt during peak flows. Portions of the SLE that normally average 24 ppt decrease to 5 ppt, and the Indian River Lagoon, which normally averages 30 ppt, decreases to approximately 20 ppt. The high volume freshwater discharges may coincide with a high incidence of fish with lesions and public health warnings due to Harmful Algal Blooms (HABs).

In addition to the deleterious effect that freshwater releases from Lake Okeechobee have on salinity, direct impacts on the water quality of the estuary are felt, including conveyance of silts, sediments, and other pollutants to the estuary. Because of local runoff from agricultural and urban development within the watershed, even in the absence of Lake Okeechobee discharges, the desirable salinity envelope of the estuary is often violated by too much fresh water entering the estuary.

C. Summary/Planning Objectives

Resource concerns were divided into existing problems that the project was designed to address (*e.g.,* lake stages, inappropriate hydrology, and habitat loss) and concerns that result from the construction and operation of those project features (*e.g.,* contaminants, habitat loss, and fishery concerns). With a wide variety of resource concerns dependent upon the effectiveness of regional water management, the planning objective for this project was to balance these resource needs and select a plan that best meets the storage and habitat goals and benefits of the project.

V. EVALUATION METHODOLOGY

The District LOCAR Project Team initiated plan formulation by reviewing previous studies and revisited opportunities to meet the goals of the CERP Component A. The LOCAR Project Team initially evaluated the five deep storage reservoirs carried forward in the LOWRP: K-05 Large, K-05 North, K-05 South, I-01, and K-42. Three of these reservoirs were dismissed due to operational constraints and concerns for dam safety identified in previous studies and a fourth was revised to have shallow storage.

Water conveyance to meet the CERP Component A goals was a priority in plan formulation, along with lessons learned from work on the C-43 and EAA reservoirs. The area surrounding the K-42 site became the focus for a deep storage above-ground reservoir because of its location upstream of S-65E, allowing for a connection to C-41A and the ability to divert water to and from Lake Okeechobee. Reservoir siting opportunities were evaluated within a preliminary project area bounded by the C-38/Kissimmee River to the east, County Road 621 to the west, C-41A to the south, and the Istokpoga Canal and the CSX Railroad to the north.

Reservoir locations were identified to avoid known existing infrastructure, including public roads and residential developments. Residential areas in the southeast corner of the preliminary project area were avoided to further narrow sites for the LOCAR.

Other environmental constraints were considered for siting in the remaining project area, including threatened and endangered species habitat and wetlands. Much of the area was identified as potential Florida grasshopper sparrow habitat with scattered isolated wetlands. Areas to the north and west have been in citrus and sugarcane production and would be expected to have limited habitat for protected species. The remaining land area is improved pasture, ideal habitat for the crested caracara. Many of the wetland features in the area were identified as designed infrastructure for farming operations.

Siting of a potential reservoir proceeded to identify opportunities for operational flexibility, account for seepage, and reduce the potential for overtopping from waves generated within the reservoir's storage cells. The three reservoirs, described as Alternatives 1 (LCR1), 2 (LCR2), and 3 (LCR3), were laid out in the project area (Figures 2-4). Each was located adjacent to C-41A, allowing for conveyance to and from Lake Okeechobee.

LCR1 was later refined in the plan formulation process by removing approximately 500 acres in the south and is known as Alternative 4 (LCR4) in the Corps' Draft EIS. This upland area that was removed consists of a thick stand of broad-leaved trees on a natural rise, regionally referred to as a "hammock". No additional modeling was required from this change to LCR1, and therefore, all references to the analysis and evaluations of LCR4 in this report are the same as LCR1.

Initial conceptual reservoir designs for LCR1, LCR2, and LCR3 varied by depth and operational flexibility. All of the alternatives were designed to store excess water that would have been sent to Lake Okeechobee. LCR2 and LCR3 were initially designed with connections to the Istokpoga Canal to allow the LOCAR to be used to influence Lake Istokpoga operations. LCR2 was also designed as two separate reservoirs connected by a canal to reduce the necessary depth of water stored from an average of 17 feet (LCR1) to an average of 11 feet (LCR2). Water from the southern reservoir would be pumped through the canal to the northern reservoir. The footprint and connection to C-41A for all the alternatives was carried forward. However, connections to Istokpoga Canal were screened out and not carried forward for further consideration, as described below.

The Lake Istokpoga Regulation Schedule was identified in Other Project Elements (OPE) of CERP. The intent of the feature was to enhance fish and wildlife benefits where a possible reduction in the annual fluctuation of the lake reduced quality habitat (Corps 1999). At this time, water levels in Lake Istokpoga remain relatively stable and performance metrics to quantify habitat conditions have not been defined. Developing performance metrics and consideration of a new regulation schedule for Lake Istokpoga are beyond the scope of this study. Therefore, measures to increase operational flexibility by connecting reservoir alternatives with Lake Istokpoga (via connection to the Istokpoga Canal) were not carried forward for further evaluation.

Evaluations of the alternatives were made by comparing the modeling results for each alternative (LCR1 [same as LCR4], LCR2, LCR3) (as expressed in performance measure output) with the Existing Conditions Baseline 2023 (ECB23L) and the Future Without Project (FWOL) and with each other. The Period of Record (POR) used for modeling purposes included years 1965 through 2016.

The following performance measures (PMs) were used:

Lake Okeechobee

- Percent time below stage envelope
- Percent time within stage envelope
- Percent time above stage envelope

- Upper penalty - all years
- Lower penalty - all years
- Upper penalty - recovery years
- Lower penalty - recovery years
- Percent time above 17 ft and frequency
- Percent time above 16 ft and frequency
- Percent time below 11 ft
- Percent time below 10 ft
- MFL Exceedance = Low Stage < 11 ft for > 80 days
- Low Stage Number of Days < 12.56 ft
- Number of years LOK stage > 15ft May-Sept for: >60 days (cumulative, not consecutive)
- Number of years LOK stage > 15ft May-Sept for: >120 days (cumulative, not consecutive)
- Number of years LOK stage > 15ft Oct-Apr for: >120 days (cumulative, not consecutive)

Caloosahatchee River Estuary

- Low Flow - Number of times 14-day Moving Average Flows < 750 cfs
- Optimal Flow - Number of times 14-day Moving Average Flows ≥ 750 cfs and less than 2,100 cfs
- High Flow (Basin Runoff) - Number of times 14-day Moving Average Flows ≥ 2,100 cfs and < 2,600 cfs
- High Flow (Lake Okeechobee) - Number of times 14-day Moving Average Flows ≥ 2,100 cfs and < 2,600 cfs
- Damaging Flow (Basin Runoff) - Number of times 14-day Moving Average Flows ≥ 2,600 cfs
- Damaging Flow (Lake Okeechobee) - Number of times 14-day Moving Average Flows ≥ 2,600 cfs
- Number of MFL Exceedances

St. Lucie River Estuary

- Low Flow - Number of times 14-day Moving Average Flows <150 cfs
- Optimal Flow - Number of times 14-day Moving Average Flows were ≥150 cfs and < 1,400 cfs
- High Flow (Basin Runoff) - Number of times 14-day Moving Average Flows ≥ 1,400 cfs and < 1,700 cfs
- High Flow (Lake Okeechobee) - Number of times 14-day Moving Average Flows ≥ 1,400 cfs and < 1,700 cfs
- Damaging Flow (Basin Runoff) - Number of times 14-day Moving Average Flows ≥ 1,700 cfs
- Damaging Flow (Lake Okeechobee) - Number of times 14-day Moving Average Flows ≥ 1,700 cfs

VI. FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

Without the project, the current rural landscape, agricultural land use, and somewhat reduced plant and animal habitats would continue in the near term. Over the longer term, development patterns may stay the same or be exacerbated by more people moving into the area whether it be retirees, seasonal residents, or others from coastal areas due to effects of climate change. Without the project, additional water storage benefits would not be realized. Conditions in Lake Okeechobee would continue to deteriorate and freshwater discharges from the lake to the northern estuaries would continue despite other water storage being built elsewhere in the system (*i.e.,* C-43 and C-44 reservoirs). The No Action alternative may be more favorable for those plants and animals currently occupying upland and freshwater marsh areas proposed to be flooded within the reservoir, including some federally listed species.

VII. DESCRIPTION OF THE TENTATIVELY SELECTED PLAN AND OTHER ALTERNATIVES

The District Project Team selected four possible configurations for the LOCAR. The plan formulation process to select these alternatives is described in greater detail in the LOCAR Draft EIS. Table 2 summarizes the features of each alternative. The operations for all four alternatives would be similar, allowing for a combination of methods to divert water from and return water to Lake Okeechobee. Water would be conveyed to the reservoir in one of three ways: (1) full or partial diversion of flow in C-41A downstream of S-83, (2) full or partial diversion of flow in C-38 downstream of S-65D by conveying water from the S-65E drainage basin (between S-65D and S-65E), or (3) back pumping water from Lake Okeechobee via pumping from C-41A downstream of S-84 into C-41A between S-83 and S-84. Water would be returned to Lake Okeechobee by discharging from the reservoir to the C-41A upstream and/or downstream of S-83. The location of the reservoir outflow culverts would allow for water to be conveyed south to provide opportunities for storage in surrounding canals (*e.g.,* C-41A, C-41, C-40, and C-39A). A full description of reservoir operations for the TSP is described in the Corps' Draft EIS.

Table 2. Array of alternatives.

Feature	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Water storage capacity (ac-ft)	200,000	200,000	200,000	200,000
Land area of reservoir site (ac)	12,800	20,400	14,900	12,392
Land area of S-84+ spillway and PS-1 pump station site (ac)	1.5	1.5	1.5	1.5
Average ground elevation within each reservoir cell (ft NAVD88)	34 (east cell) 34 (west cell)	44 (north cell) 34 (southeast cell) 34 (southwest cell)	44 (north cell) 35 (south cell)	34 (east cell) 34 (west cell)
Average storage depth within each reservoir cell (ft)	17 (east cell) 17 (west cell)	11 (north cell) 11 (southeast cell) 11 (southwest cell)	15 (north cell) 15 (south cell)	18 (east cell) 18 (west cell)
Number of reservoir inflow pump stations (total number)	2	3	3	2
Total reservoir inflow capacity (cubic feet per second [cfs])	1,500	1,500	1,500	1,500
Total reservoir outflow capacity (cfs)	3,000	3,000	3,000	3,000

*Note: Quantities for water storage capacity, depth, and land area are approximate and are based on normal full storage levels determined for the planning level design of the alternative.

A. Tentatively Selected Plan (TSP)

Alternative 1 (LCR1) includes a 200,000-acre-foot above-ground storage reservoir north of the C-41A (Figure 2). The 12,800 acre reservoir would be designed to have an average storage depth of 17 feet at its normal full storage level. The reservoir would include two pump stations, outflow culverts, outflow canal, interior divider dam with culvert, and two overflow spillways.

The two pump stations would be used to fill the reservoir at 1,500 cfs. One pump station would be located downstream of S-84 and move water from C-38 into C-41A, upstream of S-84. The second pump would be located on the C-41A Canal upstream of State Highway 70 to pump water from C-41A directly into the reservoir. A gated outflow culvert would be constructed on the west side of the reservoir to discharge water into C-41A upstream of S-83, while another gated culvert would be constructed near the southeast side of the reservoir to discharge water into C-41A downstream of S-83.

The reservoir would be designed to have two storage cells (*i.e.,* east and west) split by an interior divider dam to reduce wave runup. The interior divider dam would include a 1,500 cfs, gated, divider dam culvert to allow for controlled conveyance of water between the two cells. Each cell would include an ungated overflow spillway into C-41A.

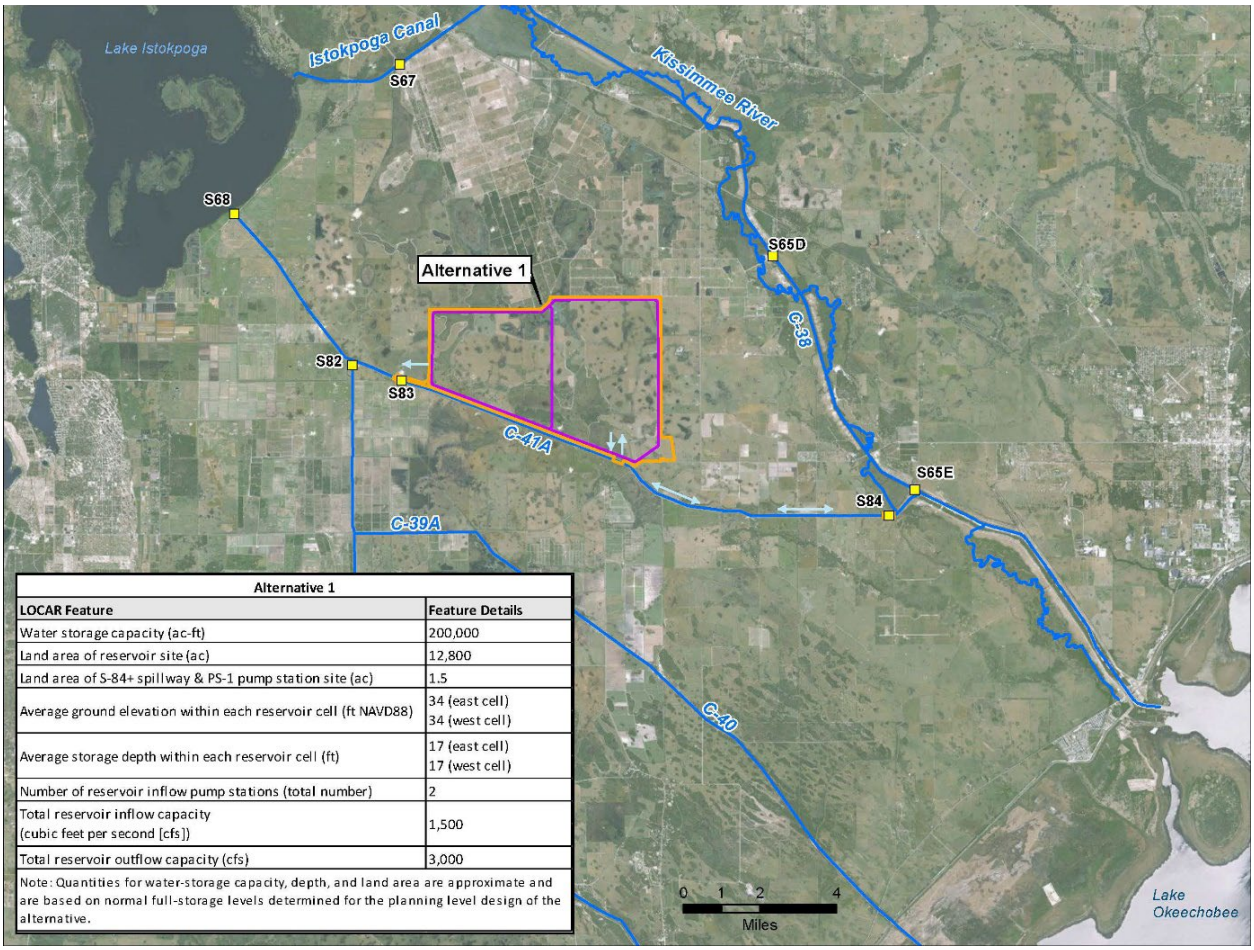
Alternative 4 (LCR 4) has almost the same footprint as Alternative 1, but with modifications or refinements (Figure 5). The Alternative 1 footprint was refined to create Alternative 4 by removing an environmentally sensitive area. The environmentally sensitive area is a 484-acre area along the southern boundary of the footprints of Alternatives 1 and 4. This upland area consists of a thick stand of broad-leaved trees on a natural rise, regionally referred to as a "hammock." This hammock is not in the Alternative 4 footprint. Alternative 4 is the District's North of Lake Okeechobee Storage Reservoir Section 203 Study Recommended Plan (*i.e.,* TSP) and was identified as the most cost-effective best buy.

B. Other Alternatives

Alternative 2 (LCR2) has a capacity, structures, and operations similar to LCR1, but covers a larger area, allowing for a shallower storage depth. LCR2 includes two reservoirs connected by a canal (Figure 3). The southern reservoir would include east and west cells in the same configuration and location as LCR1. The northern reservoir would be located south of the Istokpoga Canal at U.S. Highway 98 with an overflow spillway into the Istokpoga Canal. The 200,000-acre-foot reservoir would cover 20,532 acres and be designed to have an average depth of 11 feet. In addition to the features in LCR1, a third pump station would pump water through a connector canal from the southern to northern reservoir.

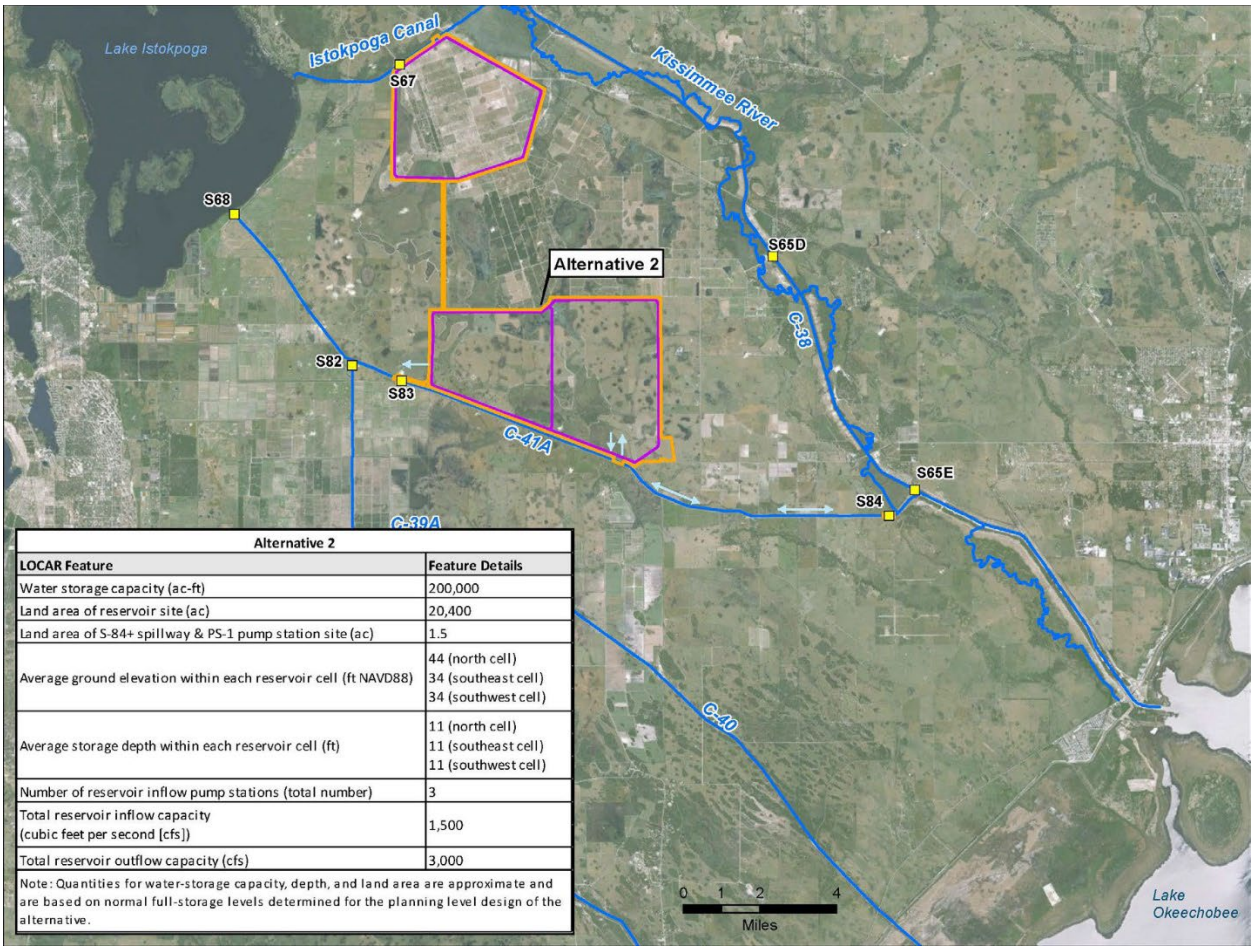
Alternative 3 (LCR3) has a capacity and operations similar to LCR1, but is configured north to south between the Istokpoga Canal and C-41A (Figure 4). The reservoir would include an interior divider dam with a 1,500 cfs gated outflow culvert and a 1,500 cfs pump station used to move water from the southern cell into the northern cell. Reservoir operations would be similar to LCR1, bringing water into and releasing water from the reservoir from/to C-41A.

No Action Alternative (FWOL) assumes CERP Component A would not be constructed, but includes other authorized CERP projects as well as other federal, state, and local projects constructed or approved under existing governmental authorities that occur in the study area. The No Action Alternative is consistent with the Future Without Project Condition described in the LOCAR FS. It assumes the Lake Okeechobee Regulation Schedule is consistent with the Central Everglades Planning Project (CEPP) EAA Reservoir Operation; completion of the Herbert Hoover Dike, Kissimmee River Restoration, Ten Mile Creek Reservoir, and STA; and 370,000 acre-feet of storage from the A-1 Flow Equalization Basin (FEB), A-2 STA, and A-2 Reservoir.



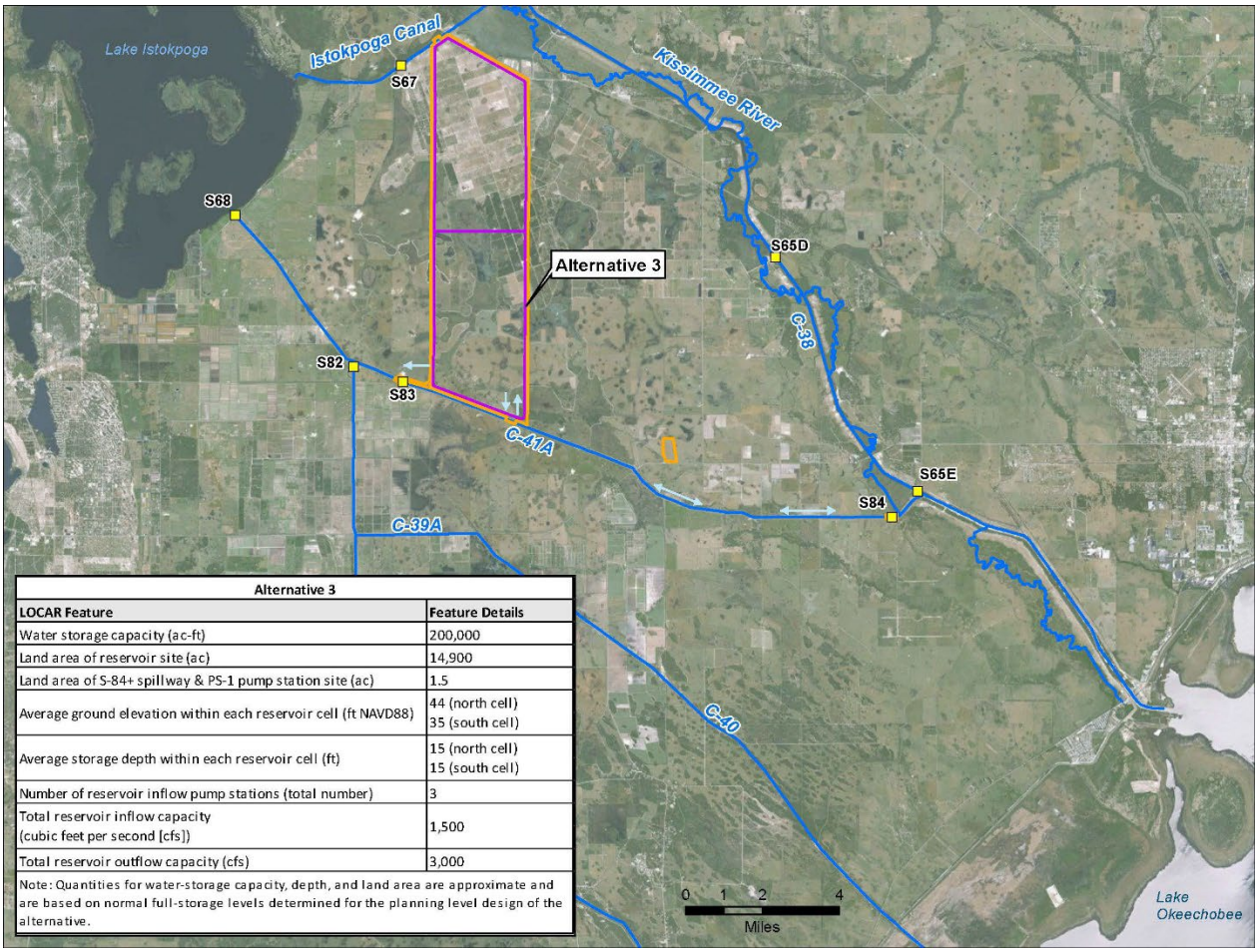
Alternative 1	
LOCAR Feature	**Feature Details**
Water storage capacity (ac-ft)	200,000
Land area of reservoir site (ac)	12,800
Land area of S-84+ spillway & PS-1 pump station site (ac)	1.5
Average ground elevation within each reservoir cell (ft NAVD88)	34 (east cell) 34 (west cell)
Average storage depth within each reservoir cell (ft)	17 (east cell) 17 (west cell)
Number of reservoir inflow pump stations (total number)	2
Total reservoir inflow capacity (cubic feet per second [cfs])	1,500
Total reservoir outflow capacity (cfs)	3,000
Note: Quantities for water-storage capacity, depth, and land area are approximate and are based on normal full-storage levels determined for the planning level design of the alternative.	

Figure 2. LOCAR Alternative 1.



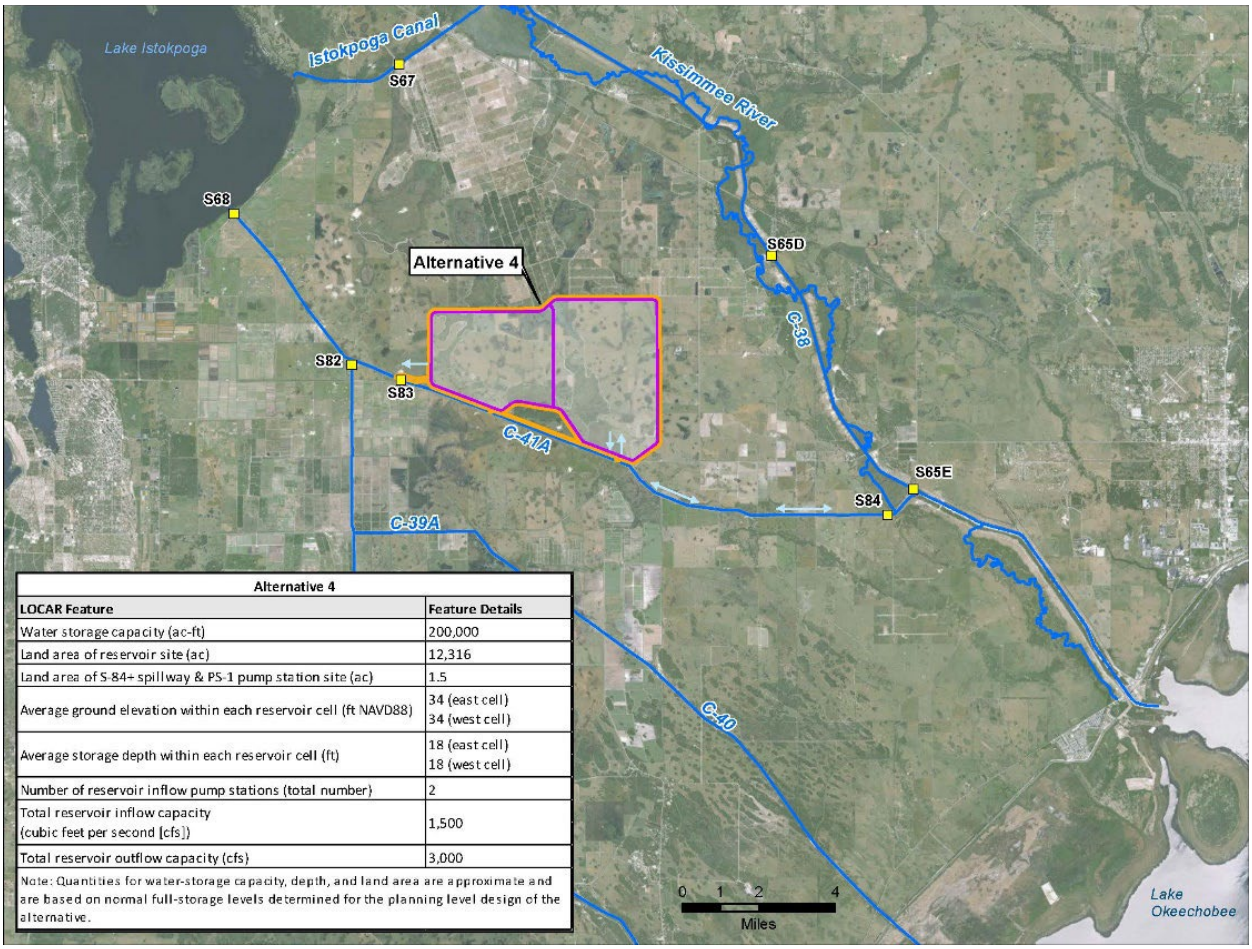
Alternative 2	
LOCAR Feature	**Feature Details**
Water storage capacity (ac-ft)	200,000
Land area of reservoir site (ac)	20,400
Land area of S-84+ spillway & PS-1 pump station site (ac)	1.5
Average ground elevation within each reservoir cell (ft NAVD88)	44 (north cell) 34 (southeast cell) 34 (southwest cell)
Average storage depth within each reservoir cell (ft)	11 (north cell) 11 (southeast cell) 11 (southwest cell)
Number of reservoir inflow pump stations (total number)	3
Total reservoir inflow capacity (cubic feet per second [cfs])	1,500
Total reservoir outflow capacity (cfs)	3,000
Note: Quantities for water-storage capacity, depth, and land area are approximate and are based on normal full-storage levels determined for the planning level design of the alternative.	

Figure 3. LOCAR Alternative 2.



Alternative 3	
LOCAR Feature	**Feature Details**
Water storage capacity (ac-ft)	200,000
Land area of reservoir site (ac)	14,900
Land area of S-84+ spillway & PS-1 pump station site (ac)	1.5
Average ground elevation within each reservoir cell (ft NAVD88)	44 (north cell) 35 (south cell)
Average storage depth within each reservoir cell (ft)	15 (north cell) 15 (south cell)
Number of reservoir inflow pump stations (total number)	3
Total reservoir inflow capacity (cubic feet per second [cfs])	1,500
Total reservoir outflow capacity (cfs)	3,000
Note: Quantities for water-storage capacity, depth, and land area are approximate and are based on normal full-storage levels determined for the planning level design of the alternative.	

Figure 4. LOCAR Alternative 3.



Alternative 4	
LOCAR Feature	**Feature Details**
Water storage capacity (ac-ft)	200,000
Land area of reservoir site (ac)	12,316
Land area of S-84+ spillway & PS-1 pump station site (ac)	1.5
Average ground elevation within each reservoir cell (ft NAVD88)	34 (east cell) 34 (west cell)
Average storage depth within each reservoir cell (ft)	18 (east cell) 18 (west cell)
Number of reservoir inflow pump stations (total number)	2
Total reservoir inflow capacity (cubic feet per second [cfs])	1,500
Total reservoir outflow capacity (cfs)	3,000
Note: Quantities for water-storage capacity, depth, and land area are approximate and are based on normal full-storage levels determined for the planning level design of the alternative.	

Figure 5. LOCAR Alternative 4.

VIII. EVALUATION OF THE ALTERNATIVES AND TENTATIVELY SELECTED PLAN

Project with-action alternatives were evaluated against the others (*i.e.,* LCR1 [same as LCR4], LCR2, and LCR3), and against the existing conditions baseline (ECB23L) and FWOL in order to identify which one best approached the multiple goals of the project. Alternatives were evaluated by comparing their respective performance measure model outputs.

A. Lake Okeechobee

For Lake Okeechobee, one desired restoration condition is for the stage to remain within the ecologically preferred range of 11.5 to 15.5 feet and avoid frequent or prolonged departures outside of this range. Figure 6 shows the "percentage of time" from the modeling output for each alternative. Each with-action alternative performed identically in relation to percent time below, within, and above stage envelope and were improvements over ECB23L and FWOL.

The occurrence of extreme high and low lake stage events should also be rare for healthy lake ecology. The targets for extreme lake stages either above 17 feet or below 10 feet are zero weeks. FWOL performed the best (lower is better) for time below 10 feet (3.05%) compared to

LCR1 (4.11%), LCR2 (3.98%), LCR3 (4.12%), and ECB23L (4.41%). All three with-action alternatives performed almost the same for time above 17 feet (LCR1 [0.59%], LCR2 [0.58%], and LCR3 [0.58%]), and all were improvements over ECB23L (1.37%) and FWOL (2.05%). Figure 6 shows similar results of significant improvements for upper penalty scores for all with-action alternatives compared to ECB23L and FWOL. However, FWOL performs best for lower penalty scores, but all with-action alternatives perform better than ECB23L.

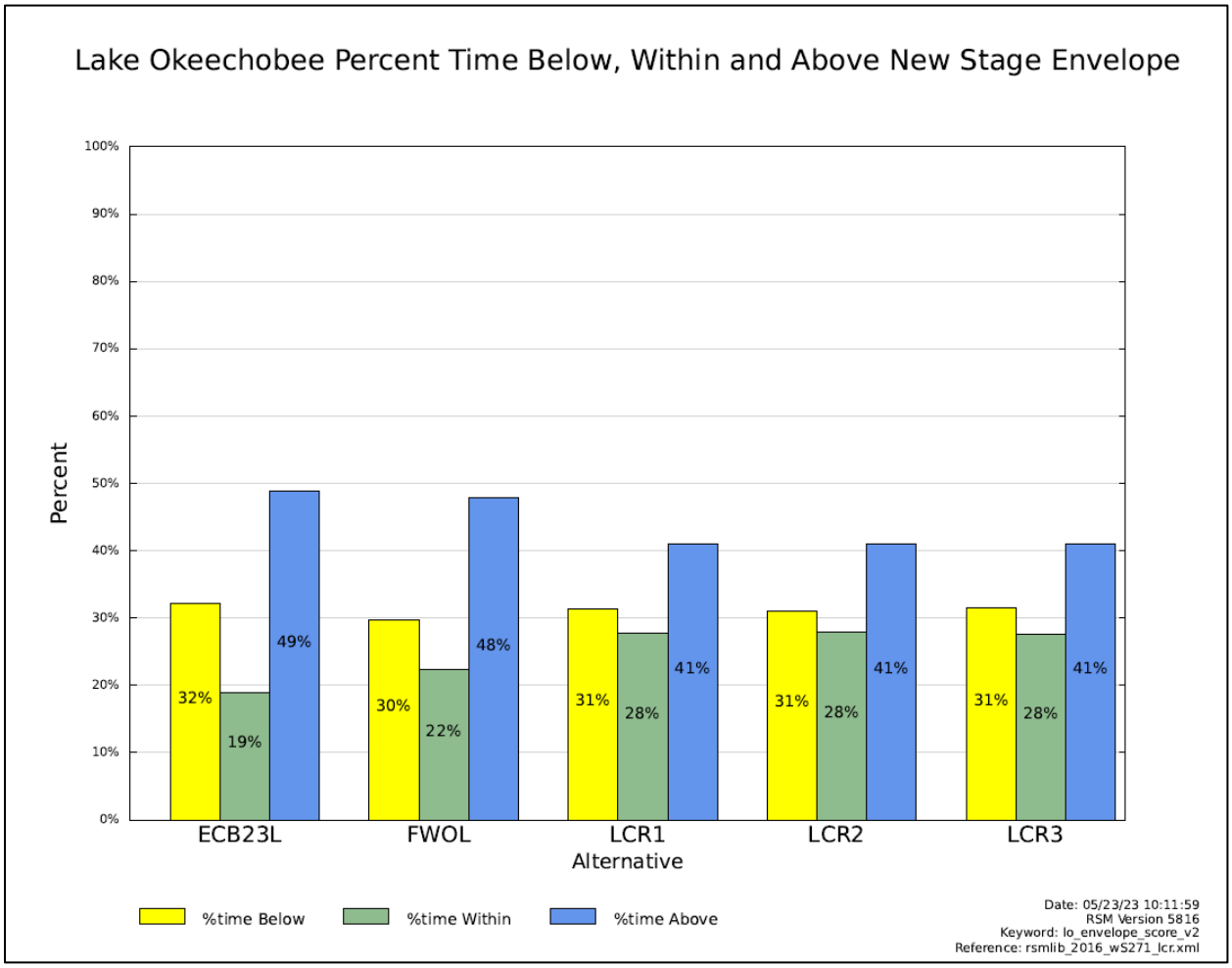


Figure 6. Lake Okeechobee percent time below, within, and above stage envelope.

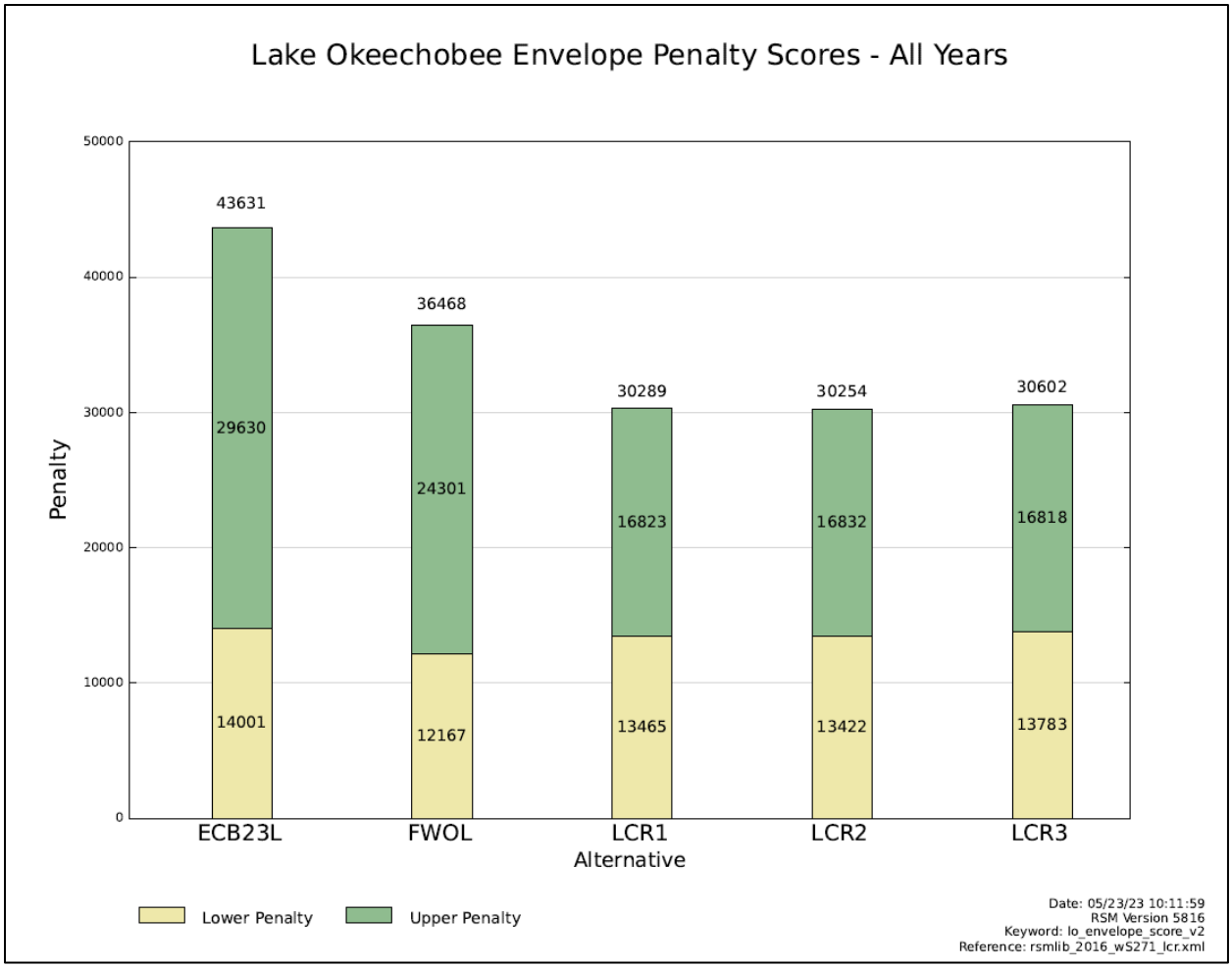


Figure 7. Lake Okeechobee envelope penalty scores.

Overall, the modeling of project with-action alternatives suggests that the difference in performance between the proposed alternatives is so small as to approach insignificance (Figures 6, 7, and 8). All with-action alternatives performed better than ECBL23 and FWOL for most of the evaluated performance metrics. Each with-action alternative is essentially the same feature since the designed storage capacity for each alternative is 200,000 acre-feet. Therefore, it was expected they would result in very similar performance.

Lake Okeechobee Statistics Report
Period of Record 1965/1/1 - 2016/12/31

Stg_>17 = Percent of POR when LOK stage > 17 ft, NGVD.
Stg_>16 = Percent of POR when LOK stage > 16 ft, NGVD.
Stg_<11 = Percent of POR when LOK stage < 11 ft, NGVD.
Stg_<10 = Percent of POR when LOK stage < 10 ft, NGVD.
Yrs_>18 = Number of years when LOK has at least 1 day with stage > 18 ft.
Yrs_>17 = Number of years when LOK has at least 1 day with stage > 17 ft.
ConsYrs_>17 = Number of times when LOK has at least 1 day with stage >17 ft in consecutive years.
Yrs_>16 = Number of years when LOK has at least 1 day with stage >16 ft.
ConsYrs_>16 = Number of times when LOK has at least 1 day with stage >16 ft in consecutive years.
APHC_gt15_M_S_60 = Number of years LOK stage > 15ft May-Sept for: >60 days (cumulative, not consecutive).
APHC_gt15_M_S_120 = Number of years LOK stage > 15ft May-Sept for: >120 days (cumulative, not consecutive).
APHC_gt15_O_A_120 = Number of years LOK stage > 15ft Oct-Apr for: >120 days (cumulative, not consecutive).

Simulation	Stg_>17	Stg_>16	Stg_<11	Stg_<10	Yrs_>18	Yrs_>17	ConsYrs_>17	Yrs_>16	ConsYrs_>16	APHC Gt15_M_S_60	APHC Gt15_M_S_120	APHC Gt15_O_A_120
ECB23L	1.37%	17.94%	11.85%	4.41%	0	9	4	25	18	13	8	20
FWOL	2.05%	10.31%	9.89%	3.05%	1	8	3	23	15	10	5	18
LCR1	0.59%	5.77%	10.26%	4.11%	0	6	2	16	8	8	1	10
LCR2	0.58%	5.78%	10.05%	3.98%	0	6	2	16	8	8	1	9
LCR3	0.58%	5.83%	10.30%	4.12%	0	6	2	16	8	8	1	10

Figure 8. Lake Okeechobee Statistics Report for LOCAR modeling.

B. Northern Estuaries

Freshwater discharges from Lake Okeechobee can cause adverse ecological impacts to the St. Lucie and Caloosahatchee Estuaries. If excessive, these discharges decrease salinity and adversely affect valuable estuarine resources such as oysters, juvenile marine fishes, seagrass, and other submerged aquatic vegetation. The LOCAR water storage should alleviate some of this potential for harm and allow estuarine resources to recover. Figures 9 and 10 show the scores for each alternative for the estuary performance measures. The difference in performance for all with-action alternatives are statistically insignificant. However, all three with-action alternatives improved optimum flows, while reducing the high and damaging Lake Okeechobee regulatory releases for both the St. Lucie and Caloosahatchee Estuaries when compared to ECBL23 and FWOL.

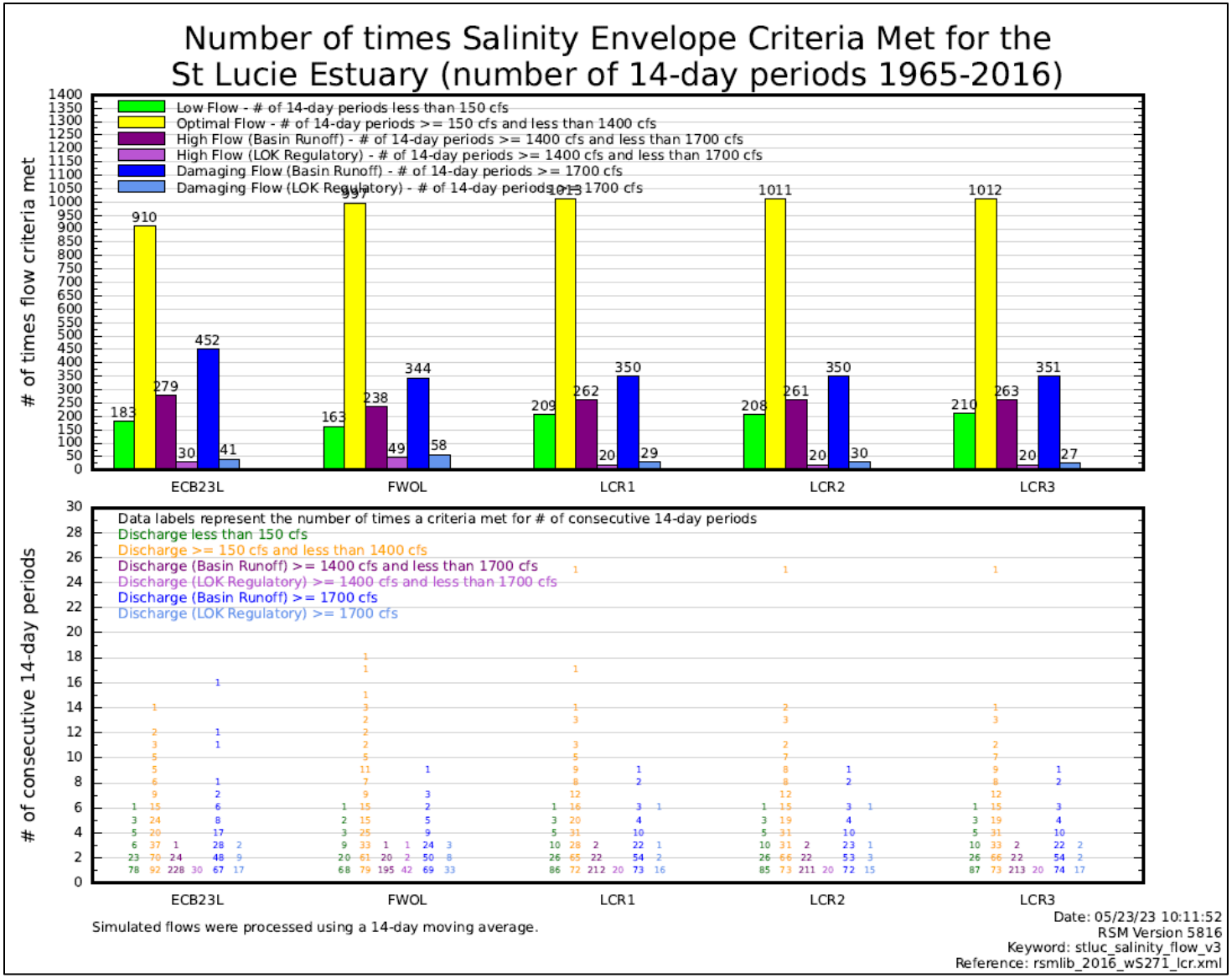


Figure 9. St. Lucie estuary performance metrics.

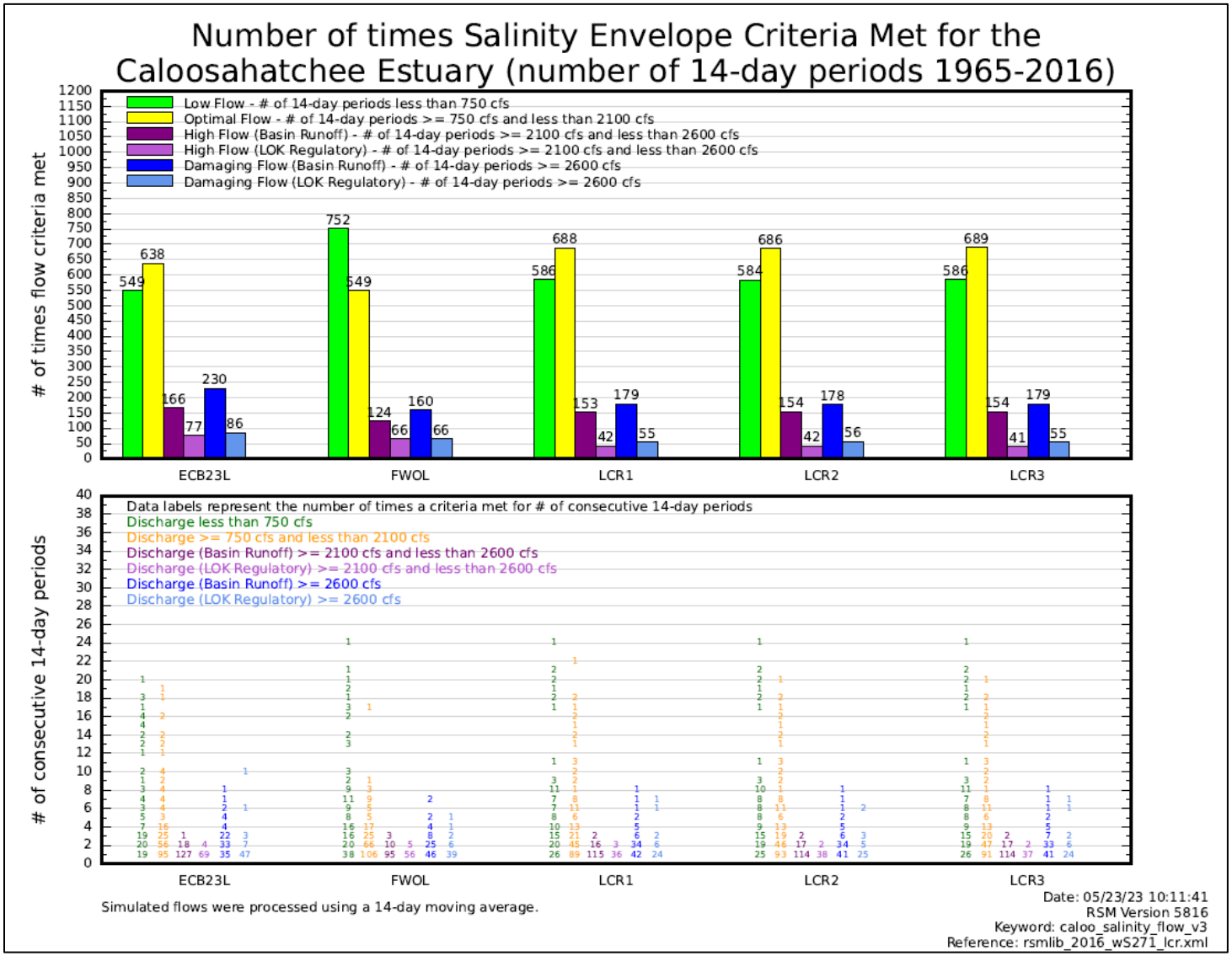


Figure 10. Caloosahatchee estuary performance metrics.

C. Habitat Unit Analyses

The ecological benefits of each alternative were calculated as habitat units (HUs). Simply, a HU is the product of the "quality" of the environmental metric (on a scale of zero to one) multiplied by the "quantity" (*i.e.,* acres) of that metric. The time scale is the same, so HUs can be calculated for Existing Conditions, and predicted for both Future With and Future Without Project conditions. In addition, calculating HUs for different ecosystems (*e.g.,* lake and estuaries) creates a "common currency" to make equivalent comparisons and sum the entire alternative's benefits in one number. Table 3 shows the overall HUs for Lake Okeechobee.

Table 3. Lake Okeechobee Stage PM Scores, Weighted Combined Scores, and Habitat Units for the Final Array of Alternatives.

Alternative	Above Envelope PM	Below Envelope PM	Extreme High PM	Extreme Low PM	Weighted Combined Score (0-100)	Habitat Units (0-450k)	Potential Lift (HUs)
ECB	569.8 (36.8)	269.3 (54.1)	1.36% (77.3)	4.41% (51.0)	55.6	250,073	N/A
FWO	467.3 (52.0)	234.0 (63.9)	2.05% (65.8)	3.05% (66.1)	61.0	274,335	N/A
Alternative 1	323.5 (73.4)	258.9 (57.0)	0.59% (90.2)	4.11% (54.3)	73.1	328,902	54,568
Alternative 2	323.7 (73.4)	258.1 (57.2)	0.58% (90.3)	3.98% (55.8)	73.4	330,369	56,034
Alternative 3	323.4 (73.5)	265.1 (55.3)	0.58% (90.3)	4.12% (54.2)	72.8	327,822	53,487

1. Lower scores are better for the PMs, while higher scores are better for the Weighted Combined Scores and Habitat Units. Normalized scores for PMs are in parentheses.

Table 4 shows the combined Northern Estuaries HUs and potential lift compared to the ECB and FWO. The PMs for each estuary are combined with equal weighting. Combined, the best performing alternative is Alternative 1 at 92,274 HUs, but only marginally so compared to Alternative 2 at 92,269 HUs and Alternative 3 at 92,001 HUs.

Table 4. Combined Northern Estuaries HUs for the Final Array of Alternatives.

Region	ECB	FWO	Alternative 1	Alternative 2	Alternative 3
Caloosahatchee HUs	35,817	53,884	57,217	57,195	57,129
St. Lucie Estuary HUs	21,561	37,503	35,057	35,074	34,872
Overall Northern Estuaries HUs	57,378	91,387	92,274	92,269	92,001
Potential Lift from FWO	N/A	N/A	887	882	614
Potential Lift from ECB	N/A	34,009	34,896	34,891	34,623

For a more detailed description of the HUs analyses for the LOCAR study, refer to Appendix D of the Corps' Biological Assessment (BA) (Corps 2023).

IX. POTENTIAL ADVERSE AND BENEFICAL EFFECTS OF THE TENTATIVELY SELECTED PLAN

A. Lake Okeechobee Stage and Marsh Improvements

Any alternative that does not substantially "flatten" the annual hydrograph can be only marginally successful at restoring the lake's littoral zone close to more favorable historic vegetation patterns. However, this cannot be achieved with the current infrastructure surrounding the lake. Much more dynamic storage will need to be connected to the lake. The LOCAR TSP takes a step in that direction and helps the lake stages stay in the optimal zone six percent of the time (about 1,139 days over the 52 year POR) more than the FWOL. The TSP also decreases the amount of time that the lake is above 17 feet (TSP [0.59%] vs FWOL [2.05%]). This may benefit the overall fisheries and aquatic invertebrates along with avian species that utilize the lake throughout the year.

B. Water Quality Improvements

Any alternative that generally decreases lake levels compared to the ECB23L and FWOL will likely have positive effects on the water quality of Lake Okeechobee. All three alternatives evaluated for the LOCAR study decreased the high lake stage performance metrics and increased the amount of time the lake is within the preferred stage envelope when compared to the ECB23L and FWOL.

Because higher lake levels (*i.e.,* >15 feet) can cause numerous adverse effects to the water quality on Lake Okeechobee by transporting nutrient-rich water and suspended solids from the mid-lake region to the shoreline regions as well as reducing water clarity and light penetration, the Service expects improvements to the ecological health and functioning of the lake from the TSP (RECOVER 2020). Of particular importance, is the likelihood in the improvements of the SAV communities that are critical to the overall ecological functioning of Lake Okeechobee, and are predicted to be negatively affected under the next regulation schedule.

Modeling results for the TSP indicate decreases in chlorophyll-a concentrations compared to the ECB23L and FWOL (Figure 11 and Figure 12). Chlorophyll-a concentrations are used as a predictive measure for HAB occurrence when evaluating alternatives for the LOCAR study. While this metric cannot precisely predict the frequency, duration, and severity of HABs, it was used as the best available tool at the time to assess the likelihood of HAB occurrence. The frequency and severity of algal bloom occurrence on the lake are likely to decrease as the lower lake stages from the TSP are predicted to decrease nutrient levels (*e.g.,* phosphorus). Increases in phosphorus-laden water can contribute to noxious cyanobacteria (blue-green algae) algal blooms (Havens and Gawlik 2005). When these blooms peak and then collapse, dissolved oxygen concentrations and decay byproducts of the algae can cause negative impacts to the aquatic flora and fauna on the lake (Havens and Gawlik 2005), potentially directly impacting fish, migratory waterfowl, manatees, and other wildlife species. The predicted lower lake stages are likely to contribute to the improvement of Lake Okeechobee and the northern estuaries native plant communities that help filter nutrients which are critical to water quality.

Period of Record 1965/1/1 2016/12/31

Descriptors
>20ppb = Percent of years where Chlorophyll-a concentration are > 20 ppb based on average of May-Aug LOK stage
>40ppb = Percent of years where Chlorophyll-a concentration are > 40 ppb based on average of May-Aug LOK stage
>60ppb = Percent of years where Chlorophyll-a concentration are > 60 ppb based on average of May-Aug LOK stage
%q>20ppb = Percent of total POR regulatory flow released during windows of higher HAB risk (Chlorophyll-a concentration > 20 ppb)
%q>40ppb = Percent of total POR regulatory flow released during windows of higher HAB risk (Chlorophyll-a concentration > 40 ppb)
%q>60ppb = Percent of total POR regulatory flow released during windows of higher HAB risk (Chlorophyll-a concentration > 60 ppb)
Note 1. LOK stages are normalized to 11.5 (e.g. stg - 11.5, not less than 0.0) and then averaged May-Aug.
Note 2. Regulatory flow discharges during windows of higher HAB risk are based on months of Jul-Aug and May-Aug for Pelagic.
Note 3. Regulatory flow discharges during windows of higher HAB risk are based on months of Jul-Aug and Jun-Aug for Littoral-W.
Note 4. Pelagic region is associated with regulatory discharges from S308.
Note 5. Littoral West region is associated with regulatory discharges from S77.
Note 6. Chlorophyll-a concentrations are computed using regression equations from Dr. Bill Walker and provided by USACE email dated 10 Feb 2021.

Simulation	Pelagic	Littoral-W	Littoral-S	Pelagic Jul-Aug	Pelagic May-Aug	Littoral-W Jul-Aug	Littoral-W Jun-Aug
	>20ppb	>20ppb	>20ppb	%q>20ppb	%q>20ppb	%q>20ppb	%q>20ppb
ECB23L	73.08%	50.00%	38.46%	9.28%	13.39%	7.36%	11.40%
FWOL	76.92%	51.92%	40.38%	14.69%	25.64%	15.89%	23.15%
LCR1	76.92%	42.31%	28.85%	7.17%	8.44%	6.51%	7.11%
LCR2	76.92%	44.23%	28.85%	7.15%	8.24%	6.64%	7.19%
LCR3	76.92%	42.31%	28.85%	7.19%	8.47%	6.55%	7.18%

Simulation	Pelagic	Littoral-W	Littoral-S	Pelagic Jul-Aug	Pelagic May-Aug	Littoral-W Jul-Aug	Littoral-W Jun-Aug
	>40ppb	>40ppb	>40ppb	%q>40ppb	%q>40ppb	%q>40ppb	%q>40ppb
ECB23L	0.00%	23.08%	19.23%	0.00%	0.00%	6.33%	9.48%
FWOL	0.00%	13.46%	13.46%	0.00%	0.00%	9.15%	15.12%
LCR1	0.00%	9.62%	9.62%	0.00%	0.00%	4.96%	5.23%
LCR2	0.00%	9.62%	9.62%	0.00%	0.00%	4.96%	5.16%
LCR3	0.00%	9.62%	9.62%	0.00%	0.00%	4.98%	5.25%

Simulation	Pelagic	Littoral-W	Littoral-S	Pelagic Jul-Aug	Pelagic May-Aug	Littoral-W Jul-Aug	Littoral-W Jun-Aug
	>60ppb	>60ppb	>60ppb	%q>60ppb	%q>60ppb	%q>60ppb	%q>60ppb
ECB23L	0.00%	7.69%	9.62%	0.00%	0.00%	3.84%	6.30%
FWOL	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
LCR1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
LCR2	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
LCR3	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Figure 11. Lake Okeechobee HAB Report.

Period of Record 1965/1/1 2016/12/31

Average Annunal flow (k-ac-ft/yr) of lake regulatory releases through S-77 during high bloom risk months (May-Aug) over POR.
Average Annunal flow (k-ac-ft/yr) of lake regulatory releases through S-77 during high bloom risk months (Jun-Aug) over POR.
Average Annunal flow (k-ac-ft/yr) of lake regulatory releases through S-308 during high bloom risk months (May-Aug) for POR.

Simulation	S77reg May-Aug	S77reg Jun-Aug	S308reg May-Aug
ECB23L	98.94	61.40	16.43
FWOL	65.66	56.47	31.98
LCR1	49.69	24.92	5.77
LCR2	49.57	25.13	5.60
LCR3	49.66	25.06	5.73

Figure 12. Northern Estuary HAB Report.

C. Loss and Fragmentation of Habitat in the Watershed

According to the Florida Cooperative Land Cover Data, Version 3.6 (FFWCC 2022), the project footprint is dominated by improved pasture, accounting for 60.8% of the TSP (7,534 acres; Table 5; Figure 13). Other dominant vegetation communities include unimproved and woodland pasture (15.0%) and isolated freshwater marsh (16.1%). One of the most significant adverse effects of the TSP is the loss and fragmentation of these habitats that support numerous fish and wildlife resources (including numerous federally listed species) as they are converted into an above-ground water storage feature.

Federally listed species that may be affected by the LOCAR are the indigo snake, crested caracara, Florida bonneted bat, tricolored bat (proposed to be listed as endangered), and Florida panther. Most of the adverse effects to these species are due to the LOCAR's construction activities and loss of habitat by the conversion of upland and wetland communities into a deep-water reservoir. The Service's Panther Habitat Assessment Methodology (2012) was used to determine the amount of panther habitat units (PHUs) lost due to construction of the TSP. The TSP will result in the conversion of 12,877 acres of panther habitat to reservoir. This acreage includes over 18 miles of perimeter and interior "dams" that will not be functionally available to panthers. Additionally, due to the construction of the seepage canal surrounding the perimeter dam, 485 acres of habitat will also functionally be unavailable to panthers. Because water levels within the reservoir will average 19 feet, the TSP will lead to a total of approximately 12,877 acres (12,392 ac of reservoir plus 485 acres of functionally unavailable habitat) of existing suitable habitat becoming unsuitable for panthers and their prey. This will result in a net loss of approximately 42,006 PHUs. The Corps and District have agreed to provide mitigation for the loss of listed species habitat.

Table 5. Vegetative Communities in the LOCAR Project Boundary.

Land Cover Type[1]	Acres	Percent of the Project Area
Upland Vegetative Communities		
Improved Pasture	7,534	60.8
Unimproved/Woodland Pasture	1,895	15.0
Palmetto Prairie	39	0.3
Shrub and Brushland	22	0.2
Mesic Flatwoods	12	0.1
Aquatic Vegetative Communities		
Isolated Freshwater Marsh	1,993	16.1
Wet Prairie	356	2.9
Floating/Emergent Aquatic Vegetation	185	1.5
Mixed Scrub-shrub Wetland	159	1.3
Marshes	79	0.6
Canal	4	<0.1
Depression Marsh	4	<0.1
Other		
Rural Open	17	0.3
Row Crops	19	0.2
Roads	74	0.6
Total	**12,392**	**100**

[1]FFWCC 2022

Of the four alternative above-ground reservoir locations studied for the LOCAR, the TSP (LCR4 similar to LCR1) has the smallest footprint of 12,392 acres compared to 20,500 acres (LCR2) and 14,900 acres (LCR3) (Corps 2023). Selecting the smallest footprint for the project will help to minimize the harm caused to the current fish and wildlife resources occupying the area from the conversion into an above-ground reservoir. However, in addition to the quantity, the quality of the habitat being converted is also an important factor when selecting an alternative. LCR2 includes the entire TSP footprint plus an additional approximately 8,100 acres because it keeps the reservoir at lower levels (average depth of 11 feet [LCR2] versus 18 feet [TSP]. Therefore, LCR2 would likely cause the most harm to resources currently occupying the area due to the additional conversion of 8,100 acres compared to the TSP. While LCR3 increases the project footprint by approximately 2,500 acres compared to the TSP, much of the current land cover in LCR3 is less suitable for many fish and wildlife resources due to the heavy agricultural, including row crop usage compared to the TSP. Therefore, there are important tradeoffs (*e.g.,* quantity and quality of habitat impacted in each alternative) that need to be considered between the TSP and LCR3. The TSP impacts the least number of acres of all alternatives, but contains better habitat for fish and wildlife resources. LCR3 impacts more acres than the TSP, but contains some less quality habitat.

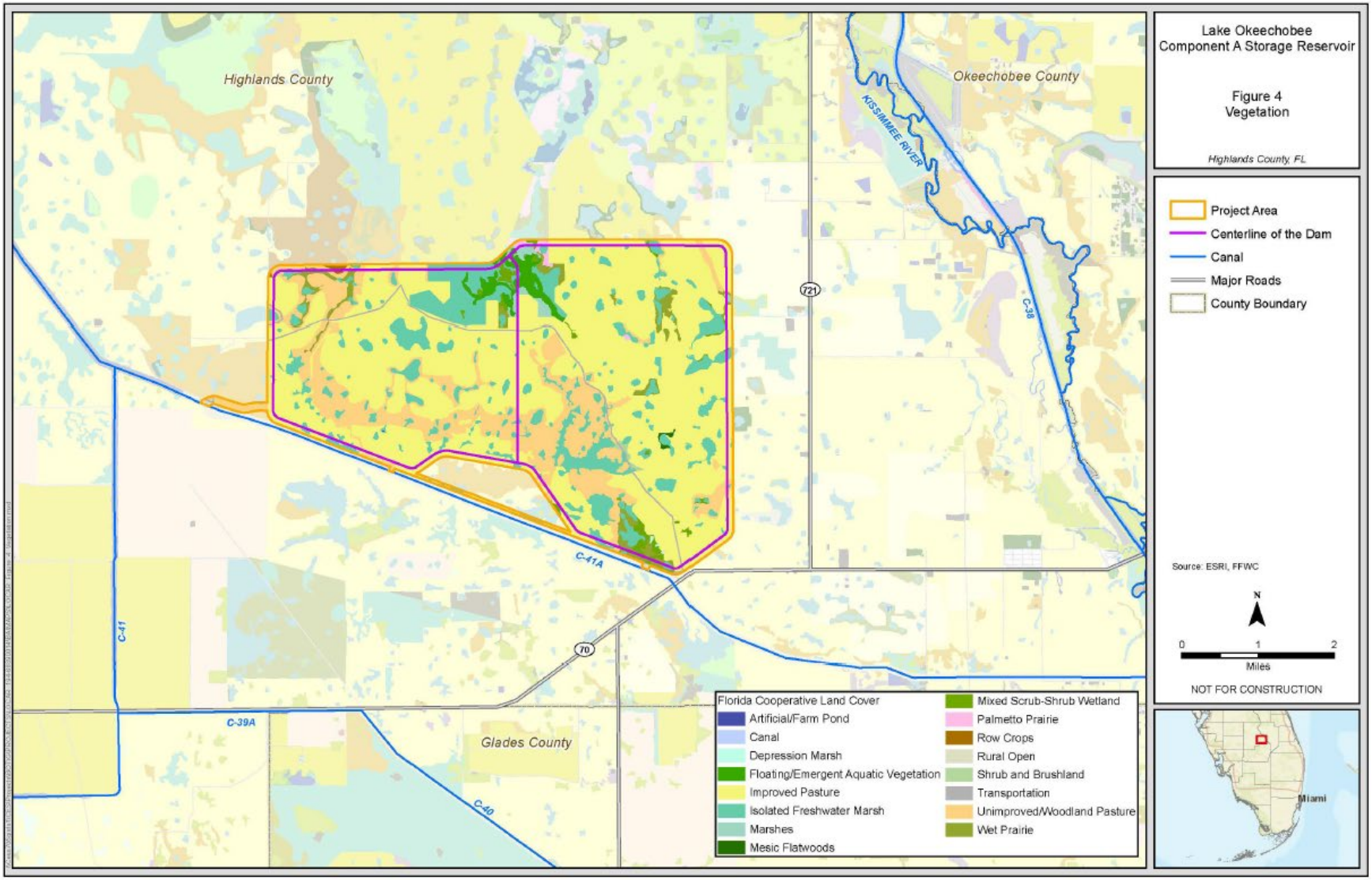


Figure 13. LOCAR Existing Vegetation Types.

D. St. Lucie and Caloosahatchee Estuaries Benefits

The effects of the TSP show a measurable reduction in damaging discharge events from Lake Okeechobee to both the St. Lucie and Caloosahatchee Estuaries. Additionally, the TSP shows increases in optimum flows for both estuaries. The LOCAR goal for these estuaries was to contribute to their restoration by reducing damaging freshwater lake releases. The TSP is likely to improve the ecological health of these important downstream ecosystems, including keystone species that support major ecosystem components along both estuary's salinity gradient such as fresh and salt water SAV and oysters.

Other CERP projects (*i.e.,* Indian River Lagoon-South project for the SLE and the C-43 Reservoir project for the Caloosahatchee Estuary) are under construction now and those planning efforts targeted restoring a larger share of both their respective estuaries. The Service expects that the combination of all these CERP projects, in addition to on-going State, Federal, and Local efforts in the basins, will be needed to restore high-functioning estuarine systems.

E. Recreation Improvements

The hydrologic improvements of the TSP to Lake Okeechobee, and the St. Lucie and Caloosahatchee Estuaries are likely to improve recreational opportunities for hunting, fishing, wildlife watching, hiking, biking, and environmental studies.

F. Habitat Unit Analyses

The ecological benefits of the TSP was calculated as habitat units (HUs) as described above in Section VIII(C). The Lake Okeechobee Stage PM output is shown in Table 6 for the TSP. The scores for the envelope (above and below) and time exceeding extreme stages (above 17 feet and under 10 feet NGVD) are combined and normalized based on their performance relative to theoretical best- and worst-case scenarios. The 'Above Envelope' and 'Extreme High' scores are weighted by 0.67, while 'Below Envelope' and 'Extreme Low' are weighted by 0.33. The combined, weighted score is multiplied by the 450,000-acre lake size to calculate HUs. See Appendix D of the Corps' BA (Corps 2023) for more details on the normalization and weighting methodology.

Table 6. Summary of Lake Okeechobee PMs, Weighted Combined Scores, HUs, and the TSP.

Alternative	Above Envelope PM	Below Envelope PM	Extreme High PM	Extreme Low PM	Weighted Combined Score (0-100)	Habitat Units (0-450k)	Potential Lift (HUs)
ECB	569.8 (36.8)	269.3 (54.1)	1.36% (77.3)	4.41% (51.0)	55.6	250,073	N/A
FWO	467.3 (52.0)	234.0 (63.9)	2.05% (65.8)	3.05% (66.1)	61.0	274,335	N/A
Alternative 1	323.5 (73.4)	258.9 (57.0)	0.59% (90.2)	4.11% (54.3)	73.1	328,902	54,568

Table 7 shows the trajectory of Lake Okeechobee HUs for the recommended plan from 2033 through 2083 as well as the average annual habitat unit (AAHU) lift. The Lake Okeechobee AAHU lift for the TSP is 1,577 from ECB and 485 from FWO.

Table 7. Summary of Lake Okeechobee TSP HU trajectory.

Alternative	ECB Lake O HUs (2033)	FWP Lake O HUs (2035)	FWP Lake O HUs (2038)	FWP Lake O HUs (2043)	FWP Lake O HUs (2058)	FWP Lake O HUs (2083)	Average Annual Lake OHU Lift from ECB
FWO	250,073	251,043	252,499	254,925	262,204	274,335	485
Alternative 1	250,073	269,780	289,488	297,370	328,902	328,902	1,577

G. Summary of Consultation under the Endangered Species Act

Activities associated with the construction and operation of the LOCAR may affect the caracara, indigo snake, Florida bonneted bat, tricolored bat (proposed to be listed as endangered), and Florida panther. Many of the effects to these species stem from the loss of habitat by the conversion of upland and wetland communities into a deep water reservoir. These activities may have numerous effects on these species and their habitat, which include: (1) loss of habitat for foraging, nesting, sheltering, and dispersing; (2) reduction in the geographic distribution of habitat for these species; (3) disturbance due to construction activities; (4) increased potential for mortality due to heavy equipment and vehicle operation; (5) increased disturbance due to human activities; and (6) increased potential for intraspecific aggression among conspecifics due to shifts in territories of near neighbors and a reduction of the geographic distribution of available habitat.

The Service received a letter with a Biological Assessment from the Corps requesting initiation of formal consultation under the provisions of section 7 of the ESA for the above mentioned species on August 16, 2023. We expect to complete a Biological Opinion for effects of the LOCAR on federally listed species in the fall of 2023.

X. RECOMMENDATIONS/CONSERVATION MEASURES

Management of water into and out of Lake Okeechobee is critical to maintaining a proper water balance throughout south Florida. The Service is providing recommendations on this project in order to make the project more environmentally compatible and to further enhance the diversity and abundance of fish and wildlife resources in the project area.

1. The Service recommends that the Corps and District continue to seek our involvement as the engineering design phase proceeds (in accordance with CERP Memorandum Guidance #66, entitled: RECOVER Assistance to Projects During Implementation).

2. The Service has previously provided technical assistance to the Corps to address concerns related to the design of reservoir embankments that have the potential to cause wildlife entrapment. Specifically, some reservoirs are designed and constructed with ‘stair-step’ embankments. These embankments have been shown to create barriers to the movement of wildlife. The Service requests that during the development of design alternatives for

the LOCAR consideration be given to the protection of fish and wildlife, specifically as it relates to wildlife entrapment.

3. Coordinate the development of the operational guidelines/water control plan for the LOCAR with the Service.

4. The Service recommends that the Corps and District use their authorities to offset impacts to fish and wildlife resources by providing for the conservation and protection of lands within the vicinity of the LOCAR.

XI. SUMMARY OF POSITION

The Service has reviewed the alternatives and the TSP for this project. The Service believes that the TSP will improve ecological conditions within Lake Okeechobee's littoral zone by holding the lake in the optimal range more often, and reduce the extent and duration of extreme high water elevations during wet periods. However, the Service believes there are still adverse effects on fish and wildlife resources including federally listed species within the project footprint caused by the conversion of the current landcover types into an above-ground water storage feature. The Service believes the St. Lucie and Caloosahatchee estuaries will benefit by a reduction in both high discharge volumes and discharge events from Lake Okeechobee.

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A.2 Endangered Species Act Biological Assessment

FINAL

BIOLOGICAL ASSESSMENT

FOR THE

LAKE OKEECHOBEE COMPONENT A STORAGE RESERVOIR

HIGHLANDS COUNTY, FLORIDA

Prepared by:
U.S. Army Corps of Engineers, Jacksonville District

Prepared for:
U.S. Fish and Wildlife Service

August 2023

Table of Contents

List of Tables

List of Figures

List of Appendices

List of Acronyms and Abbreviations

Action Area	Same as Study Area
BA	Biological Assessment
ESA	Endangered Species Act
FR	*Federal Register*
LOCAR	Lake Okeechobee Component A Reservoir.
Project	The 12,392-acre Lake Okeechobee Component A Storage Reservoir
SAV	Submerged aquatic vegetation
Study Area	The 12,392-acre reservoir, Lake Okeechobee, and Northern Estuaries
Corps	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

1. INTRODUCTION

The purpose of a Biological Assessment (BA) is to evaluate the potential effects of a Federal action on both listed species and those proposed for listing, including designated and proposed critical habitat, and determine whether the continued existence of any such species or habitat are likely to be affected by the federal action. The Federal action analyzed in this BA is the Lake Okeechobee Component A Storage Reservoir (Project) Section 203 Study described in Sections 2 and 3. The BA is also used to determine whether formal consultation or a conference is necessary (50 Code of Federal Regulations Section 402.12(a)). The BA will support a consultation between the U.S. Army Corps of Engineers (Corps) and the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the ESA. This BA was informed by previous work completed for the Lake Okeechobee Watershed Restoration Project (LOWRP), which addressed some of the same geography and the same species (USACE 2022). The species considered in the BA and the determinations made, were in part informed by the species considered and determinations made in the January 2022 LOWRP BA, along with new information from the USFWS Information for Planning and Consultation (IPAC) (https://ipac.ecosphere.fws.gov/) and updated information on species distribution and habitat use in the area.

2. PROJECT BACKGROUND AND PURPOSE

The purpose of the SFWMD Section 203 Study is to identify aboveground storage north of Lake Okeechobee, in line with Component A in the Yellow Book. The Yellow Book, or CERP, was approved by Congress as a framework for the restoration of the natural system under Section 601 of WRDA 2000. CERP, as documented in the 1999 Yellow Book, consists of 68 components. The purpose of Component A is to detain water during wet periods for later use during dry periods to Lake Okeechobee. Increased storage capacity would reduce the duration and frequency of both high and low water levels in Lake Okeechobee that are stressful to the lake's littoral ecosystems and cause large releases from the lake that are damaging to the downstream estuary ecosystems. The SFWMD is providing their Section 203 Study, for which this BA evaluates the effects of the human environment, to the ASA(CW) for review and decision on approval for submission to Congress for authorization. The goal of the SFWMD Section 203 Study is to identify a storage reservoir north of Lake Okeechobee, to address Everglades-related water resource issues identified in the Central and Southern Florida (C&SF) Project Comprehensive Review Study (Restudy) for the northern portion of the Lake Okeechobee Watershed, Lake Okeechobee, and Caloosahatchee and St. Lucie estuaries (Northern Estuaries) (USACE 1999). Similar aboveground storage reservoirs are being constructed to the east, south, and west of Lake Okeechobee.

Ecosystems within the LOWRP study have been anthropogenically altered over decades (more than 120 years), mostly because competing needs in the area. The Central and Southern Florida (C&SF) Project, first authorized by Congress in 1948, is a multi-purpose project that provides flood control, water supply for municipal, industrial, and agricultural uses, prevention of saltwater intrusion, recreation, groundwater recharge, water supply for Everglades National Park, and preservation of fish and wildlife resources. The effects of the original C&SF Project on the hydrology of these nationally significant ecosystems have included a change of the natural timing, quantity, and distribution of flows entering and leaving Lake Okeechobee; high volume and rates of freshwater releases from Lake Okeechobee to the Northern Estuaries; and elimination of natural storage resulting in a lower quantity of water available for the

Greater Everglades. The overall purposes of the C&SF Project, authorized by Congress in 1948, includes provisions of flood control, water supply for municipal, industrial, and agricultural uses, prevention of saltwater intrusion, recreation, groundwater recharge, water supply for Everglades National Park, and preservation of fish and wildlife resources. The effects of the original C&SF Project on the hydrology of this ecosystem has been a disruption of the natural timing, quantity, quality, and distribution of flows entering and leaving Lake Okeechobee; high volume freshwater releases to the Caloosahatchee Estuary and St. Lucie Estuary (collectively called the Northern Estuaries); and elimination of natural storage resulting in a lower quantity of water available for the Greater Everglades.

Water that once flowed from Lake Okeechobee south through the Everglades, down Shark River Slough, and to the southern estuaries has been impounded in Lake Okeechobee and now flows to the Northern Estuaries through the C-43 and C-44 canals. Changes in the quantity, timing, and distribution of freshwater entering the Northern Estuaries often leads to salinity fluctuations, causing subaquatic vegetation stress, loss of benthic organisms and habitat, increased sedimentation, decreased water clarity, and redistribution of salinity-sensitive species, including commercially and recreationally important fish. The spatial extent of wetlands throughout the system has been significantly reduced due to development and farming of natural areas after drainage from public and private actions, including the C&SF Project, made them viable.

As stated above, the purpose of the SFWMD Section 203 Study is to identify storage north of Lake Okeechobee to detain and store water during wet periods for later use during dry periods and offer operational flexibility to draw and store water from the Lake and the basin to improve its littoral ecosystems. Increased storage capacity would reduce the duration and frequency of both high and low water levels in Lake Okeechobee that are stressful to the Lake's littoral ecosystems and cause large releases from the Lake which, combined with local basin runoff, are damaging to the downstream estuarine ecosystems.

3. PROJECT DESCRIPTION

The proposed Project includes a 200,000-acre-foot (ac-ft) aboveground storage reservoir north of the C-41A (Figure 1). The reservoir would cover an area of approximately 12,392 ac and be designed to have an average storage depth of 19 ft at its normal full-storage level. The reservoir would include two pump stations, two outflow culverts, an outflow canal, an interior divider dam with a gated control structure, and two ungated overflow spillways.

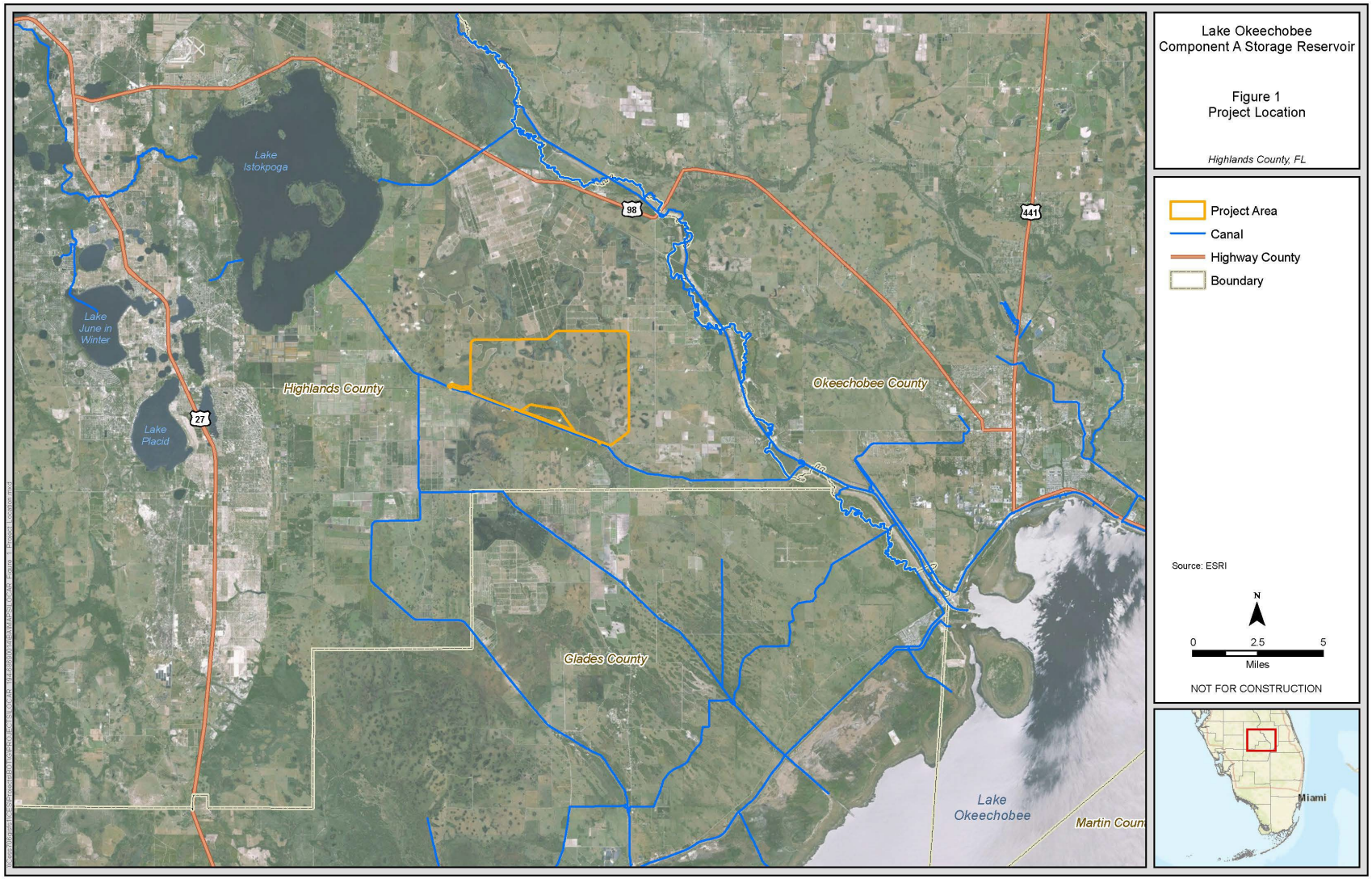
Construction. The reservoir would be constructed with a perimeter dam and an interior divider dam each having an average height of approximately 33 ft above the ground. The perimeter dam would be approximately 18 miles (mi) around, allowing for recreational opportunities. Material from the Project footprint and the surrounding seepage canal would be used to construct the dams. A gated outflow culvert would be constructed on the west side of the reservoir to discharge water into C-41A upstream of S-83, while another gated culvert would be constructed near the southeast side of the reservoir to discharge water into C-41A downstream of S-83. The C-41A Canal would be widened to accommodate increase water conveyance.

The reservoir would be constructed to have two storage cells (i.e., east and west) split by an interior divider dam to reduce wave runup. The interior divider dam would include a 1,500-cubic-foot-second,

gated water-control structure to allow for controlled conveyance of water between the two cells. Each cell would include an ungated overflow spillway designed to discharge into C-41A.

A seepage canal would be constructed outside the perimeter dam of the reservoir. Seepage from the reservoir would collect in the canal and be returned to the reservoir via seepage pump stations. If the seepage pump stations were not operational, the seepage collected in the canal would eventually overflow into the C-41A via overflow weir structures.

Operations. Two pump stations would be used to fill the reservoir at 1,500 cfs. One pump station would be located downstream of S-84 and move water from C-38 into C-41A, upstream of S-84. The second pump would be located on the C-41A canal upstream of State Highway 70 to pump water from C-41A directly into the reservoir. Water would be conveyed to the reservoir in one of two ways: (1) full or partial diversion of flow in C-41A downstream of S-83, or (2) back-pumping water from Lake Okeechobee via pumping from C-41A downstream of S-84 into C-41A between S-83 and S-84. Water would be returned


Lake Okeechobee
Component A Storage Reservoir
Figure 1
Project Location
Highlands County, FL
Project Area
Canal
Highway County
Boundary
Source: ESRI
N
0
2.5
5
Miles
NOT FOR CONSTRUCTION
Lake Istokpoga
Lake June in Winter
Lake Placid
Highlands County
Okeechobee County
Glades County
Lake Okeechobee
Martin Coun
Miami
98
441
27

to Lake Okeechobee by discharging from the reservoir to C-41A upstream and/or downstream of S-83. The location of the reservoir outflow culverts would allow for water to be conveyed south to provide opportunities for storage in surrounding canals (e.g., C-41A, C-41, C-40, and C-39A). A more detailed Project Layout is shown in Figure 2.

3.1 Project Features

Table 1 and Figure 3 includes the proposed Project features and capacity, including average storage depth and inflow/outflow capacity, and direction.

Table 1. Proposed Project Features and Dimensions

Project Feature	Feature Details
Water Storage Capacity	200,000 acre-feet
Land Area of Reservoir Site	12,392 acres
Average Storage Depth	19 feet
Number of Reservoir Inflow Pump Stations	2 stations
Total Reservoir Inflow Capacity	1,500 cubic feet/second
Total Reservoir Outflow Capacity	3,000 cubic feet/second

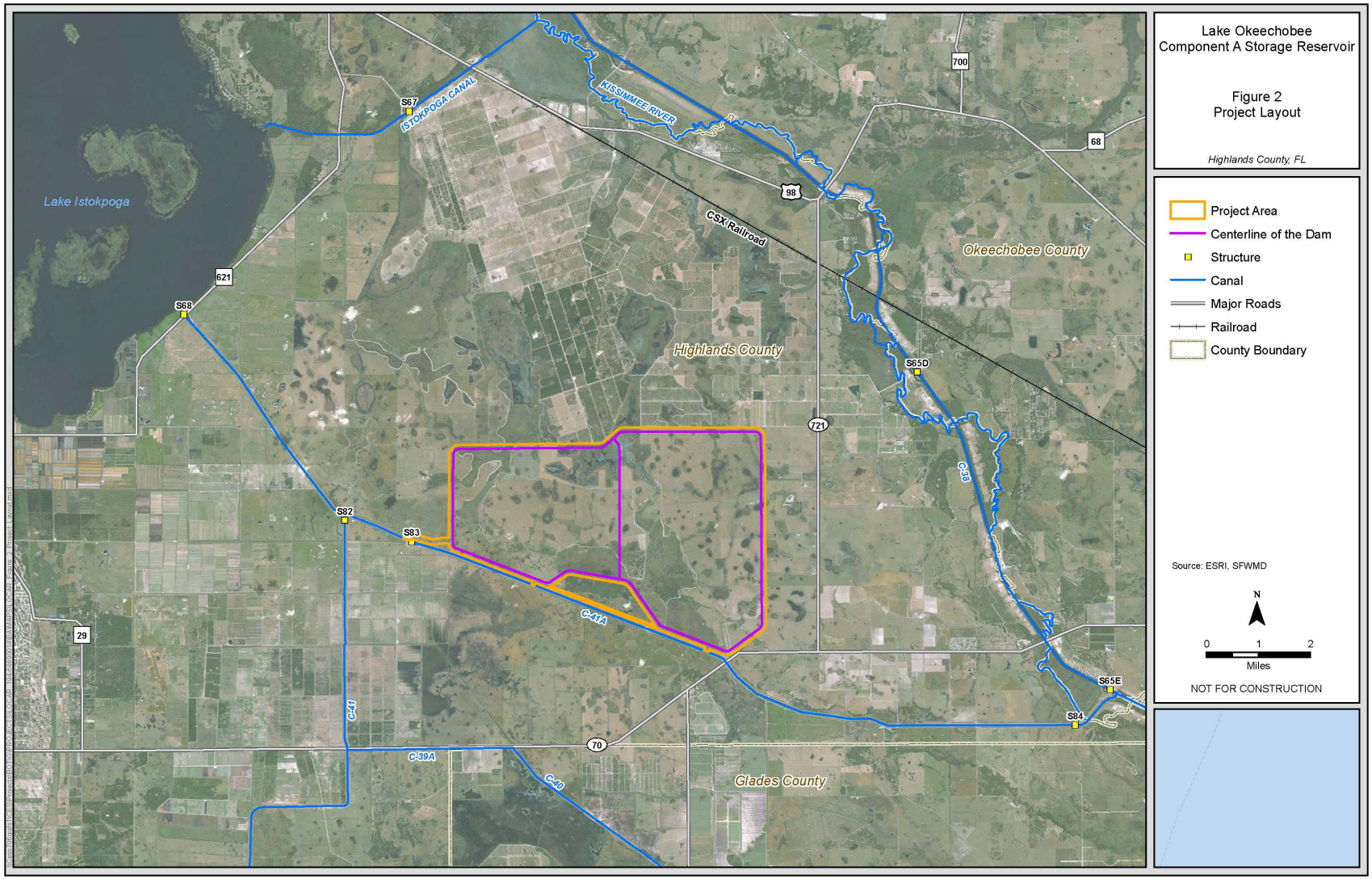
4. ACTION AREA

The Projects' area of direct effects includes the 12,392-acre reservoir described in Section 3. Construction of the reservoir also is expected to result in indirect effects to the Lake Okeechobee watershed, Lake Okeechobee, and the Northern Estuaries, as well as and canals and ditches located downstream of the reservoir, which are evaluated in this BA as the Action Area. A description of the Project Area that extends beyond the reservoir within the three regions described above is presented in Table 2, below. The Action Area is the same as the Study Area described in the EIS. Hereafter, in this BA this area is referred to as the Study Area, for consistency across documents.

Table 2. Description of the Study Area.

Study Area Region	Description of the Region
Lake Okeechobee Watershed	The combined Lower Kissimmee, Indian Prairie, Fisheating Creek, Taylor Creek, and Nubbin Slough contribute 50 percent of the flow into Lake Okeechobee; 12 percent of that flow is from the Indian Prairie Basin. The Lake Istokpoga watershed contributes an additional 14 percent. Historically, approximately 40 percent of this area was comprised of wetland habitat, consisting of cypress and bay tree forests, inland swamps, freshwater marsh, wet prairie, and sawgrass marsh. Today, only 15 percent of the area is wetlands. The current major land uses include agriculture, urban, and natural/open lands and wetlands.
Lake Okeechobee	Lake Okeechobee is a large, shallow lake (surface area approximately 730 square miles) located 30 miles west of the Atlantic coast and 60 miles east of the Gulf of Mexico. The lake is impounded by a system of levees, with six outlets: St. Lucie Canal eastward to the Atlantic Ocean, Caloosahatchee Canal/River westward to the Gulf of Mexico, and four agricultural canals (West Palm Beach, Hillsboro, North New River, and Miami). The lake is mostly surrounded by the 143-mile-long Herbert Hoover Dike (HHD). The lake has many functions, including flood risk management, urban and agricultural water supply, navigation, recreation, fisheries, and wildlife habitat. It is critical for flood control during wet seasons and water supply during dry seasons. Agriculture in the Lake Okeechobee Service Area (LOSA), including the Everglades Agricultural Area immediately south of the lake, is the predominant user of

Study Area Region	Description of the Region
	lake water. The lake is a significant economic driver for both the surrounding areas and south Florida's economy.
Northern Estuaries	In the current modified system, Lake Okeechobee flows into the two Northern Estuaries (Caloosahatchee and St. Lucie estuaries). The St. Lucie Canal flows eastward into the St. Lucie Estuary, which is part of the larger Indian River Lagoon Estuary. The Caloosahatchee Canal/River flows westward into the Caloosahatchee Estuary and San Carlos Bay, which are part of the larger Charlotte Harbor Estuary. The St. Lucie and Caloosahatchee estuaries are designated Estuaries of National Significance, and the larger Indian River Lagoon and Charlotte Harbor Estuaries are part of the National Estuary Program sponsored by the United States Environmental Protection Agency (USEPA). The landscape includes pine flatwoods, wetlands, mangrove forests, submerged aquatic vegetation (SAV), estuarine benthic areas (mud and sand), and nearshore reefs.


Lake Okeechobee
Component A Storage Reservoir
Figure 2
Project Layout
Highlands County, FL
Project Area
Centerline of the Dam
Structure
Canal
Major Roads
Railroad
County Boundary
Source: ESRI, SFWMD
N
0 1 2
Miles
NOT FOR CONSTRUCTION
Lake Istokpoga
ISTOKPOGA CANAL
KISSIMMEE RIVER
CSX Railroad
Okeechobee County
Highlands County
Glades County
S67
S68
S82
S83
S65D
S65E
S84
C-41A
C-41
C-39A
C-40
C-38
621
700
68
98
721
29
70

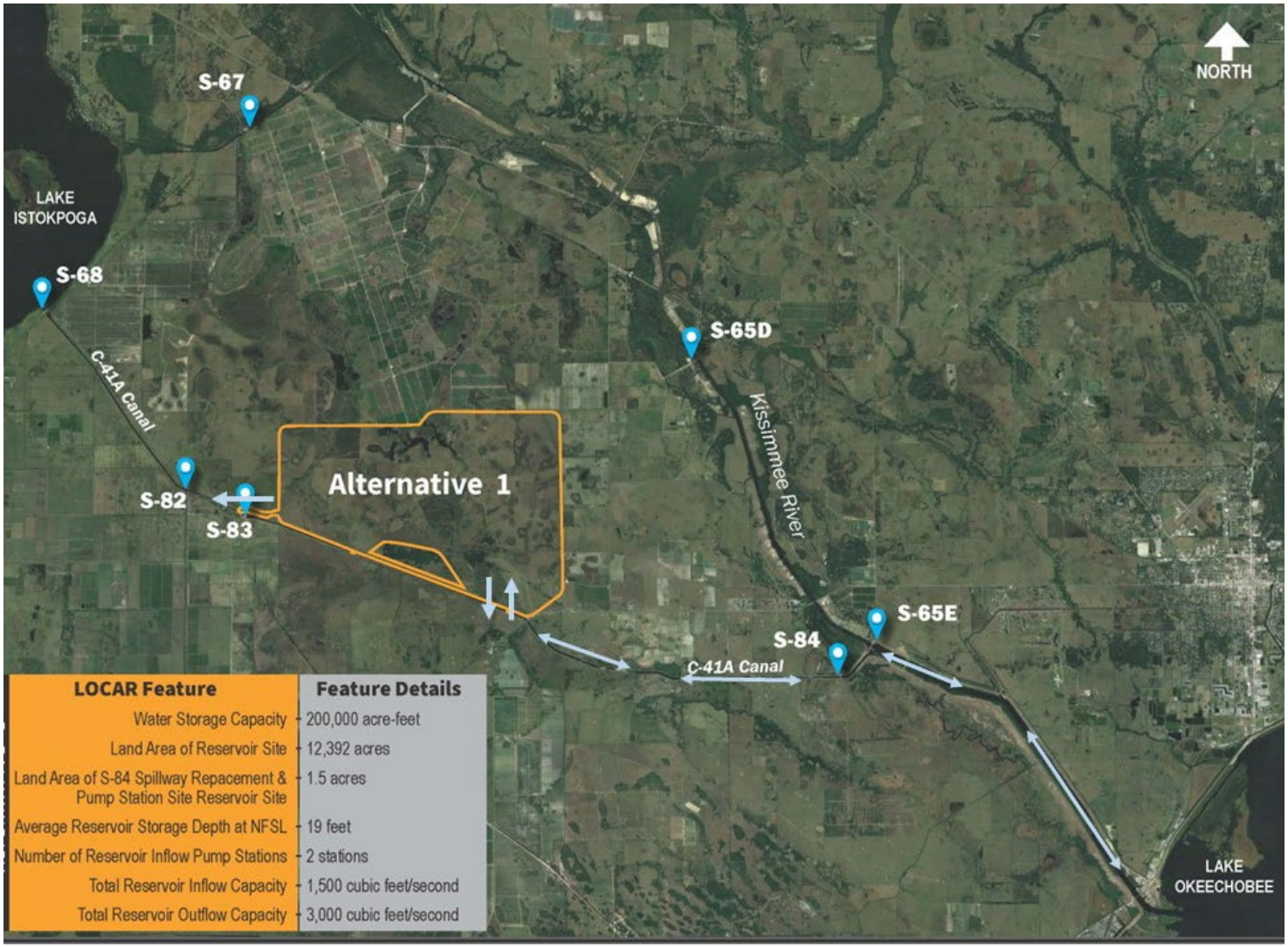


Figure 3. Project Area, Key Features, and Direction of Flow

5. DESCRIPTION OF EXISTING CONDITIONS

5.1 Existing Conditions within Project Area

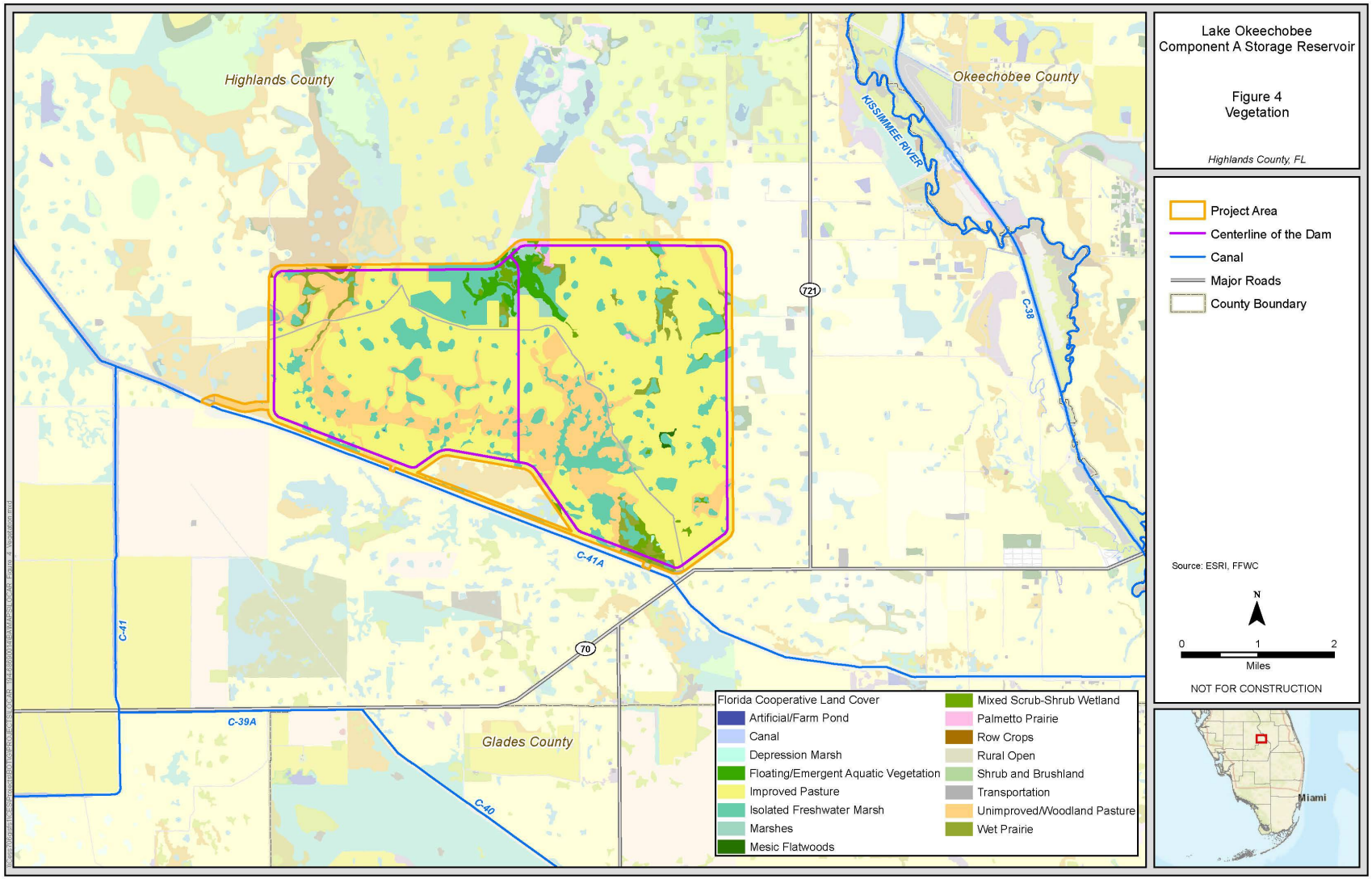
According to the Florida Cooperative Land Cover Data, Version 3.6 (FFWCC 2022), the Project Area is dominated by improved pasture, accounting for 60.8 percent (7,534 acres; Table 3; Figure 4). Other dominant vegetation communities include unimproved/woodland pasture (15.0 percent) and isolated freshwater marsh (16.1 percent).

Table 3. Vegetative Communities in the Project Area

Land Cover Type[1]	Acres	Percent of the Project Area
Upland Vegetative Communities		
Improved Pasture	7,534	60.8
Unimproved/Woodland Pasture	1,895	15.0
Palmetto Prairie	39	0.3
Shrub and Brushland	22	0.2
Mesic Flatwoods	12	0.1
Aquatic Vegetative Communities		
Isolated Freshwater Marsh	1,993	16.1
Wet Prairie	356	2.9
Floating/Emergent Aquatic Vegetation	185	1.5
Mixed Scrub-shrub Wetland	159	1.3
Marshes	79	0.6
Canal	4	<0.1
Depression Marsh	4	<0.1
Other		
Rural Open	17	0.3
Row Crops	19	0.2
Roads	74	0.6
Total	**12,392**	**100**

[1]FFWCC 2022

Additionally, the SFWMD visited the Project Area on May 3, 2023, and identified/characterized some areas of upland oak hammock and xeric oak. Those communities were observed, but not mapped, so they are described below but acreages are not included in Table 3. There are no active fire management practices in the Project Area, and vegetation is entirely managed through grazing. The Project Area is also used for palm and citrus farming and for hunting. Descriptions of the habitats observed during the site visit are provided in the sections below. The environs of Lake Okeechobee and other associated estuaries are also briefly described as part of the Study Area.


Lake Okeechobee
Component A Storage Reservoir
Figure 4
Vegetation
Highlands County, FL
Highlands County
Okeechobee County
Glades County
KISSIMMEE RIVER
C-38
C-41A
C-41
C-39A
C-40
721
70
Project Area
Centerline of the Dam
Canal
Major Roads
County Boundary
Source: ESRI, FFWC
N
0
1
2
Miles
NOT FOR CONSTRUCTION
Miami
Florida Cooperative Land Cover
Artificial/Farm Pond
Canal
Depression Marsh
Floating/Emergent Aquatic Vegetation
Improved Pasture
Isolated Freshwater Marsh
Marshes
Mesic Flatwoods
Mixed Scrub-Shrub Wetland
Palmetto Prairie
Row Crops
Rural Open
Shrub and Brushland
Transportation
Unimproved/Woodland Pasture
Wet Prairie

5.1.1 Upland Vegetative Communities

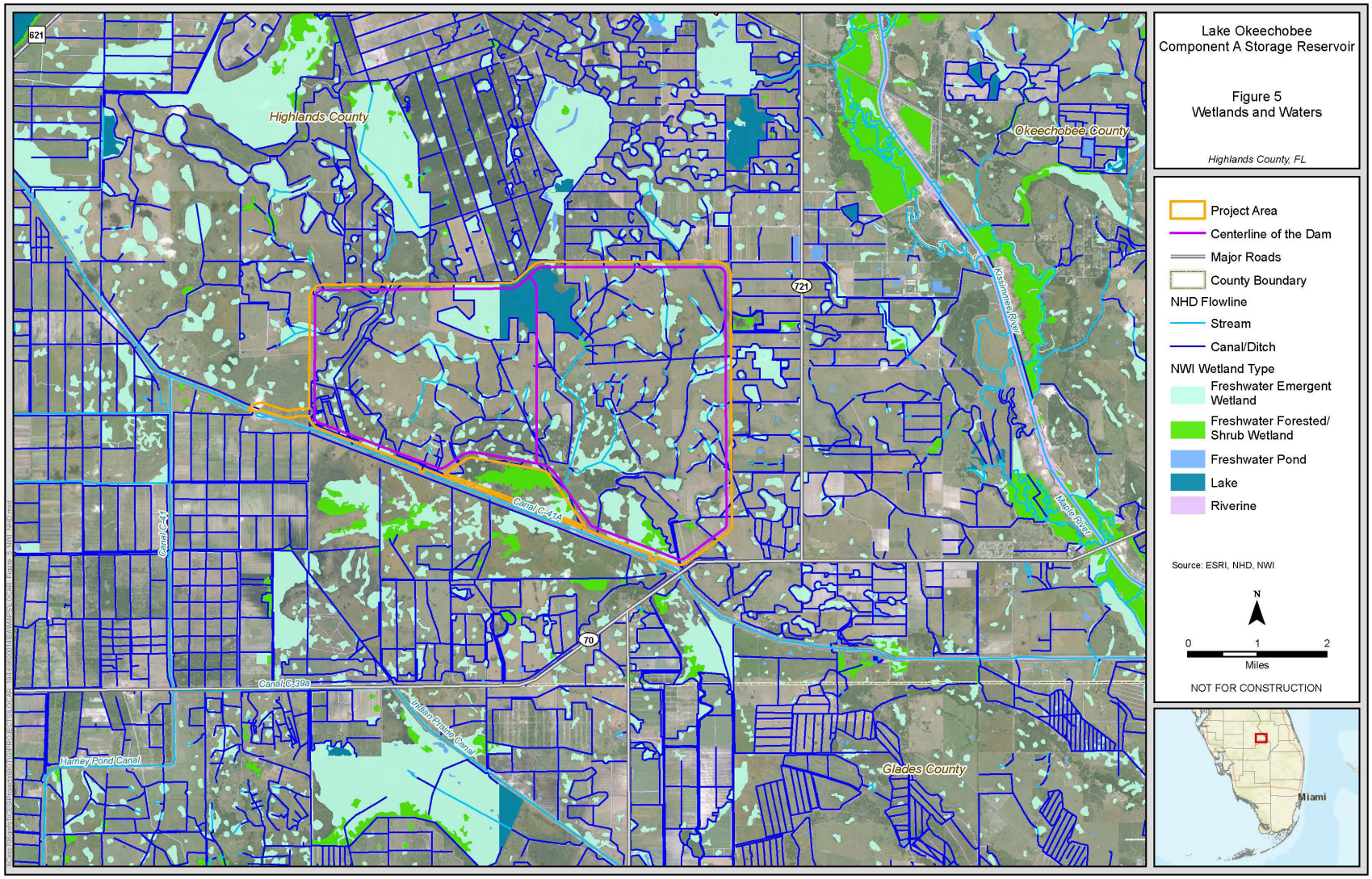
Upland vegetation communities identified in the Project Area include improved pasture, unimproved woodland pasture, palmetto prairie, and some smaller extents of shrub and brushlands and mesic flatwoods (Figure 4, Table 3). The majority of upland vegetation in the Project Area are pastures, which included large open areas of bahia grass and were most likely formerly dry prairie communities. The highest quality prairie habitat was concentrated towards the northeast corner of the Project Area. This community was interspersed with pockets of wet prairie. Palmetto prairie community was composed of a mixture of sedges, grasses, and saw palmetto (*Serenoa repens*), along with bahia grass (*Paspalum notatum*) and torpedograss (*Panicum repens*), and other exotic grasses. The areas of oak hammock communities observed during the field visit in May 2023 were dominated by a mature canopy of live oak (*Quercus virginiana*), with numerous cabbage palm (*Sabal palmetto*), and an understory of shrubs including wild coffee (*Psychotria* spp.), beauty berry (*Callicarpa americana*), and blue-stem palmetto (*Sabal minor*), along with several species of wild grapes (*Vitis* spp.). Xeric oak communities observed included numerous species of scrub oaks (*Quercus* spp.), typically greater than 5 meters (16.4 feet) tall, and an understory of gopher apple (*Licania michauxii*) and prickly pear cacti (*Opuntia* spp.). The lack of prescribed fire in the Project Area has allowed the oaks to become very tall with dense ground cover. Those present in the southern part of the Project Area, along C-41A will be avoided.

5.1.2 Aquatic Vegetative Communities

Aquatic vegetative communities documented in the Florida Cooperative Land Cover data include over, isolated freshwater marsh, along with dispersed occurrences on wet prairie, floating/emergent aquatic vegetation, and mixed scrub/shrub wetland (Table 3, Figure 4). The National Wetlands Inventory (NWI) and National Hydrologic Data (NHD) are shown in Figure 5. Communities identified by these data sources include freshwater emergent wetland, freshwater forested/shrub wetland, freshwater pond, lake, and riverine.

The wetland vegetation observed within the Project Area during a site visit on May 3, 2023, confirmed that the communities are predominantly a mixture of wet prairie, marshes, and vegetation associated with water quality reservoir impoundments. The wet prairie community was composed of shallow, short-duration wetlands dominated by herbaceous species. The wet prairie varied in quality based on the level of cattle grazing. The higher quality wet prairies were dominated by beakrush (*Rhynochospora tracyi*), bluestem (*Andropogon* sp.), yellow eyed grass (*Xyris* sp), duck potato (*Sagittaria latifolia*), pickerelweed (*Pontederia cordata*), St. John's wort (*Hypericum* spp.), water grass (*Luziola fluitans*), and blue maidencane (*Amphicarpum muehlenbergianum*). Many of the wet prairies contained wax myrtle (*Myrica cerifera*) shrub cover of various heights. Depressional marshes in the Project Area were dominated by sawgrass (*Cladium jamaicense*), Button bush (*Cephalanthus occidentalis*), and alligator flag (*Thalia geniculata*). Water levels varied across the site from very shallow areas less than 8 inches in depth to deep pools of 1 to 2 feet in depth. Fringe wet prairie often bordered many of the depressional wetlands and was saturated or had standing water in some areas. Water quality reservoirs were also present in the Project Area and included large tracts of impoundment areas used for treatment of citrus grove runoff. The water quality reservoirs were dominated by spike rush (*Eleocharis cellulosa*), torpedo grass, cattails (*Typha* spp.), and

cabbage palms. There were pockets of palmetto and wax myrtle along the impoundment berms and isolated islands of shrubs throughout.


Lake Okeechobee
Component A Storage Reservoir
Figure 5
Wetlands and Waters
Highlands County, FL
Project Area
Centerline of the Dam
Major Roads
County Boundary
NHD Flowline
Stream
Canal/Ditch
NWI Wetland Type
Freshwater Emergent Wetland
Freshwater Forested/ Shrub Wetland
Freshwater Pond
Lake
Riverine
Source: ESRI, NHD, NWI
N
0
1
2
Miles
NOT FOR CONSTRUCTION
Miami
Highlands County
Okeechobee County
Glades County
Canal C-41A
Canal C-41
Canal C-39a
Indian Prairie Canal
Harney Pond Canal
Kissimmee River
Maple River
621
721
70

5.2 Existing Conditions beyond the Project Area within the Study Area

5.2.1 Lake Okeechobee Watershed Vegetation Communities

In the Lake Okeechobee watershed, freshwater marshes and wet prairies are found as zones along topographical gradients around Lake Okeechobee, the Kissimmee River, and Fisheating Creek (Kissimmee Marsh, Indian Prairie, and Fisheating Creek marshes). The higher elevations with shorter hydroperiods and shallower flooding are classified as wet prairies, while the lower elevation, long hydroperiod wetlands are designated as freshwater marshes. Freshwater marshes include the sawgrass marshes, cattail marshes, flag marshes, sloughs, mixed emergent grass/sedge marshes, open water marshes, submerged vegetation marshes, and floating vegetation marshes. Freshwater marshes are vegetated primarily with sawgrass and scattered clumps of Carolina willow (*Salix caroliniana*), sweetbay (*Magnolia virginiana*), and cypress (*Taxodium* spp.). Hardwood swamps dominated by red maple (*Acer rubrum*), sweetbay, and sweet gum (*Liquidambar styraciflua*) occur in riverine areas feeding Lake Okeechobee, while cypress swamps are found in depressional areas throughout the region. The wet prairies include sawgrass prairies, wiregrass prairies, and savannahs. The distribution of dominant vegetative species in wet prairies and freshwater marshes is dependent on soil type, depth, and hydrological conditions (Kushlan 1990). Most of these plant associations are found in the Kissimmee River floodplain and Lake Okeechobee perimeter marshes. These plant communities are frequently located within the littoral zones associated with lakes, creeks, and rivers. Soils have changed with shifts in water management practices in Lake Okeechobee reflected in variations in hydrology and vegetative decomposition rates (Brown et al. 1990).

5.2.2 Lake Okeechobee Vegetative Communities

Most of the surface of Lake Okeechobee (i.e., 450,000 acres) is not vegetated and provides open water (pelagic and nearshore) habitat. Open water habitat within Lake Okeechobee covers about 75 percent of the lake's surface area.

A 98,000-acre (154-square-mile) littoral zone is found along Lake Okeechobee's northwestern and western edges and on the islands in its southern shore (i.e., Kraemer Island, Torry Island, and Ritta Island, which together encompass 4,000 acres). The littoral zone supports more than 50 species of emergent, submerged, and floating-leaf plants. Emergent vegetation within the littoral zone is dominated by herbaceous species, such as cattail, spike rush, and the invasive exotic torpedograss. Other emergent vegetation includes bulrush (*Scirpus californicus*), sawgrass, pickerelweed, duck potato, beakrush, wild rice (*Zizania aquatica*), arrowhead (*Sagittaria latifolia*), buttonbush, sand cordgrass (*Spartina bakeri*), fuirena (*Fuirena scirpoidea*), rush (*Scirpus cubensis*), southern cutgrass (*Leersia hexandra*), maidencane (*Panicum hemitomon*), white vine (*Sarcostemma clausum*), dogfennel (*Eupatorium capillifolium*), and mikania (*Mikania scandens*). Woody vegetation consists of primrose willow (*Ludwigia peruviana*), Carolina willow, and the invasive exotic melaleuca (*Melaleuca quiquenervia*). Over the years, there has been an ongoing effort to eradicate melaleuca in the Lake Okeechobee region. The eradication effort has been extremely effective.

Submerged vegetation within Lake Okeechobee is composed almost entirely of hydrilla (*Hydrilla verticillata*), an invasive exotic species, pondweed (*Potamogeton illinoensis*), bladderwort (*Utricularia foliosa*), Chara (*Chara* spp.), coontail (*Ceratophyllum demersum*), and tape grass (*Vallisneria americana*).

The floating, component of the littoral zone consists of lotus lily (*Nelumbo lutea*), fragrant water lily (*Nymphaea odorata* and *N. mexicana*), the invasive exotic water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiotes*), duckweed (*Lemna* spp.), coinwort (*Hydrocotyle umbellata*), and ludwigia (*Ludwigia leptocarpa*).

Periods of extended high lake stages can severely impact littoral vegetation, which declined by 60 percent after the 2004 to 2005 hurricanes. The extended drought in 2007 and 2008 resulted in the littoral zone spreading into more than half of South Bay. The littoral zone emergent and submerged aquatic vegetation recovered under a lowered regulation schedule and several years of favorable rainfall patterns. Since the high-water levels in the winter of 2016 and fall of 2017, the edge of this portion of the littoral zone has moved towards the southern shoreline.

5.2.3 Northern Estuaries Vegetative Communities

Submerged aquatic vegetation (SAV), which includes seagrass and macroalgae, is one of the most important vegetation communities of the St. Lucie River, Indian River Lagoon, and Caloosahatchee River and Estuary (IRLNEP1996). These communities are highly productive and provide food and habitat for fish, sea turtles, manatees, a myriad of invertebrates, and other species. Seagrass meadows improve water quality by removing nutrients, dissipating the effects of waves and currents, and stabilizing bottom habitats, thereby reducing suspended solids. Seagrass beds support some of the most abundant and diverse fish populations. Many commercial and recreational fisheries (e.g., clams, shrimp, lobster, and fish) are associated with healthy seagrass beds (USFWS 1999).

6. FEDERALLY LISTED SPECIES

A list of federally or state listed species that could be present in the Project Area was downloaded through the USFWS Information for Planning and Consultation (IPaC) online database. The IPaC list was generated within the Project Area and did not include the greater Study Area; however, species from the Lake Okeechobee Watershed Restoration Project (LOWRP) Biological Assessment (USACE 2022) that had a "May Affect, Not Likely to Adversely Affect" determination were also included in the analysis for this BA. The species list generated comprises the species that may occur in the Project Area or be affected by the reservoir, and are therefore considered in this BA. The status and effect determination for each species is shown in Table 4.

If a species received a "No Effect" determination, the rationale for that determination is provided in Table 4, and they are not discussed further in this BA. Species may have received a "No Effect" determination for the following reasons:

1. Documented species range does not overlap with the Project Area;
2. USFWS consultation area for the species does not overlap with the Project Area; and/or
3. Species range does overlap with the Project Area, but no habitat exists in the Project Area that will support the species.

Table 4. List of Threatened and Endangered Species with Potential to Occur in the Project Area or Study Area

Scientific Name	Common Name	Federal Status	Effect Determination[1]	Rationale for No Effect Determination
Reptiles				
Drymarchon couperi	Eastern indigo snake	Threatened	May Affect	Assessed in Biological Assessment (BA)
Birds				
Ammodramus savannarum floridanus	Florida grasshopper sparrow	Endangered	MANLAA	Assessed in BA
Aphelocoma coerulescens	Florida scrub jay	Threatened	NE	The Project is in the USFWS consultation area for the species, but the species is not expected to be affected by the action due to lack of suitable habitat.
Grus americana	Whooping crane	Experimental Population, Non-Essential	N/A	Species is not regulated under ESA as it is an experimental population,
Laterallus jamaicensis ssp. jamaicensis	Eastern black rail	Threatened	May Affect	Assessed in BA
Mycteria americana	Wood stork	Threatened[3]	MANLAA	Assessed in BA
Caracara plancus (Note the listed entity is: Polyborus plancus audubonii)	Crested caracara (Note the listed entity is Audubon's crested caracara)	Threatened	May Affect	Assessed in BA
Rostrhamus sociabilis plumbeus	Everglade Snail kite	Endangered	MANLAA	Assessed in BA
Mammals				
Perimyotis subflavus	Tricolored bat	Proposed listing	May Affect	Assessed in BA
Eumops floridanus	Florida bonneted bat	Endangered	May Affect	Assessed in BA
Puma concolor coryi	Florida panther	Endangered	May Affect	Assessed in BA
Trichechus manatus	West Indian (Florida) manatee	Endangered	MANLAA	Assessed in BA

Scientific Name	Common Name	Federal Status	Effect Determination[1]	Rationale for No Effect Determination
Plants and Lichen				
Chionanthus pygmaeus	Pygmy fringe-tree	Endangered	NE	Species is known to occur along Lake Wales Ridge (8.5 miles west of Project Area), in scrub, sandhill, and xeric hummock habitat. No potentially suitable habitat was observed within the Project Area.
Cladonia perforata	Florida perforated cladonia (also known as Perforate reindeer lichen)	Endangered	NE	Species is known to occur in rosemary scrub habitat, on the Florida Panhandle coasts, Lake Wales Ridge, and Atlantic Coastal Ridge. No potentially suitable habitat was observed within the project Area.
Clitoria fragrans	Pigeon wings	Threatened	NE	Species is known to occur in turkey oak barrens with wire grass, bluejack and turkey oak, scrub, scrubby high pine, and dry roadsides. No potentially suitable habitat was observed within the Project Area.
Conradina brevifolia	Short-leaved rosemary	Endangered	NE	Species is known to occur in scrub, scrubby sandhill, in open areas, and along cleared roadsides. No potentially suitable habitat was observed within the Project Area.
Cucurbita okeechobeensis	Okeechobee gourd	Endangered	MANLAA	Assessed in BA
Crotalaria avonensis	Avon Park harebells	Endangered	NE	Species is known to occur in bare patches of white sand, scrub, and occasionally in disturbed areas in Lake Wales Ridge. No potentially suitable habitat was observed within the Project Area.
Dicerandra christmanii	Garret's mint	Endangered	NE	Species is known to occur in openings of oak scrub on the Lake Wales Ridge. No potentially suitable habitat was observed within the Project Area.

Scientific Name	Common Name	Federal Status	Effect Determination[1]	Rationale for No Effect Determination
Dicerandra frutescens	Scrub mint	Endangered	NE	Species is known to occur in pine scrub and sandhills on the Lake Wales Ridge. No potentially suitable habitat was observed within the Project Area.
Eryngium cuneifolium	Snakeroot	Endangered	NE	Species is known to occur in sand pine scrub, usually in gaps on rosemary balds. No potentially suitable habitat was observed within the Project Area.
Hypericum cumulicola	Highlands scrub hypericum	Endangered	NE	Species is known to occur in open patches in white sand scrubs and rosemary balds, and occasionally in openings of scrubby flatwoods and oak scrubs over yellow sands. No potentially suitable habitat was observed within the project Area.
Liatrus ohlingerae	Scrub blazing star	Endangered	NE	Species is known to occur in rosemary balds, especially edges that transition to oak scrub, scrubby flatwoods, and disturbed scrub. No potentially suitable habitat was observed within the Project Area.
Paronchia chartacea	Papery whitlow-wort	Threatened	NE	Species is known to occur in rows in sand pine scrubs and Florida rosemary scrubs. No potentially suitable habitat was observed within the Project Area.
Polygala lewtonii	Lewton's polygala	Endangered	NE	Species is known to occur in sandhill, scrub, scrubby flatwoods, and their transition zones. No potentially suitable habitat was observed within the Project Area.
Polygonella basiramia	Wireweed	Endangered	NE	Species is known to occur in rosemary phases of sand pine scrub on white sands at higher elevations of the Lake Wales, Winter Haven, and Bombing Range

Scientific Name	Common Name	Federal Status	Effect Determination[1]	Rationale for No Effect Determination
				Ridges. No potentially suitable habitat was observed within the Project Area.
Polygonella myriophylla	Sandlace	Endangered	NE	Species is known to occur in open sandy areas within scrub, mostly on white sands. No potentially suitable habitat was observed within the Project Area.
Warea carteri	Carter's mustard	Endangered	NE	Species is known to occur in sandhill, scrubby flatwoods, inland, and coastal scrub. No potentially suitable habitat was observed within the Project Area.
Ziziphus celata	Florida ziziphus	Endangered	NE	Species is known to occur in oak-hickory scrub, scrubby flatwoods, or sandhills on yellow sand. No potentially suitable habitat was observed within the Project Area.
Critical Habitat				
Rostrahamus sociabilis plumbeus	Everglade snail kite	Endangered	MANLAA	Assessed in BA
Trichechus manatus	West Indian manatee	Endangered	NE	Critical habitat does not overlap the Project Area.

Notes:

1\ NE = No Effect; MANLAA = May Affect, Not Likely to Adversely Affect
2\ Threatened due to similarity of appearance with another listed species and is listed for its protection
3\ Proposed to be delisted (February 2023)

6.1 Designated Critical Habitat

There is designated critical habitat for Everglade snail kite in the Study Area (USFWS 2023b). Effects on Everglade snail kite critical habitat, including a map depicting critical habitat locations, is shown and discussed in Section 7.3.12.

7. EFFECTS DETERMINATIONS

7.1 Summary of Changes in Lake Okeechobee as a Result of the Project

A detailed summary of the modeling completed to determine how the Project will change habitat conditions in Lake Okeechobee and the Northern Estuaries is included as Appendix D. The models also calculate changes in habitat units generally. Those changes can also be translated to federally listed species. When applicable there are specific discussions for individual species in Section 7.3 related to changes in habitat in Lake Okeechobee and the Northern Estuaries.

Moderate, long term beneficial effects to Lake Okeechobee's littoral vegetation are anticipated from the new reservoir, relative to the Future Without the Project (FWO). The overall effect of the Project will be to stabilize water levels and reduce high lake stages; maintaining lake stage within the ecologically preferred seasonal stage envelope (11.5-15.5 ft. NGVD) more frequently than the FWO (Table 5). Stages were within the envelope 6% more time than FWO, with 7% less time spent above the envelope– a critically important metric due to the severity and longevity of high-stage impacts to the littoral ecosystem (Havens 2002, Havens and Gawlik 2005). Although the implementation of the Project will primarily reduce durations at moderate to high stages, there is expected to also be a slight increase in duration of low stages, spending 1% more time below the envelope than the FWO. However, compared to the 7% reduction in time above and 6% increase in time within the envelope, this effect is minimal and would likely help to offset impacts from remaining high-stage events (Havens et al. 2004, Jin and Ji 2013).

The overall effect of substantially lowering the duration and frequency of moderate and high lake stages with only minimal increases in low stage durations should significantly improve vegetation throughout the littoral marshes relative to FWO, primarily by reducing hydroperiods at the upper elevations and providing larger areas for submerged aquatic vegetation (SAV) at low elevations. When lake stages are maintained nearer the ecological envelope, the maximum practicable extent and diversity of littoral marsh is realized; the base of the surrounding levee sits at approximately 15 ft NGVD29, and relatively steeper bathymetric slopes occur at roughly 9 ft NGVD29 and below. When lake stages are above the envelope, large portions of diverse, medium-short hydroperiod marshes can be replaced by invasive cattail, while SAV and fringing bulrush communities are reduced or lost at the limnetic interface (~9-10 ft NGVD29). Increased transport of turbid limnetic water to clearer, nearshore littoral areas during high lake stages decreases light levels and reduces coverage of SAV and emergent marshes; all ultimately reducing the quantity and quality of littoral habitat (Havens 2002, Havens et al. 2005).

Conversely, when lakes stages are kept below the envelope for extended durations, higher elevation marshes can be invaded by woody species like wax myrtle (*Myrica cerifera*) and willow (*Salix caroliniana*), and exotic species like torpedograss (*Panicum repens*). Simultaneously, emergent marsh species can move downslope and displace SAV communities, where steep shorelines at the limnetic interface limit the extent to which SAV can migrate lakeward.

The ecological envelope represents a suite of seasonally variable stages that promote the largest extent of littoral marsh with the greatest diversity of vegetation communities (Richardson et al. 1995), comprised of short-hydroperiod marshes at high elevations and large expanses of SAV habitat at low elevations. Because all action alternatives increase the frequency of time inside the envelope, primarily by reducing the time spent above it, littoral marshes of the lake should increase in diversity, have increased coverage of short-hydroperiod communities, improvements to woody habitats that support wading bird nesting, and recovery of SAV beds relative to FWO.

Table 5. Lake Okeechobee Stage Levels With and Without the Project.

Lake Okeechobee Stage Levels		Future Without Project	With Project
% Time Inside Ecologically Preferred Stage Envelope	Varies between 11.5 ft. and 15.5 ft seasonally	22%	28%
%Time Above Stage Envelope	Varies between 12.5 ft. and 15.5 ft seasonally	48%	41%
%Time Below Stage Envelope	Varies between 11.5 ft. and 14.5 ft seasonally	30%	31%
% Time Below Navigational Min. Stage	% TIME < 12.5 ft.	27.2%	30.1%
Extreme High Stage	% TIME > 17 ft.	2.05%	0.59%
Extreme Low Stage	% TIME < 10 ft.	3.05%	4.11%

7.2 Effect Analysis

Species were evaluated based on a comparison between the existing conditions and future conditions with the Study Area. An assessment was made for each species regarding whether take was reasonably certain to occur from implementation of the Project. In this BA, the take mechanisms discussed for each species include the potential for mortality of individuals to occur, and the potential for harm to occur as the result of habitat loss or modification.

The ESA defines "take" as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or to attempt to engage in any such conduct (16 United States Code 1532(B)). Harm is further defined to include impacts to a species from habitat modification in situations where an activity is likely to result in significant habitat loss that will impair essential behavior patterns, including breeding, feeding, and sheltering, and is likely to result in an actual injury or death to a listed species.

For species that may occur in the Project Area, preconstruction surveys will be conducted to determine if species are present, and construction will be planned around active nesting periods as able. All attempts will be made to avoid mortality of individual species during construction of the reservoir. For some species, this may not be completely possible, and those are discussed in relevant species sections below. The primary effect on species from construction of the reservoir, will be removal of habitat that is

currently supporting essential behavior patterns for species, including breeding, feeding, and sheltering. Beyond direct mortality to species, habitat removal can result in displacement of individuals, pushing them into nearby habitats where interspecific competition may become a stressor. Adjacent or nearby habitats may be of lower quality, resulting in lower reproductive rates and shorter life expectancy. Specific implications of habitat loss are discussed in this BA for the species for which a take is reasonably certain.

7.3 Species Effect Determinations

The Corps recognizes that until completion of CERP there are few opportunities within the current constraints of the C&SF system to completely avoid effects to listed species. However, the proposed Project would improve the duration in which Lake Okeechobee stages are maintained within the preferred range of 12.5 to 15.5 feet, providing an improvement in conditions within the C&SF system (Appendix D). Also, of the alternatives considered for aboveground storage, the Project would result in the least amount of habitat loss. The Corps has determined that the Project may affect federally listed species occurring within the Study Area, as summarized in Table 4 above. The Corps has made "May Affect, Not Likely to Adversely Affect" determinations for the following species: Florida grasshopper sparrow, wood stork, Everglade snail kite, Florida manatee, and Okeechobee gourd. The Corps has made "May Affect" determinations for the following species: Eastern indigo snake, Eastern black rail, Crested caracara, tricolored bat, Florida bonneted bat, and Florida panther. All standard protection measures for species would be followed during and post-construction.

7.3.1 Okeechobee Gourd

The Okeechobee gourd is an annual or perennial, fibrous rooted, high-climbing vine with tendrils. The Okeechobee gourd possesses heart- to kidney-shaped leaf blades, with five to seven angular shallow lobes and irregularly serrated margins. Young leaves are covered with soft hairs, and the cream-colored flowers are bell shaped. The light green gourd is globular or slightly oblong, with 10 indistinct stripes, and hard shelled with bitter flesh. The seeds are gray-green and flat (USFWS 1999). The Okeechobee gourd was historically found on the southern shore of Lake Okeechobee, in Palm Beach County, and formerly in the Everglades (USFWS 1999). Now both Lake Okeechobee and St. Johns River populations of Okeechobee gourd persist (USFWS 2021a). The species is limited to the shoreline and island around the southern and northwestern parts of the lake (USFWS 2021a).

Around Lake Okeechobee, the gourd relies on pond apple trees to support its vines above rising water levels during the wet season. Other trees and shrubs, such as willow and bald cypress (*Taxodium distichum*), may also provide suitable support for the vines. Along the St. Johns River, Okeechobee gourds are most typically found growing on elderberry (*Sambucus nigra*) and common reed (*Phragmites* spp.). The Okeechobee gourd also seems to readily germinate on alligator nests around Lake Okeechobee, which provide suitably elevated soil berms in full sun, with no competition from other plants. These disturbed sites provide areas where competition is reduced and elevated areas that promote the growth of elderberry, button bush, and other erect bushes and shrubs (USFWS 1999).

7.3.2 Okeechobee Gourd "May Affect, Not Likely to Adversely Affect" Determination

7.3.2.1 Mortality

There are unlikely to be Okeechobee gourds present in the footprint of the Project Area. No direct mortality is expected from the implementation of the proposed Project.

7.3.2.2 Harm Resulting from Habitat Loss

The decline of Okeechobee gourd is largely attributable to conversion of swamp forests to agriculture, and water level management in Lake Okeechobee. For the gourd to maintain viable healthy populations, fluctuations in lake level are necessary. High lake levels facilitate dispersal and inundate and destroy aggressive weeds in local habitats. As lake levels decrease, the cleared open habitats allow the quickly germinating Okeechobee gourd seeds to sprout and begin climbing before they have to compete with other pioneer species. Water regulation practices can greatly influence the timing and duration of flooding and drying cycles across remnant areas of suitable elevation and soils around Lake Okeechobee. Permanent inundation of suitable soils is detrimental to the plant. Another potential threat to this plant is the proliferation of exotic plant species around the edges of Lake Okeechobee (USFWS 1999).

Due to the changes in Lake Okeechobee stages and the increased amount of time that water levels are within the beneficial stage envelopes (Table 5), the Corps has determined that there may be slight beneficial effects to the Okeechobee gourd from the Project, and therefore it "May Affect, but is Not Likely to Adversely Affect" the species.

7.3.3 Crested Caracara (Caracara)

The threatened crested caracara is a unique raptor scavenger in the family *Falconidae* that reaches the northern limit of its geographic range in the southern U.S. In Florida, this raptor occurs as an isolated population in the south-central region of the state. Changes in land use patterns throughout central Florida have resulted in this population becoming a subject of concern. This raptor has been documented to occur almost exclusively in cabbage palms on privately owned cattle ranches in the south-central part of the state.

Currently, much of the caracara population is found on improved or semi-improved pastures on private cattle ranches. Available evidence suggests that the most serious threat to Florida's caracara population is loss or degradation of nesting and feeding habitat. Such loss is most commonly due to conversion of pasture and other grassland habitats and wetlands to citrus, sugar cane, other agriculture, and urban development.

Adult caracaras exhibit high site and mate fidelity; therefore, extensive loss of habitat within the home range, particularly of the nesting site itself, may cause the pair to abandon that home range, or at least the nesting site (Morrison et al. 2001). Egg laying has been documented as early as September and as late as June; peak activity occurs from late December through February (Morrison et al. 2001). Clutch size is two to three eggs, with an incubation period of 32 to 33 days. Double brooding can occur if a nest is lost early in the season. Fledging occurs at 8 weeks. Young are dependent on parents for at least 2 months post-fledging and may remain in the natal territory for up to 10 months. Most young in Florida leave natal territory after 4 to 6 months and form groups of up to 30 individuals.

The caracara is an opportunistic feeder, taking prey items such as insects, small reptiles and amphibians, and small mammals. Eggs and carrion are also included in the diet of caracaras. Foraging for food takes place in early morning and late afternoon. Caracaras often walk through pastures searching for prey items, particularly after disturbance, such as mowing or plowing. Caracaras have also been observed feeding in recently burned areas. Hunting takes place from conspicuous perches or while in flight. Once prey is sighted, the caracara flies to the ground and walks up to prey item (Morrison 1996, 2001). Caracara nests and gathering areas around Lake Okeechobee are shown in Figure 6.

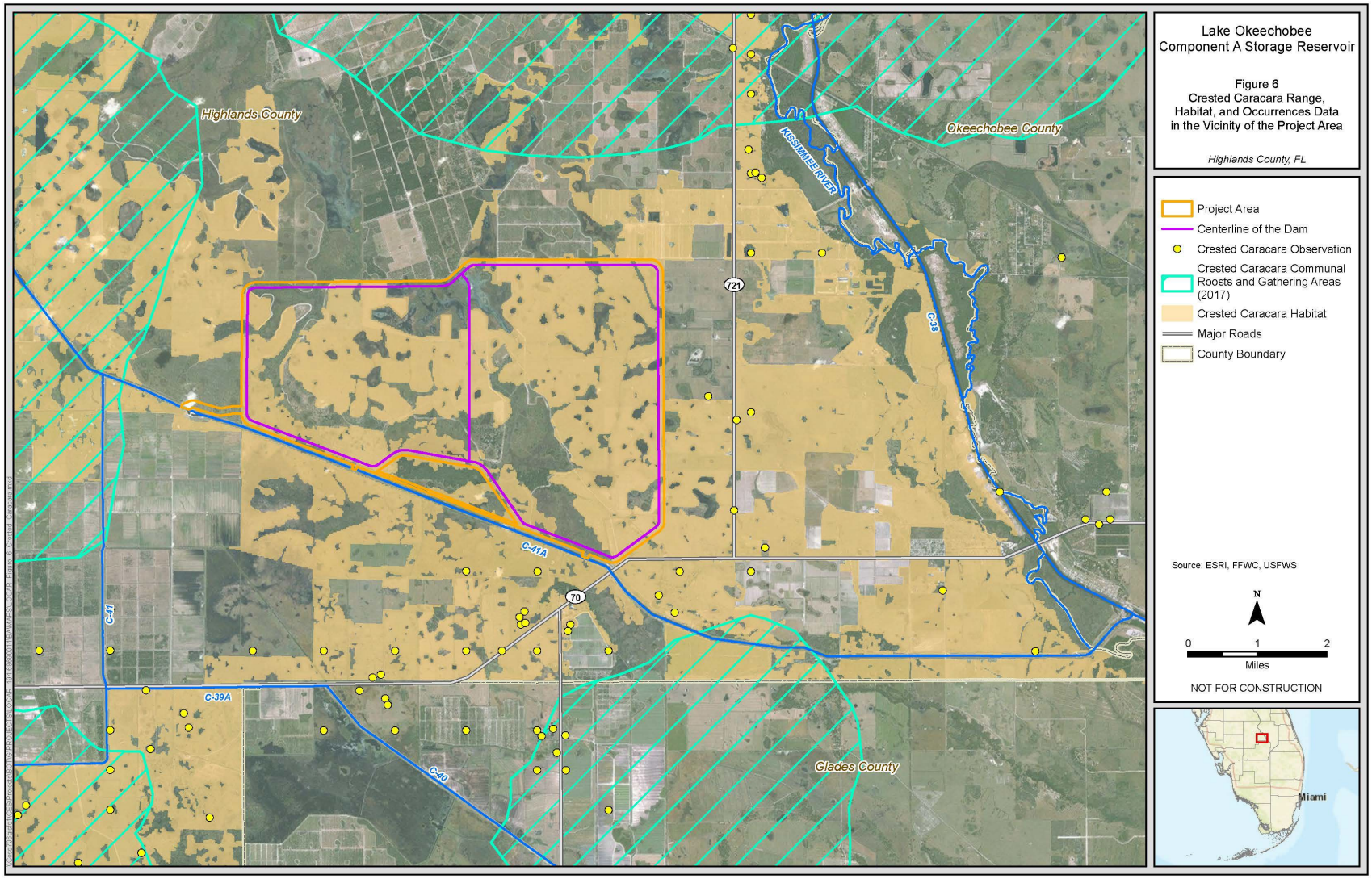
7.3.4 Crested Caracara "May Affect" Determination

7.3.4.1 Mortality

The Project Area is within the USFWS Consultation Area for crested caracara. There are known caracara observations, nest sites, communal roosts and gathering areas, and foraging habitat within the footprint of the reservoir (Figure 6). During a site visit on May 3, 2023, many caracaras were observed in and around the Project Area. Nesting occurs exclusively in cabbage palms, which are prevalent in the Project Area. Cabbage palms will be removed from the reservoir footprint at a time when caracara nests are not active, removing the potential for take to occur. In addition, surveys will be conducted prior to project construction (i.e., removal of cabbage palms) to provide additional assurances of lack of caracara in the trees.

7.3.4.2 Harm Resulting from Habitat Loss

Construction of the reservoir would remove 7,567 acres of mapped caracara habitat (Figure 6). This habitat will be permanently removed and replaced with infrastructure that is not suitable for caracara nesting or foraging. Therefore, the removal of habitat resulting from construction of the Project "May Affect" caracara.


Lake Okeechobee
Component A Storage Reservoir
Figure 6
Crested Caracara Range,
Habitat, and Occurrences Data
in the Vicinity of the Project Area
Highlands County, FL
Project Area
Centerline of the Dam
Crested Caracara Observation
Crested Caracara Communal Roosts and Gathering Areas (2017)
Crested Caracara Habitat
Major Roads
County Boundary
Source: ESRI, FFWC, USFWS
N
0
1
2
Miles
NOT FOR CONSTRUCTION
Highlands County
Okeechobee County
Glades County
KISSIMMEE RIVER
C-38
C-41A
C-41
C-39A
C-40
721
70
Miami

7.3.5 Florida Grasshopper Sparrow

The Florida grasshopper sparrow is federally listed as endangered and is one of four subspecies of grasshopper sparrows in North America. The Florida grasshopper sparrow is a year-round resident of Florida and is endemic to the dry prairie of central and southern Florida. This subspecies is extremely habitat specific and relies on fire every 2 to 3 years to maintain its habitat. Florida grasshopper sparrow is named for one of its calls, a quiet buzz that sounds much like a grasshopper. Male sparrows sing only a few months of the year during the nesting season, for a few hours each day. Florida grasshopper sparrow nests in spring (April to July) on the ground, under palmettos, or in grass clumps. The female lays three to five eggs, and young fledge within 9 to 10 days. The male sings from a low perch to defend its territory—about the only time they are readily visible--and helps raise the young. Diet includes seeds and invertebrates. It is thought that most individuals live their entire lives within a few miles of their place of birth.

Florida grasshopper sparrow habitat consists of large (greater than 50 hectares [123 acres]), treeless, relatively poorly drained grasslands that have a history of frequent fires (Delany et al. 2007, USFWS 1988). The dry prairie habitats where grasshopper sparrow occurs are typically characterized by the presence of bluestem grasses, St. John's wort, and wiregrasses (*Aristida* spp.; Delany et al. 1985) and interspersed with saw palmetto and dwarf live oaks (*Quercus minima*) ranging from 30 to 70 centimeters (12 to 28 inches) in height. These dry prairies are relatively flat and are moderately to poorly drained. Thus, dry prairies may become flooded for short periods during the rainy season but remain dry for the remainder of the year. The water table in these prairies is normally found between several centimeters and a meter below the soil surface.

Grasshopper sparrows cannot tolerate tree densities as high as one tree per acre. Some dry prairies may be artifacts of clearcutting, unnaturally frequent burning, livestock grazing, and alteration of hydrology (Abrahamson and Hartnett 1990). Prairie habitat may also have disappeared due to infrequent burn regimes from fire prevention and from planting of slash pine.

When compared with habitat of other grasshopper sparrows, habitat used by Florida grasshopper sparrow is characterized by a larger percentage of shrub and bare ground, a smaller percentage of tall vegetation, and less litter (Delany et al. 1985). Because the sparrows are ground-dwelling birds, they usually require at least 20 percent bare ground for unrestricted movement and foraging but need enough vegetation to provide nesting cover (Whitmore 1979, Vickery 1996). Large areas of prairie habitat between 240 to 1,348 hectares are needed to maintain populations of 50 breeding pairs (Delany et al. 2007). Florida grasshopper sparrows are also documented to be reproductively successful in pastures that are overgrown or un-grazed. As pastures become more heavily grazed, however, sparrow populations have been documented to decrease or disappear.

Historically Florida grasshopper sparrows were distributed across Collier, Miami-Dade, DeSoto, Glades, Hendry, Highlands, Polk, Okeechobee, and Osceola counties (USFWS 1999). As reported in the species 5-year status review in 2023 the subspecies range had become restricted to Highlands, Okeechobee, Osceola, and Polk counties (USFWS 2023b). Notably in recent years the number of locations where the species was known to occur has increased. Previously the species had been documented at three discrete

locations: the Three Lakes Wildlife Management Area, Kissimmee Prairie Reserve State Park, and, and Avon Park (USFWS 2023b). In recent years the DeLuca Preserve and Corrigan Ranch were protected for the species, both of which share a common border with Kissimmee Prairie Preserve State Park (USFWS 2023b). These areas are approximately five miles north of the Project location.

In 2010, a portion of the Project Area was evaluated for potential habitat that could support Florida grasshopper sparrow as part of the Highlands Ethanol, LLC, Farm Lease Site (Kautz et al. 2010) project. The habitat assessment evaluated desktop data sources and included field surveys to characterize the Farm Lease Site and identify potential habitat for Florida grasshopper sparrow. A total of four parcels were evaluated that overlap with the proposed reservoir boundary. Habitat suitability was characterized by evaluating several criteria, including quality of dry prairie, contiguous size of dry prairie habitat, treeless habitat, vegetation height, bare or litter-covered open ground, and fire frequency. Secondary assessment criteria included presence of fencing, cattle grazing, and hydrologic management. Among the four parcels overlapping the proposed reservoir boundary, only Parcel 1, which aligns with the northwestern corner of the proposed reservoir, was found to have any characteristics suitable for Florida grasshopper sparrow, but lacked all the other important habitat features necessary for Florida grasshopping sparrow (Kautz et al. 2010). During the May 2023 site visit habitat conditions were observed to be consistent with this previous assessment. The landowner confirmed that the area does not undergo any prescribed burning, and that grazing is the only vegetation management tool currently used.

7.3.6 Florida Grasshopper Sparrow "May Affect, but is Not Likely to Adversely Affect" Determination

7.3.6.1 Mortality

The Project Area is within the USFWS Consultation Area for Florida grasshopper sparrow. Preconstruction surveys will be conducted prior to building all features to confirm there are no grasshopper sparrows present. If Florida grasshopper sparrow are encountered during the preconstruction surveys, the Corps will work closely with the USFWS to identify options to eliminate or minimize any potential effects. As a result, mortality of grasshopper sparrows is not anticipated. Preconstruction surveys for Florida grasshopper sparrow will be conducted to confirm no nesting individuals will be impacted during habitat removal.

7.3.6.2 Harm Resulting from Habitat Loss

Within the Project Area there are 7,534 acres of improved pasture (Table 2). Nearly all of this improved pasture has some potential to support nesting Florida grasshopper sparrows. During a site visit on May 3, 2023, it was observed that there are large expanses of open pasture, areas typically suitable for nesting. Grazing was observed during the site visit and is the only form of vegetation management in the Project Area; no fire is used. Improved pasture is prevalent in the Project Area, and it is also prevalent in the region. Removal of the habitat and placement of the reservoir will permanently reduce the amount of nesting habitat available for Florida grasshopper sparrow. However, based on the limited suitability of the habitat for Florida grasshopper sparrow, due to the lack of prescribed fire and cattle grazing, the Project "May Affect, but is Not Likely to Adversely Affect" Florida grasshopper sparrow.

7.3.7 Eastern Black Rail

The eastern black rail was federally listed as threatened by the ESA on November 9, 2020 (85 *Federal Register* [FR] 63764 63803). Eastern black rail is a sparrow-sized bird and is the rarest and smallest of all rail species. Eastern black rail is a highly secretive bird that resides in marsh habitats, is rarely seen in flight, and will walk or run throughout their marsh habitat along narrow paths created by rodents. No critical habitat has been designated for the eastern black rail.

Eastern black rail range in the U.S. extends along the coastal areas of the eastern states, from New Jersey to the southern tip of Florida, along the gulf coast from Florida to Texas, and in the midwestern states, extending from Michigan to eastern Colorado (USFWS 2023c). Within its range, the species has historically been most concentrated along the Atlantic Coast, along coastal salt marshes from Connecticut to Florida.

In Florida, eastern black rail is a year-round resident throughout the coastal areas and the full southern half of the state. Habitat for the species is characterized by shallow, densely vegetated, marshes in salt, brackish, and freshwater environments (USFWS 2023c). The species appears to be limited to specific habitat characteristics in marsh environments, including persistent water coverage and depth, very dense herbaceous vegetation, and topographic variation (ACJV 2020). Habitats supporting black rail typically have water levels around 3 centimeters in depth, which is persistent. If water levels pool up seasonally or become too low or dry up in the summer months, the species will abandon the site. Vegetation structure is also an important habitat characteristic, and typically includes greater than 80 percent grasses, and also includes bulrushes, sedges, and cattails. Topographic variation is an important characteristic in black rail habitat to allow for escape when water levels rise and to allow greater foraging opportunity for invertebrate food sources that rails depend on. Small numbers of black rails have also been documented in impoundments, freshwater wetlands, coastal prairies, and grassy fields, where there are suitable habitat conditions present.

Nesting occurs from mid-March through August, and the species constructs their nests on or near the ground in very dense vegetation over water or moist soil or in shallow water (Watts 2022). Clutch size is typically around seven eggs, and the eggs are incubated for 17 to 20 days. The nestlings leave the nest within 1 day and the parents are believed to care for the young and feed them.

The Project Area was evaluated for potential habitat to support Eastern black rail during a site visit on May 3, 2023. The entire site is composed of a mixture of managed grasslands (e.g., pastures and grazing), dry prairie, oak scrub, and wetland habitats. The wetland habitats observed within the Project Area are predominantly a mixture of emergent vegetation, such as sawgrass and shrub-dominated wetlands, including species such as buttonbush. Water levels varied across the site from very shallow areas less than 8 inches in depth to deep pools of 1 to 2 feet in depth. Water levels are likely variable throughout the year, but those with less than approximately 3 inches would be suitable for nesting (Watts 2022). Shrubby vegetation often bordered many of the wetlands and was saturated or had standing water in some areas, and beyond that was improved pasture. Wetlands within the Project Area could provide potentially suitable habitat for eastern black rail.

7.3.8 Eastern Black Rail "May Affect" Determination

7.3.8.1 Mortality

Eastern black rail has a moderate probability of occurrence within the Project Area based on potentially suitable habitat that is present. Efforts will be made to avoid mortality of the species during construction by avoiding vegetation clearing/grubbing during the active nesting season as well as surveys for Eastern black rails prior to initiation of construction activities. Direct mortality, while unlikely, could result from collision with construction-related equipment and motorized vehicles. It is not possible to estimate how many Eastern black rails may be killed so habitat, as described below, will be used as a surrogate for estimating take.

7.3.8.2 Harm Resulting from Habitat Loss

The Project will permanently remove 2,671 acres of wetlands (Figure 5), which could support Eastern black rail and is therefore likely to have unavoidable adverse effects on the species. The Corps will utilize Standard Protection Measures for Eastern black rails throughout the Project design and construction to minimize any potential adverse effects to the extent practicable. The Corps has determined that the Project "May Affect" Eastern black rail.

7.3.9 Everglade Snail Kite

The Everglade snail kite is listed as an endangered species by the USFWS. Although previously located in freshwater marshes over a considerable area of peninsular Florida, the range of the snail kite is now limited to central and southern portions of Florida. Six large freshwater systems are located within the current range of the snail kite: Upper St. Johns marshes, Kissimmee Chain of Lakes, Lake Okeechobee, Loxahatchee Slough, the Everglades, and the Big Cypress basin.

Lake Okeechobee and surrounding wetlands represent significant snail kite nesting and foraging habitats that have historically supported snail kites. Lake Okeechobee is of particular importance since it serves as a critical stopover point as snail kites traverse the network of wetlands within their range. A loss of suitable habitat and refugia, especially during droughts in the lake, may have significant demographic consequences. Lake Okeechobee is critical to the snail kite's long-term population persistence, especially given the susceptibility of juvenile snail kites in the Kissimmee River Valley to an increased frequency of local disturbance events due to cold weather and the treatment of hydrilla.

The Everglade snail kite's apple snail diet is dependent on the hydrology and water quality of the watersheds. Foraging habitat requires shallow open-area ponds with low marsh areas; nesting/roosting sites are located over water. Foraging conditions have expanded recently due to the increase in exotic apple snail population (since about 2010). As a result, the Everglade snail kite breeding season has lengthened (sometimes into fall) and some previous unsuitable foraging areas now have the more robust exotic apple snail and are being utilized by kites. Snail kites nest in both woody and herbaceous vegetation in the Lake Okeechobee littoral zone. Mapped habitat for Everglade snail kite is shown in Figure 7.

7.3.10 Everglade Snail Kite "May Affect, Not Likely to Adversely Affect" Determination

7.3.10.1 Mortality

The Project Area is within the USFWS Everglade snail kite consultation area. Numerous freshwater wetlands and open water systems suitable for nesting and foraging habitat for Everglade snail kite will be

permanently removed by the construction of the reservoir. Efforts will be made to avoid mortality of the species during construction by avoiding vegetation clearing/grubbing during the active nesting season as well as preconstruction monitoring for the Everglade snail kite within the Project Area. It is therefore not anticipated that mortality would occur as a result of the Project.

7.3.10.2 Harm Resulting from Habitat Loss

The Project will result in the loss of 2,671 acres of freshwater marshes, wet prairies, and mixed-scrub-shrubland, all of which have the potential to support roosting and foraging habitat for Everglade snail kite. The habitats being lost are not unique to the region but the amount of habitat being lost at one time is notable.

Conversely, the Project has the potential to indirectly benefit snail kites if the hydrology allows for creation and maintenance of apple snail populations and if nesting substrate is available in Lake Okeechobee. Water storage would likely improve the overall lake levels and moderate stage fluctuations. This may increase suitable habitat for apple snails, thereby increasing spatial extent of suitable foraging opportunities for snail kites. Minor beneficial effects to vegetation (including vegetation used for snail kite nesting) within Lake Okeechobee's extensive littoral zone are also anticipated. These ecological benefits are a result of the small increase in amount of time within the beneficial stage envelope and less time in the extremely low stages (less than 10 feet, NGVD) (Table 5).

Converse to providing beneficial effects due to a change in lake stages, the high-water levels could cause short-term, minor adverse effects to the littoral zone and nearshore aquatic vegetation that need lower lake stages to persist. This may not result in a difference in vegetation from what is currently occurring through natural conditions and current operations. However, if the high lake stages do occur more often and the vegetation shifts to a different type of community, this could impact the ability for apple snails to persist.

Because the lake stage is expected to be more stable with the reservoir in place and periods when the lake is at high-water levels expected to be less frequent and for shorter durations, the Corps has therefore determined that the construction of the Project "May Affect, but is Not Likely to Adversely Affect", Everglade snail kite.

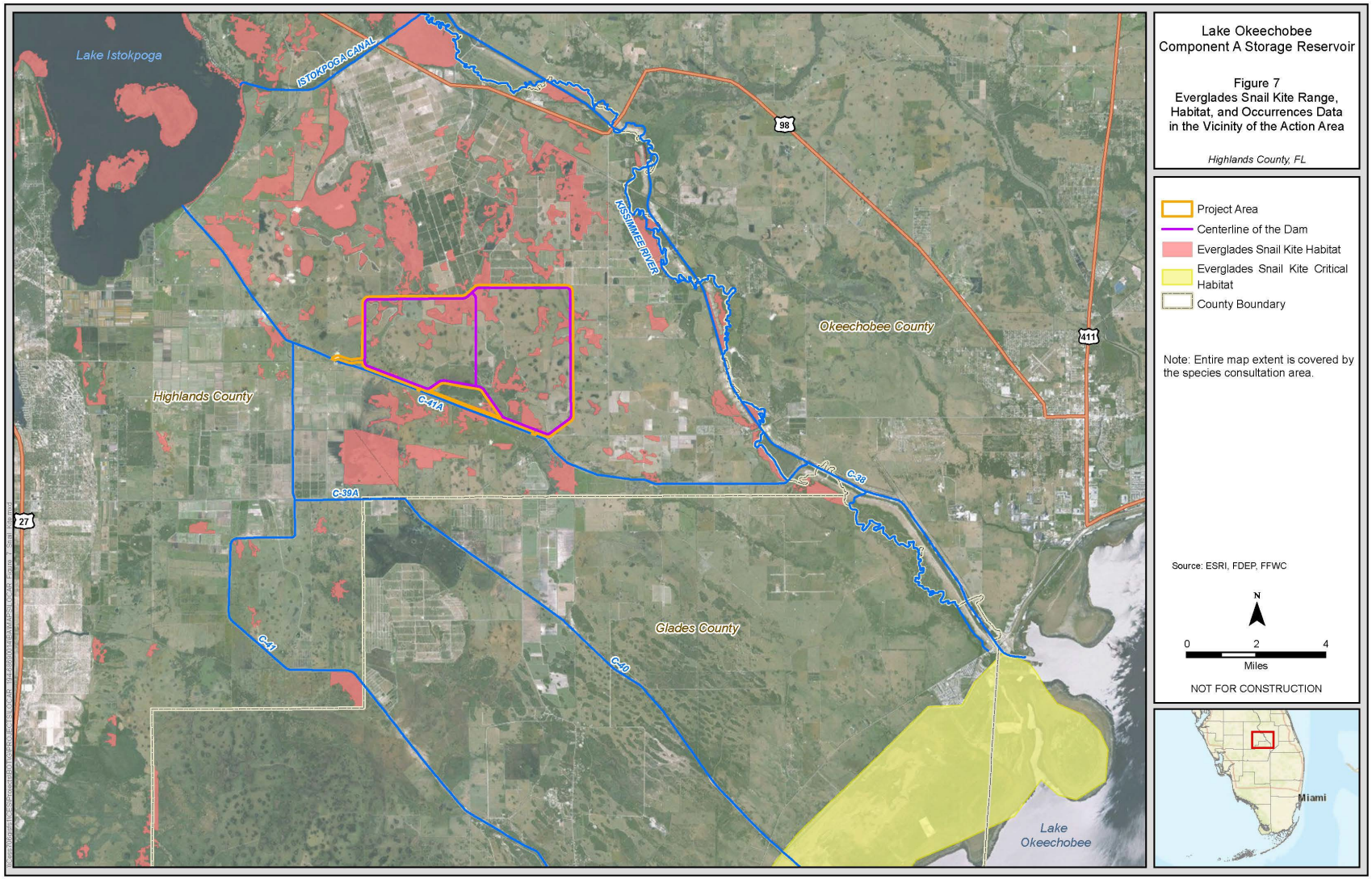
7.3.11 Everglade Snail Kite Critical Habitat

Designated critical habitat within the Project Area includes western portions of Lake Okeechobee (Figure 7). Snail kite critical habitat in Lake Okeechobee is located in the western parts of Glades and Hendry Counties, extending along the western shore to the east of the dike system and the un-diked high ground at Fisheating Creek, and from the Hurricane Gate at Clewiston northward to the mouth of the Kissimmee River, including all the spike rush flats of Moonshine Bay, Monkey Box, and Observation Shoal, but excluding the open water north and west of the northern tip of Observation Shoal north of Monkey Box and east of Fisheating Bay (USFWS 2023a).

7.3.12 Everglade Snail Kite Critical Habitat "May Affect, Not Likely to Adversely Affect" Determination

The Project indirect benefits described above for vegetation within the Lake Okeechobee littoral zone are mostly within the designated snail kite critical habitat (Appendix D). Therefore, snail kite critical habitat in

Lake Okeechobee should indirectly benefit by implementation of the Project, particularly by reducing the frequency of extreme low lake stages. Due to these anticipated indirect beneficial effects on Lake Okeechobee's littoral vegetation, the Corps has determined that implementation of the Project "May Affect, but is Not Likely to Adversely Affect", Everglade snail kite critical habitat.


Lake Istokpoga
ISTOKPOGA CANAL
98
KISSIMMEE RIVER
Okeechobee County
411
Highlands County
C-41A
C-38
C-39A
27
Glades County
C-41
C-40
Lake Okeechobee
Lake Okeechobee Component A Storage Reservoir
Figure 7
Everglades Snail Kite Range, Habitat, and Occurrences Data in the Vicinity of the Action Area
Highlands County, FL
Project Area
Centerline of the Dam
Everglades Snail Kite Habitat
Everglades Snail Kite Critical Habitat
County Boundary
Note: Entire map extent is covered by the species consultation area.
Source: ESRI, FDEP, FFWC
N
0
2
4
Miles
NOT FOR CONSTRUCTION
Miami

7.3.13 Wood Stork

The wood stork is a large, white, long-legged wading bird that relies on shallow freshwater wetlands for foraging. It primarily utilizes shallow wetlands where prey is concentrated and movements during the breeding and non-breeding seasons are typically in response to the availability of such shallow wetlands. As a wading bird, wood storks are a wetland dependent species and rely on a mosaic of wetlands for nesting, roosting, and foraging (USFWS 2021b). This species was federally listed as endangered under the ESA on February 28, 1984. In February 2023 the USFWS proposed to delist the southeast district population segment of wood stork (88 Fed Reg. 9830, February 15, 2023). No critical habitat has been designated for the wood stork.

In the U.S., wood storks were historically known to nest in all coastal states from Texas to South Carolina (Bent 1926). Dahl (1990) estimates these states lost about 38 million acres, or 45.6 percent of their historic wetland habitat between the 1780s and the 1980s. However, it is important to note that wetlands and wetland losses are not evenly distributed in the landscape. Hefner et al. (1994) estimated 55 percent of the 2.3 million acres of the wetlands lost in the southeastern U.S. between the mid-1970s and mid-1980s were located in the Gulf-Atlantic coastal flats. These wetlands were strongly preferred by wood storks as nesting habitat. Currently, wood stork nesting is known to occur in Florida, Georgia, South Carolina, and North Carolina from March to late May. However, in south Florida, wood storks lay eggs as early as October and fledge in February or March. Breeding colonies of wood storks are currently documented in all southern Florida counties except for Okeechobee County. Wood stork Core Foraging Areas are shown in Figure 8.

The wood stork population in the southeastern U.S. appears to be increasing. Preliminary population totals indicate that the wood stork population has reached its highest level since it was listed as endangered in 1984. In 2019, 17,398 wood stork pairs were recorded across Florida, Georgia, South Carolina, and North Carolina (USFWS 2021b). Wood stork nesting was first documented in North Carolina in 2005 and wood storks have continued to nest in this state since (USFWS 2021b). This suggests that the northward expansion of wood stork nesting may be continuing.

The primary cause of the wood stork population decline in the U.S. is loss of wetland habitats or loss of wetland function resulting in reduced prey availability. Almost any shallow wetland depression where fish become concentrated, either through local reproduction or receding water levels, may be used as feeding habitat by the wood stork during some portion of the year; however, only a small portion of the available wetlands support foraging conditions (i.e., high prey density and favorable vegetation structure) that wood storks need to maintain growing nestlings. Browder et al. (1976) documented the distribution and the total acreage of wetland types occurring south of Lake Okeechobee, Florida, for the period 1900 through 1973. They combined their data for habitat types known to be important foraging habitat for wood storks (e.g., cypress domes and strands, wet prairies, scrub cypress, freshwater marshes and sloughs, and sawgrass marshes) and found these habitat types have been reduced by 35 percent since 1900.

Wood storks forage primarily within freshwater marsh and wet prairie vegetation types but can be found in a wide variety of wetland types, as long as prey are available and the water is shallow and open enough

to hunt successfully (Ogden et al. 1978, Coulter 1987, Gawlik et al. 2004). Calm water, about 5 to 25 centimeters in depth, and free of dense aquatic vegetation is ideal; however, wood storks have been observed foraging in ponds up to 40 centimeters in depth (Coulter and Bryan 1993, Gawlik et al. 2004). Typical foraging sites include freshwater marshes, ponds, hardwood and cypress swamps, narrow tidal creeks or shallow tidal pools, and artificial wetlands, such as stock ponds, shallow, seasonally flooded roadside or agricultural ditches, and managed impoundments (Coulter et al. 1999, Coulter and Bryan 1993). During nesting, these areas must also be sufficiently close to the colony to allow wood storks to efficiently deliver prey to nestlings.

7.3.14 Wood Stork "May Affect, Not Likely to Adversely Affect" Determination

7.3.14.1 Mortality

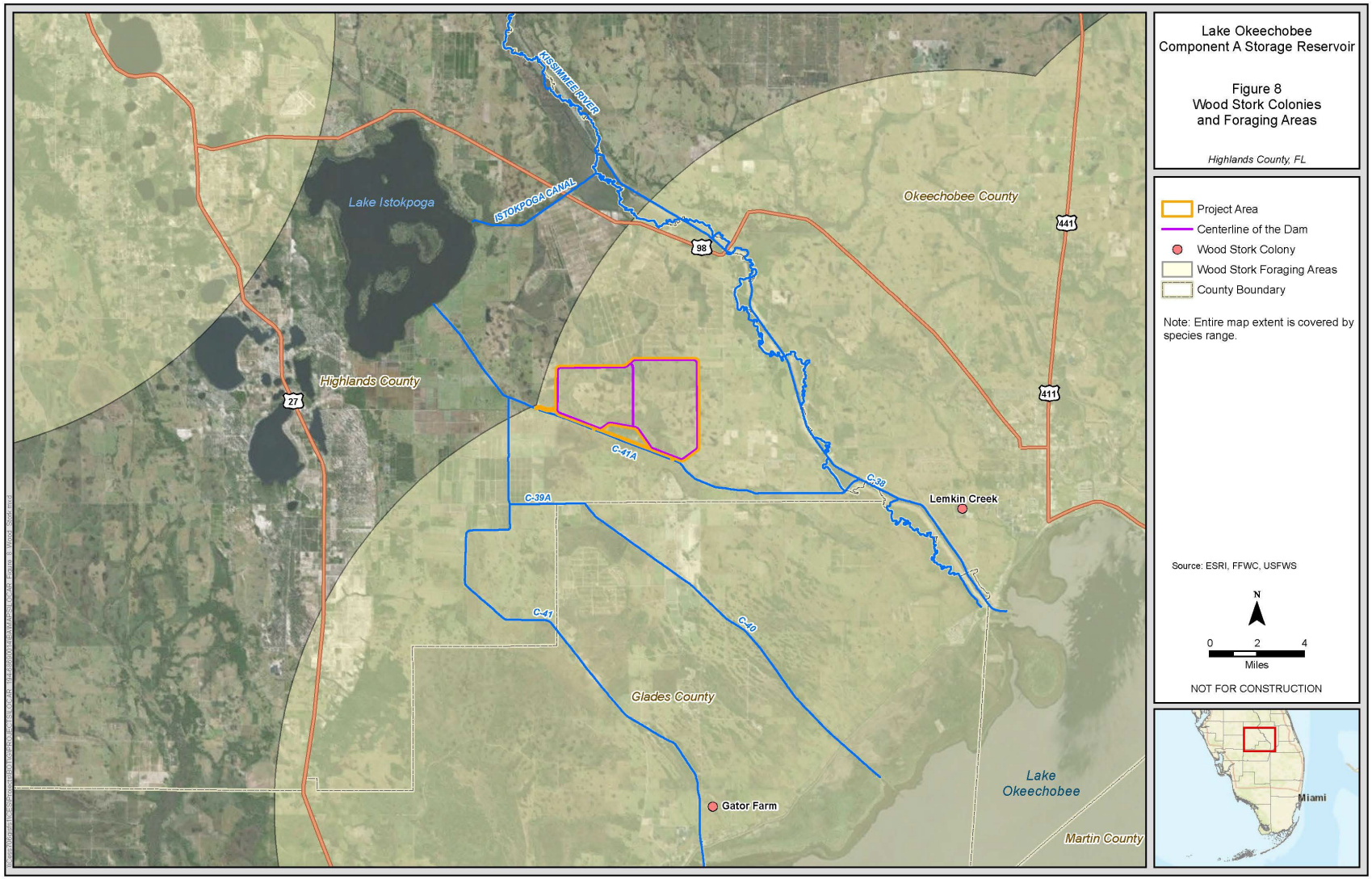
There are no known wood stork nesting colonies in the reservoir footprint; therefore, it is unlikely that species mortality would occur from construction of the Project. Nonetheless, efforts will be made to avoid mortality of the species during construction by avoiding removal of any active nests documented during preconstruction surveys.

7.3.14.2 Harm Resulting from Habitat Loss

The entire Project Area is located in Core Foraging Habitat for the Gator Farm and Lemkin Creek nesting colonies (USFWS 2021b) (Figure 8). Once the Project is constructed, approximately 2,671.02acres of wetland habitat will be permanently removed. This will result in the estimated loss of 7,022.86 kilograms of prey biomass. A wood stork prey biomass assessment for the Project Area is included as Appendix B. The prey biomass assessment was completed using desktop National Wetland Inventory data and based on general observations of wetland features from a field visit in May 2023, not from field data collection at each wetland feature, due to the number of wetland features in the Project Area.

The Project would be expected to indirectly improve conditions for wood storks in the littoral community within Lake Okeechobee due to the increased amount of time the water levels would be within the beneficial stage envelope (Table 5). This would allow for a greater opportunity for wood stork foraging. Rehydration and vegetation shifts within the lake levels (via additional Project storage) are likely to indirectly increase the spatial extent of suitable foraging opportunities and nesting habitat for wood storks, which would provide a moderate beneficial effect.

The Project will result in the removal of Suitable Foraging Habitat within the Core Foraging Area of two wood stork colonies (Figure 8). Consistent with the 2010 Wood Stork Effects Determination Key (USFWS 2010), compensation will be provided in accordance with the CWA section 404(b)(1) guidelines and shall not be contrary to the Habitat Management Guidelines (USFWS 1990); habitat compensation shall be within the appropriate Core Foraging Area or within the service area of a USFWS-approved mitigation bank; and habitat compensation shall replace foraging value, consisting of wetland enhancement or restoration matching the hydroperiod of the wetlands affected, and provides foraging value similar to or higher than those impacted. As a result, the Corps has determined that the Project "May Affect, but is Not Likely to Adversely Affect" wood stork.


Lake Okeechobee
Component A Storage Reservoir
Figure 8
Wood Stork Colonies
and Foraging Areas
Highlands County, FL
Project Area
Centerline of the Dam
Wood Stork Colony
Wood Stork Foraging Areas
County Boundary
Note: Entire map extent is covered by species range.
Source: ESRI, FFWC, USFWS
N
0 2 4
Miles
NOT FOR CONSTRUCTION
Miami
KISSIMMEE RIVER
ISTOKPOGA CANAL
Lake Istokpoga
Okeechobee County
Highlands County
Glades County
Martin County
Lake Okeechobee
Lemkin Creek
Gator Farm
C-41A
C-39
C-39A
C-41
C-40
98
441
411
27

7.3.15 Eastern Indigo Snake

The threatened Eastern indigo snake is the largest native non-venomous snake in North America. It is an isolated subspecies occurring in southeastern Georgia and throughout peninsular Florida. The Eastern indigo snake prefers drier habitats but may be found in a variety of habitats from xeric sandhills to cabbage palm hammocks, to hydric hardwood hammocks (Schaefer and Junkin 1990). The species has also been found in citrus groves and sugar cane. Eastern indigo snakes need relatively large areas of undeveloped land to maintain their population. In warm months, indigo snakes use a variety of natural areas and have large home ranges (Moler 1992, USFWS 1999). Eastern indigo snakes occupy larger home ranges in the summer than the winter. Information on snakes in Florida indicates adult males have home ranges as high as 224 hectares (553 acres) in the summer (Moler 1992). Because it is such a wide-ranging species, the eastern indigo snake is especially vulnerable to habitat fragmentation that makes travel between suitable habitats difficult. The main reason for its decline is habitat loss due to development. Further, as habitats become fragmented by roads, eastern indigo snakes become increasingly vulnerable to highway mortality as they travel through their large territories (Schaefer and Junkin 1990).

In south Florida, the Eastern indigo snake is thought to be widely distributed. Given their preference for upland habitats, eastern indigo snakes are not commonly found in great numbers in wetland complexes, though they have been found in pinelands, tropical hardwood hammocks, and mangrove forests in extreme south Florida (Duellman and Schwartz 1958, Steiner et al. 1983). Within the range of the gopher tortoise, tortoise burrows are favorite refugia for indigo snakes. They are known to use burrows made by cotton rats and land crabs, hollows at bases of trees and stumps, ground litter, trash piles and rock piles lining banks of canals, and pipes or culverts.

Sexual maturity appears to occur around 3 to 4 years of age. Breeding occurs from November to April with females laying 4 to 12 eggs in May through June (Moler 1992). Most hatching of eggs occurs from August to September, with yearling activity peaking in April and May (USFWS 1999).

7.3.16 Eastern Indigo Snake "May Affect" Determination

7.3.16.1 Mortality

Eastern indigo snakes have a high probability of occurrence within the Project Area. Though all efforts will be made to avoid mortality of the species during construction, it is likely that some snakes will be killed. It is not possible to estimate how many snakes may be killed so habitat, as described below, will be used as a surrogate for estimating take.

7.3.16.2 Harm Resulting from Habitat Loss

The Project will permanently remove 9,502 acres of uplands vegetative communities. This is primarily improved pasture, but also includes a large portion of woodland pasture (Table 3), which could support eastern indigo snakes. The Corps will require Standard Protection Measures for Eastern Indigo Snakes throughout Project design and construction to minimize any potential adverse effects to the extent practicable. The Corps has determined that the Project "May Affect" eastern indigo snake since the Project will result in removal of more than 25 acres of habitat. This determination is consistent with the Consultation Key for the Eastern Indigo Snake (USFWS 2017).

7.3.17 West Indian (Florida) Manatee

The West Indian manatee is a large, plant-eating aquatic mammal that can be found in the shallow coastal waters, rivers, and springs of Florida. The West Indian (Florida) manatee was listed as endangered throughout its range for both the Florida and Antillean subspecies (*T. manatus latirostris* and *T. manatus manatus*) in 1967 (32 FR 4061) and received federal protection with the passage of the ESA in 1973. Because the manatee was designated as an endangered species prior to enactment of the ESA, there was no formal listing package identifying threats to the species, as required by ESA Section 4(a)(1).

Florida manatees can be found throughout the southeastern U.S.; however, within this region, they are at the northern limit of their range (Lefebvre et al. 2000, USFWS 2001). Because they are a subtropical species with little tolerance for cold, they remain near warm water sites in peninsular Florida during the winter. During periods of intense cold, Florida manatees will remain at these sites and will tend to congregate in warm springs and outfall canals. During warm interludes, Florida manatees move throughout the coastal waters, estuaries, bays, and rivers of both coasts of Florida and are usually found in small groups. During warmer months, Florida manatees may disperse great distances. Florida manatees have been sighted as far north as Massachusetts and as far west as Texas and in all states in between (Rathbun et al. 1983, Fertl et al. 2005). Warm weather sightings are most common in Florida and coastal Georgia. They will once again return to warmer waters when the water temperature is too cold (Hartman 1979, Stith et al. 2006). Florida manatees live in freshwater, brackish, and marine habitats, and can move freely between salinity extremes. They can be found in both clear and muddy water. Water depths of at least 3 to 7 feet (1 to 2 meters) are preferred and flats and shallows are avoided unless adjacent to deeper water.

7.3.18 West Indian (Florida) Manatee "May Affect, Not Likely to Adversely Affect" Determination

7.3.18.1 Mortality

West Indian (Florida) manatee occurs in Lake Okeechobee and that portion of the Study Area is within the USFWS West Indian Manatee Consultation Area. Manatee does not occur within the footprint of the reservoir (Project Area). No mortality of the species is anticipated as the result of the Project.

7.3.18.2 Harm Resulting from Habitat Loss

Implementation of the Project would indirectly improve the overall manatee foraging habitat within Lake Okeechobee, local canals, and the northern estuaries. With the reservoir in operation, Lake Okeechobee's extensive littoral zone is expected to be within the optimal lake level condition more often than without the Project and therefore improve the foraging habitat in Lake Okeechobee for manatees. There are also expected to be fewer high-volume flow months within the Northern Estuaries, providing a beneficial effect to SAV. Reduction in high flows and accompanying flow velocities would result in lower suspended solid loading and decreased concentration of colored dissolved organic matter, thereby allowing greater light penetration to promote growth of SAV. In addition, reduction in high-volume releases from Lake Okeechobee would reduce extreme salinity fluctuations associated with such events. Although some SAV are tolerant of a wide range of salinity levels, a reduction in high-volume releases would reduce stress to SAV, promote increases in seagrass shoots, and have the potential to increase foraging opportunities for manatees in this region, which would provide a minor beneficial effect. Florida manatees also depend on canals as transit from one habitat to another, sources of freshwater, and resting sites. Standard manatee

protection guidelines will be used during construction along canals and rivers accessible to manatees to avoid effects.

The Corps has determined that the Project "May Affect, but is Not Likely to Adversely Affect" West Indian (Florida) manatee. There is likely to be a net benefit to the species in Lake Okeechobee because water levels will be more stable in Lake Okeechobee and the Northern Estuaries with the Project in place (Table 5). As stated in Table 4, there is no effect to designated critical habitat for the manatee.

7.3.19 Florida Panther

The endangered Florida panther was once the most widely distributed mammal in North and South America, but it is now virtually exterminated in the eastern U.S. Habitat loss had driven this subspecies south of the Caloosahatchee River. Only recently have adult female panthers been recorded north of the Caloosahatchee River. The Florida panther has been found in almost all Lake Okeechobee watershed ecological communities, including mesic temperate hammocks (Humphrey and Jodice 1992). The Florida panther uses mesic pine flatwoods in combination with other forested communities. Foraging, breeding, and wildlife corridors are provided for the panther and its prey. Mesic flatwoods are associated with natural drainage patterns defining travel corridors.

Florida panther is one of 30 cougar subspecies. It is tawny brown on the back and pale gray underneath, with white flecks on the head, neck, and shoulders. Male panthers weigh up to 130 pounds and females reach 70 pounds. Preferred habitat consists of cypress swamps and pine and hardwood hammock forests. The main diet of the Florida panther consists of white-tailed deer (*Odocoileus virginianus*), sometimes wild hog (*Sus scrofa*), rabbit, raccoon (*Procyon lotor*), armadillo (*Dasypus novemcinctus*), and birds. Present population estimations range from 80 to 100 individuals. Florida panthers are solitary, territorial, and often travel at night. Male panthers have a home range of up to 400 square miles and females about 50 to 100 square miles.

Female panthers reach sexual maturity at about 3 years of age. Mating season is December through February. Gestation lasts about 90 days and females bear two to six kittens. Juvenile panthers stay with their mother for about 2 years. Female panthers do not mate again until their young have dispersed. The main survival threats to the Florida panther include habitat loss due to human development and population growth, collision with vehicles, parasites, feline distemper, feline alicivirus (an upper respiratory infection), and other diseases (USFWS 1999).

The Florida panther has been found in almost all Lake Okeechobee watershed ecological communities. The Florida panther uses mesic pine flatwoods in combination with other forested communities. Mesic flatwoods are associated with natural drainage patterns defining travel corridors.

The Panther Focus Area is includes habitat zones developed by the USFWS panther subteam of Multi-Species/Ecosystem Recovery Implementation Team (MERIT). Members of the MERIT panther recovery subteam identified lands essential to the long-term survival of the Florida panther. The MERIT subteam defined the Primary Zone as "all lands essential for the survival of the Florida panther in the wild." A Secondary Zone includes "lands contiguous with the Primary Zone, and areas which panthers may currently use, and where expansion of the Florida panther population is most likely to occur". Lastly, a

Dispersal Zone was identified as an area needed for panthers to disperse north of the Caloosahatchee River.

The Project is located within one of the "Thatcher Dispersal Pathways" of the Panther Focus Area as shown in Figure 9 (Thatcher et al. 2009). The Thatcher Dispersal Pathways are aimed at Florida panther recovery and the facilitation of movement of Florida panthers into Central Florida, north of the Caloosahatchee River. Thatcher (2009) acknowledges that areas north of the Caloosahatchee River would only support a small number of Florida panthers and that there are significant impediments (i.e., agricultural land uses and highways) to movement from south to north.

The Project Area is outside of the USFWS Consultation Area for the species.

7.3.20 Florida Panther "May Affect" Determination

7.3.20.1 Mortality

The Project is within a Thatcher Dispersal Pathway within the Florida panther Focus Area so some potential for effect is expected, however, no mortality of Florida panther is expected from construction of the Project (Figure 9). The number of Florida panthers estimated to use areas north of the Caloosahatchee River is low and construction activity will be occurring primarily during daylight hours. Since Florida panthers are primarily active at night, panthers that could be traversing the Project Area during construction would likely not interact directly with construction activity. Nonetheless, conservation measures have been included (Section 9) to reduce any potential effects on Florida panther, including application of onsite speed limits and worker awareness training about the species.

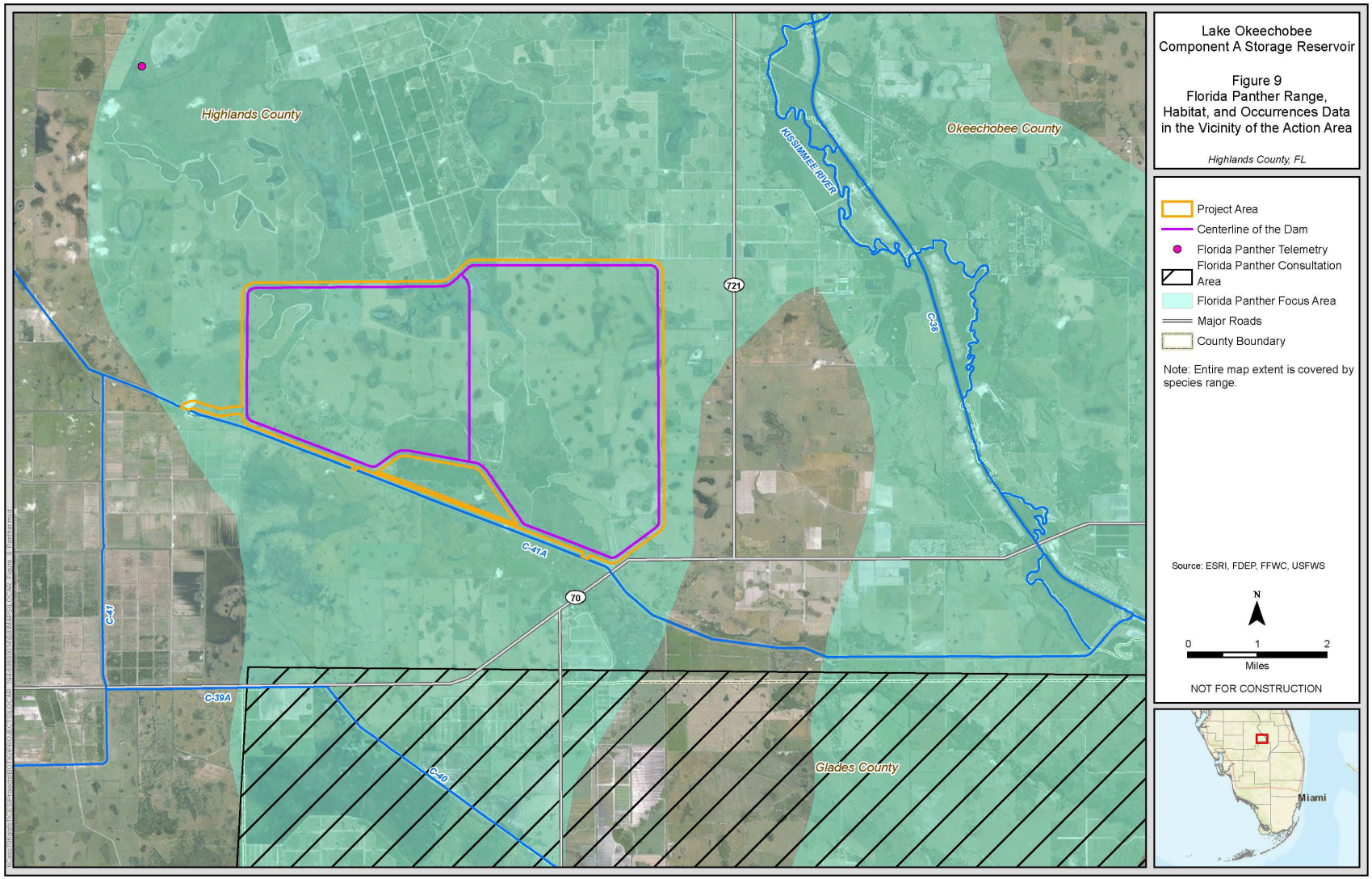
7.3.20.2 Harm Resulting from Habitat Loss

Conversion of approximately 12,392 acres of upland and wetland habitat to aboveground storage may affect the panther's dispersal pathways in the region. Though the Florida panther is a wide-ranging species with most sightings west and south of the Project Area, and there are likely only a small number of Florida panthers north of the Caloosahatchee River, it was determined that the Project "May Affect" the species. This determination is consistent with the Florida Panther Effect Determination Key (USFWS 2007) and is the result of the Project being located in an area deemed important for the expansion of the species into central Florida over time (Thatcher et al. 2009). The conversion of upland habitat to reservoir will require panthers to navigate around the Project in the future during dispersal events.

In order to quantify this habitat loss, the USFWS Panther Habitat Assessment Methodology was utilized (USFWS 2012, Appendix C). The methodology includes predetermined functional values for habitat types within the range of the species. The functional values are assigned different ratios depending on if they are located in a Primary Zone, a Secondary Zone, or an Other Zone. Since the Project Area is located in a Thatcher Dispersal Pathway within the Florida Panther Focus Area it was analyzed in the Other Zone category (Appendix C). To complete the Panther Habitat Assessment Workbook, Florida Cooperative Land Cover Data, Version 3.6 (FFWCC 2022) was utilized. The land cover classifications were cross walked into the Florida Land Use, Cover and Forms Classification Data, a subset of which are pre-populated in the habitat assessment workbook. This was done as a desktop exercise using existing data. No further interpretation of the data using air photo analysis nor field verification was completed.

The Project Area is primarily improved or unimproved pasture and march/wet prairie, along a few other habitat types. All of the exiting habitat in the Project Area will be converted to reservoir. The acres of existing habitat were entered in the Panther Habitat Assessment Workbook provided by the USFWS, as were the acre of habitat (i.e., reservoir) post construction. The functional value of the net habitat loss is calculated and is reported in the form of Panther Habitat Units (PHU) (Appendix C). The habitat lost due to Project construction equals 42,006 PHUs.

Compensatory mitigation can also be assessed in the Panther Habitat Assessment Workbook to ensure that enough Panther Habitat Units are provided to mitigate for any harm that could result from habitat loss from the Project. Compensatory mitigation lands were not assessed in the BA for the following reasons. First, it is not clear whether compensatory mitigation lands will be required for the Project, this is a determination that the USFWS will need to make during their review. Second, if compensatory mitigation lands are required, the Project is located within the boundaries of the CERP. The SFWMD Picayune Strand Restoration project is also a component of CERP. The habitat improvements for the Picayune Strand project resulted in a net gain of PHUs for the Florida panther and this net gain occurred in the Primary Zone. Currently, there are approximately 300,000 available PHUs in the Primary Zone should any of those PHUs be needed as compensation for Florida panther habitat loss from the Project. The USFWS Panther Habitat Assessment Methodology notes that the location of habitat compensation relative to habitat loss is important when considering the amount of PHUs required. They employ a Landscape Multiplier in this case to account for, for example, mitigation occurring in the Primary Zone for impacts occurring in the less important Other Zones, as is the case with this Project. The Landscape Multiplier in that case is 0.33 and is applied to the number of PHUs calculated for the Project. Therefore, if PHUs from the Picayune Strand Restoration project, which is in the Primary Zone, were utilized to compensate for PHUs lost from the Project, which is in the Other Zone, the 42,006 PHUs needed would be reduced to 13,862 (42,006 * 0.33 = 13,862).


Highlands County
Okeechobee County
Glades County
KISSIMMEE RIVER
C-38
C-41A
C-41
C-39A
C-40
721
70
Lake Okeechobee
Component A Storage Reservoir
Figure 9
Florida Panther Range,
Habitat, and Occurrences Data
in the Vicinity of the Action Area
Highlands County, FL
Project Area
Centerline of the Dam
Florida Panther Telemetry
Florida Panther Consultation Area
Florida Panther Focus Area
Major Roads
County Boundary
Note: Entire map extent is covered by species range.
Source: ESRI, FDEP, FFWC, USFWS
N
0
1
2
Miles
NOT FOR CONSTRUCTION
Miami

7.3.21 Florida Bonneted Bat

The endangered Florida bonneted bat is Florida's largest bat, weighing approximately 1.1 to 2.0 ounces, with a 19- to 21-inch wingspan and a body length of 5.1 to 6.5 inches. The species has dark brown fur and large broad ears that join together and slant forward over the eyes. Roosting habitat in central and southern Florida include: pine rocklands (south Florida rockland, rockland pine forest, rockland hammock); cypress communities (cypress swamps, strand swamps, domes, sloughs, ponds); hydric pine flatwoods (wet flatwoods); mesic pine flatwoods; and high pine (87 FR 71466-71501). Florida bonneted bats roost in tree cavities, rocky outcrops, and dead palm fronds. In residential communities, the bats roost in Spanish tile roofs, but have also been found in attics, rock or brick chimneys, and fireplaces of old buildings (FFWCC 2011). Colonies are small, with the largest reported as just a few dozen individuals. Diverse, open foraging habitats (e.g., prairies, riverine habitat) are also important. This large bat relies on swarms of larger insects for feeding; thus, foraging habitat for the Florida bonneted bat consists of areas that hatch and concentrate insects of this size, including vegetated areas and waterways (87 FR 71466-71501). These bats also frequently feed on insects from agricultural areas and golf courses (Bailey et al. 2017). Female bats give birth to a single pup from June through September (FFWCC 2011); however, limited data suggests that a female may undergo a second birthing season possibly in January or February.

The Florida bonneted bat is Florida's only endemic bat. Based upon the results of numerous surveys conducted across southern Florida since 2003, this species appears to occur predominately in central, southwest, and extreme south (mainland) Florida, with the core range primarily consisting of habitat within Polk, Charlotte, Lee, Collier, Monroe (mainland), and Miami-Dade Counties. Recent data also indicate use of portions of Highlands, Okeechobee, Glades, Palm Beach, and Broward Counties and possible use of areas within Osceola, Sarasota, and De Soto Counties (USFWS 2018b). Loss of suitable habitat is believed to be the primary cause of population declines. Other perceived threats include pesticide and herbicide use, which decrease populations of insects, the bat's primary prey. Figure 10 shows the Florida bonneted bat range and USFWS Florida bonneted bat Consultation Area, both of which overlap the Project Area.

Due to the species' small range, the greatest threats to Florida bonneted bats are loss of habitat, including the destruction of natural roost sites, and natural disasters, such as hurricanes, since the impact could occur throughout its entire range. Other perceived threats include pesticide and herbicide use, which decreases the population of insects, the bat's primary prey. Critical habitat has not yet been designated for this species.

7.3.22 Florida Bonneted Bat "May Affect" Determination

7.3.22.1 Mortality

The Project Area is located is the USFWS Florida bonneted bat consultation area. Florida bonneted bat may use the Project Area for roosting, foraging, and drinking habitat. There are locations in the Project Area where potential roost trees occur, though most of the Project Area only provides foraging habitat. Preconstruction acoustic surveys would be completed to identify whether roost trees are occupied by bats. This is consistent with the Consultation Key for the Florida bonneted bat (USFWS 2019). If bats are encountered, the Corps will coordinate measures with the USFWS to minimize or avoid potentially adverse effects. No mortality of individuals is anticipated during construction or operation of the facility.

7.3.22.2 Harm Resulting from Habitat Loss

The implementation of the Project would retain some benefits to Florida bonneted bat with the creation of aboveground water storage available for foraging and drinking, though it would replace more natural wetland complexes, which also provide this type of habitat and likely support higher concentrations of prey. The Project will remove 12,392 acres of more natural wetland/upland habitat matrix, including grassland and shrubland with intermixed wetlands (Figure 4; Table 2) and replace it with 12,392 acres of aboveground reservoir. Due to the presence of potential roost trees and the amount of foraging habitat being removed, the Corps has determined that the Project "May Affect" Florida bonneted bat. This determination is consistent with the Florida bonneted bat Consultation Guidelines (USFWS 2019).


Lake Okeechobee
Component A Storage Reservoir
Figure 10
Florida Bonneted Bat Range, Habitat, and Occurrences Data in the Vicinity of the Action Area
Highlands County, FL
Project Area
Centerline of the Dam
Florida Bonneted Bat Range
Florida Bonneted Bat Consultation Area
Highway
County Boundary
Source: ESRI, FDEP, USFWS
N
0
4
8
Miles
NOT FOR CONSTRUCTION
Lake Istokpoga
Lake Okeechobee
Miami
441
98
27
411

7.3.23 Tricolored Bat

On September 14, 2022, the USFWS proposed to list the tricolored bat (*Perimyotis subflavus*) as endangered under the Endangered Species Act (87 FR 56381). That proposal was out for public review at the time of this writing. Designation of critical habitat was deemed not prudent at the time of the proposed listing. Not knowing the timing of the final listing decision, the Corps has decided to assume that tricolored bat habitat is present in the Project Area and that removal of habitat will occur as the result of the Project.

The tricolored bat is a small insectivorous bat that ranges across the eastern and central United States and portions of southern Canada, Mexico and Central America. In Florida, the species is found throughout the entire state except for the Keys, but the species is rarely encountered and therefore considered uncommon in the state. Limited knowledge exists about tricolored bat typical home ranges, but different study sites generally found that tricolored bats restricted their movements to a few kilometers or less (Perry and Thill 2007, O'Keefe et al. 2009). A study in Kentucky and Tennessee found that tricolored bats remained within 2.5 kilometers of their original capture site (Schaefer 2017).

During the winter, tricolored bats are often found in caves and abandoned mines, although in the southern United States, where caves are sparse, tricolored bats are often found roosting in road-associated culverts where they exhibit shorter torpor bouts and forage during warm nights. Like other species, tricolored bats face extinction due primarily to the rangewide impacts of white-nosed syndrome (WNS). Compared with various other North American bat species, the hibernation preferences of the tricolored bat for warm cave areas and higher humidity are thought to increase susceptibility for WNS as these reflect ideal conditions for *Pseudogymnoascus destructans* (the fungi that causes WNS; Fujita and Kunz 1984, Briggler and Prather 2003, Quinn and Broders 2007, CBD and DW 2016).

During the spring, summer, and fall, tricolored bats are found in forested habitats where they roost in trees, primarily among leaves of live or recently dead deciduous hardwood trees, but may also be found in Spanish moss, pine trees, and occasionally human structures. Historically, the tricolored bat has been observed in tree and foliage roosts (Findley 1954, Jennings 1958, Davis and Mumford 1962). Recent summer telemetry studies have shown that tricolored bats commonly use tree roosts during the summer and most of the roost substrates are foliage. Thus, the tricolored bat is currently considered a foliage roosting species (IUCN 2008). Many bats, including tricolored bats, are known to share roost trees or use the same tree over successive days before roost switching (Owen et al. 2002, Perry and Thill 2007).

Analyses of foliage roosting bat studies across many foliage roosting species, including the tricolored bat, showed a preference by bats for roost trees with a larger diameter at breast height, greater height, and more closed canopy compared with random trees (Kalcounis-Rüppell et al. 2005). In most of the range of the tricolored bat where tree foliage was used as the roost substrate, the species of tree had a significant effect on tree use by bats (Veilleux 2001, Perry and Thill 2007, O'Keefe 2009). In addition, tricolored bats are thought to prefer areas near water and riparian zones, more so than other sympatric bat species (Fujita and Kunz 1984, Owen et al. 2004, Ford et al. 2005, Menzel et al. 2005).

7.3.24 Tricolored Bat "May Affect" Determination

7.3.24.1 Mortality

Tricolored bat may use the Project Area for roosting, foraging, and drinking habitat. There are locations in the proposed reservoir boundary where potential roost trees occur, though most of the Project Area only provides foraging habitat. Preconstruction acoustic surveys would be completed to identify whether roost trees are occupied by bats. If bats are encountered, the Corps will coordinate measures with the USFWS to minimize or avoid potentially adverse effects. No mortality of individuals is anticipated during construction or operation of the facility.

7.3.24.2 Harm Resulting from Habitat Loss

The Project would retain some benefits to tricolored bat with the creation of aboveground water storage available for foraging and drinking, though it would replace more natural wetland complexes, which also provide this type of habitat and likely support higher concentrations of prey. The Project will remove 12,392 acres of more natural wetland/upland habitat matrix, including grassland and shrubland with intermixed wetlands (Figure 4; Table 2) and replace it with 12,392 acres of aboveground reservoir. Due to the presence of potential roost trees and the amount of foraging habitat being removed, the Corps has determined that the Project "May Affect" tricolored bat.

8. CUMULATIVE EFFECTS ANALYSIS

The cumulative effects analysis includes the consideration of past, present, and reasonably foreseeable future actions in the Project Area.

8.1 Past Actions

Water management and urbanization resulted in the degradation of existing habitat function and habitat loss, leading to negative population trends of threatened and endangered species. This included land management practices that altered native habitats (e.g., agriculture) making them less desirable to native species, including those listed under the ESA.

8.2 Present Actions

Ongoing efforts have been made by federal and state agencies to implement projects to improve hydrology within the Project Area, thus improving habitat for some threatened and endangered species. The proposed action described in this document is included in that list. While it will result in some habitat loss for listed species, as describe, it will also contribute to long-term efforts to better manage habitat function, particularly those tied to regional hydrology.

8.3 Reasonably Foreseeable Future Actions

A number of projects, such as the Dispersed Water Storage managed by the state and other entities, immediately south of the Project Area, on the south side of the C-41 canal are planned in the area. The Brighton Reservation is planning a reservoir that will be managed for water retention and will likely result in the removal of wetland and upland habitat. Finally, there is a wetland attenuation feature to the southeast of the Kissimmee River, southeast of the Project Area, which is being constructed by a non-federal party for water quality treatment.

These projects could all contribute to the overall effect on eastern indigo snake habitat, crested caracara nesting and foraging habitat, Everglade snail kite nesting and foraging habitat, Florida panther movement habitat, Florida bonneted bat roosting habitat. The main effect to these species includes removal of uplands, which is replaced by the restoration of and creation of wetlands or the construction of reservoirs. The creation of wetlands just south of C-41 will increase suitable habitat in the region for eastern black rail and foraging habitat for Florida bonneted bat and tricolored bat. The removal of nesting substrate (i.e., cabbage palms) for crested caracara may only be a temporary effect, as they are likely to reestablish in the restored areas over time. The same is true for the construction of reservoirs on the Brighton Reservation and in another location just southeast of the Project Area. In those instances, the projects will result in the complete removal of habitat and will have similar effects to those discussed in this BA for the species shown in Table 4.

8.4 Summary of Cumulative Effects

Habitat improvement, monitoring, and management of threatened and endangered species at a regional scale are anticipated to allow populations to be maintained into the future. Stabilization, and in some cases increases in populations, are expected to be facilitated by the restoration and enhancement of suitable habitat through efforts to restore more natural hydrologic conditions within the Project Area.

9. CONSERVATION MEASURES

The Corps acknowledges the potential usage and occurrence of the previously discussed threatened and endangered species and/or critical habitat within the Project Area. The Corps commits to minimizing effects of the Project to the greatest extent possible in both the planning and construction phases of the Project:

1. Standard protection measures regarding the eastern indigo snake, West Indian (Florida) manatee, Florida panther, Everglade snail kite, wood stork, and crested caracara shall be included in the environmental protection plan when the Corps proceeds to the plans and specifications phase of this Project. The Corps proposes specific minimization measures as part of the Project, such as preconstruction acoustical and roost surveys and the use of avoidance buffers around known roosts to significantly reduce the potential adverse effects to the Florida bonneted bat as a result of construction activities.
2. The Corps shall conduct focused species surveys prior to construction of the Project for crested caracara, Everglade's snail kite, eastern black rail, Florida scrub jay (only if potential habitat is encountered), Florida bonneted bat and tricolored bat. Results of the focused surveys will be communicated with USFWS to get guidance on avoidance and minimization measures for any species that are identified within the Project Area.
3. Due to the probability that threatened and endangered species may be present in construction sites, the Corps has proposed training for contractors and sub-contractors on how to identify each species. Educational signs with pictures of each federally listed species will be posted to inform the contractors about these species. Any state-listed or federally listed threatened or endangered species observed at the site during construction activities will be recorded, including location sighted.

4. Turbidity screening and diversion will be used to control effects to the drainage ditches and connected canals. Runoff from the construction site or storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, and any measures required by area wide plans approved under paragraph 208 of the Clean Water Act. Temporary and permanent erosion and sedimentation control features or screening will be installed.
5. In addition, during construction, the Contractor will be responsible for keeping construction activities, including refueling and maintenance sites, under surveillance, management, and control to avoid pollution of surface, ground waters, and wetlands. The Contractor is responsible for conducting all operations in a manner to minimize turbidity and shall conform to all water quality standards as prescribed by Chapter 62-302, State of Florida, Florida Department of Environmental Protection.
6. Project construction shall not destroy migratory birds, their active nests, their eggs, or their hatchlings. Monitoring for such would be required by the construction Contractor. A buffer zone around active nests or nestling activity would be required during the nesting season.
7. Construction traffic will observe a speed limit no greater than 25 mph in the Project Area during construction in order to minimize vehicle/wildlife interactions, particularly Florida panther.

Applicable listed species guidelines and conservation measures will be followed and coordinated with the USFWS. The Corps would implement construction conservation measures as outlined in the Standard Protection Measures for eastern Black Rails, Habitat Management Guidelines for the Wood Stork in the Southeast Region, Standard Protection Measures for Florida Manatee, Draft Standard Protection Measures for the Eastern Indigo Snake, and Draft Species Conservation Guidelines for Audubon's (Florida) Crested Caracara to avoid and minimize adverse effects on those species during construction activities. Monitoring for listed species that could occur in or around the Project Area during construction would be specified in the contract specifications.

10. CONCLUSIONS

The Corps acknowledges the probable existence of 29 federally listed or proposed threatened and/or endangered species within the boundaries of the Project Area. This BA was prepared with the best available scientific and commercial information. Federally threatened or endangered species that are known to exist or potentially exist within proximity of the Project, but which would not likely be of concern due to the proposed Project, are discussed in Table 4.

The conversion of approximately 12,392 acres of upland and wetland habitat to an aboveground storage area would result in a "May Affect" determination for the crested caracara, Eastern indigo snake, Eastern black rail, Florida panther, tricolored bat, and Florida bonneted bat.

The slight change in lake levels within Lake Okeechobee would also likely benefit the Everglade snail kite and its critical habitat, wood stork, manatee, and Lake Okeechobee gourd by providing more time within the beneficial lake stages. The seagrasses within the rivers and estuaries will benefit from the expected decrease in high velocity releases from Lake Okeechobee, which therefore benefits Florida manatee.

Appropriate conservation measures and survey protocol will be followed throughout the design phase and all stages of construction and will also be coordinated with the USFWS. Adaptive management will be applied throughout construction, allowing for unforeseen issues to be addressed if they arise.

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Appendix A

Information for Planning and Consultation (IPaC) Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Florida Ecological Services Field Office
1339 20th Street
Vero Beach, FL 32960-3559
Phone: (772) 562-3909 Fax: (772) 562-4288
Email Address: fw4flesregs@fws.gov
https://www.fws.gov/office/florida-ecological-services

In Reply Refer To: June 22, 2023
Project Code: 2023-0096775
Project Name: Lake Okeechobee Component A Reservoir (LOCAR)

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. **Please include your Project Code, listed at the top of this letter, in all subsequent correspondence regarding this project.** Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see https://www.fws.gov/birds/policies-and-regulations.php.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of

this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Florida Ecological Services Field Office
1339 20th Street
Vero Beach, FL 32960-3559
(772) 562-3909

PROJECT SUMMARY

Project Code: 2023-0096775
Project Name: Lake Okeechobee Component A Reservoir (LOCAR)
Project Type: Water Supply Facility - New Constr
Project Description: LOCAR includes a 200,000-acre-foot (ac-ft) aboveground storage reservoir north of the C-41A. The reservoir would cover an area of approximately 13,000 ac and be designed to have an average storage depth of 18 ft at its normal full-storage level. The reservoir would include two pump stations, two outflow culverts, an outflow canal, an interior divider dam with a gated control structure, and two ungated overflow spillways.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@27.26851095,-81.11809904432636,14z

Counties: Highlands County, Florida

ENDANGERED SPECIES ACT SPECIES

There is a total of 28 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Florida Bonneted Bat *Eumops floridanus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8630	Endangered
Florida Panther *Puma (=Felis) concolor coryi* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1763	Endangered
Puma (=mountain Lion) *Puma (=Felis) concolor (all subsp. except coryi)* Population: FL No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6049	Similarity of Appearance (Threatened)

BIRDS

NAME	STATUS
Audubon's Crested Caracara *Polyborus plancus audubonii* Population: FL pop. No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8250	Threatened
Eastern Black Rail *Laterallus jamaicensis ssp. jamaicensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10477	Threatened
Everglade Snail Kite *Rostrhamus sociabilis plumbeus* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/7713	Endangered
Florida Grasshopper Sparrow *Ammodramus savannarum floridanus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/32	Endangered
Whooping Crane *Grus americana* Population: U.S.A. (AL, AR, CO, FL, GA, ID, IL, IN, IA, KY, LA, MI, MN, MS, MO, NC, NM, OH, SC, TN, UT, VA, WI, WV, western half of WY) No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/758	Experimental Population, Non-Essential
Wood Stork *Mycteria americana* Population: AL, FL, GA, MS, NC, SC No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8477 General project design guidelines: https://ipac.ecosphere.fws.gov/project/F4CYEAYX25BW5HQPWQX75ELT44/documents/generated/6954.pdf	Threatened

REPTILES

NAME	STATUS
American Alligator *Alligator mississippiensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/776	Similarity of Appearance (Threatened)
Eastern Indigo Snake *Drymarchon couperi* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/646	Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

FLOWERING PLANTS

NAME	STATUS
Avon Park Harebells *Crotalaria avonensis* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7093	Endangered
Carter's Mustard *Warea carteri* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5583	Endangered
Florida Ziziphus *Ziziphus celata* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2950	Endangered
Garrett's Mint *Dicerandra christmanii* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8333	Endangered
Highlands Scrub Hypericum *Hypericum cumulicola* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2940	Endangered
Lewton's Polygala *Polygala lewtonii* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6688	Endangered
Papery Whitlow-wort *Paronychia chartacea* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1465	Threatened
Pigeon Wings *Clitoria fragrans* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/991	Threatened
Pygmy Fringe-tree *Chionanthus pygmaeus* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1084	Endangered
Sandlace *Polygonella myriophylla* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5745	Endangered
Scrub Blazingstar *Liatris ohlingerae*	Endangered

NAME	STATUS
Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/864	
Scrub Mint *Dicerandra frutescens* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/799	Endangered
Short-leaved Rosemary *Conradina brevifolia* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2929	Endangered
Snakeroot *Eryngium cuneifolium* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7487	Endangered
Wireweed *Polygonella basiramia* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1718	Endangered

LICHENS

NAME	STATUS
Florida Perforate Cladonia *Cladonia perforata* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7516	Endangered

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

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1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American Kestrel *Falco sparverius paulus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9587	Breeds Apr 1 to Aug 31
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Sep 1 to Jul 31

NAME	BREEDING SEASON
Black Skimmer *Rynchops niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/5234	Breeds May 20 to Sep 15
Great Blue Heron *Ardea herodias occidentalis* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds Jan 1 to Dec 31
King Rail *Rallus elegans* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8936	Breeds May 1 to Sep 5
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Prairie Warbler *Dendroica discolor* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31
Swallow-tailed Kite *Elanoides forficatus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8938	Breeds Mar 10 to Jun 30

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee

was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.

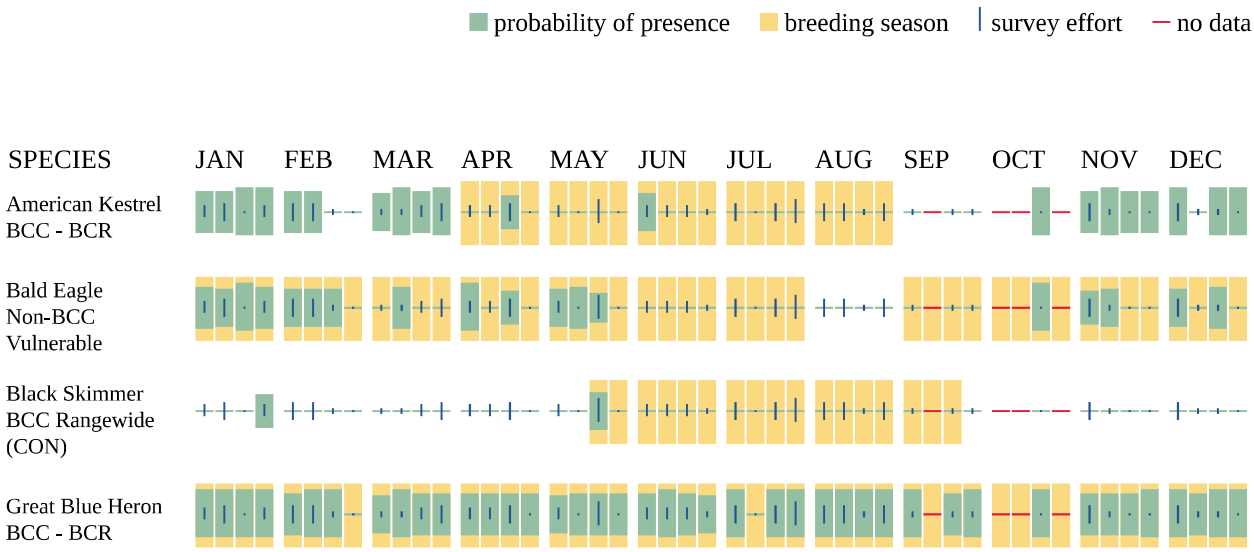
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

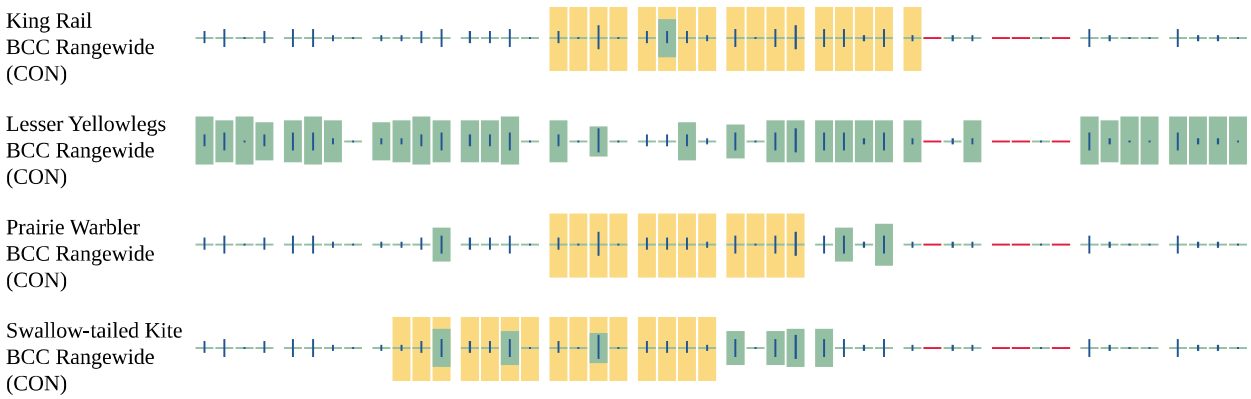
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.





Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

MIGRATORY BIRDS FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?
The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?
To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?
Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects
For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides

birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?
If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report
The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

FRESHWATER FORESTED/SHRUB WETLAND

- PSS1/3Ad
- PSS3Ad
- PSS1/3Cd
- PFO3A
- PSS1Cd
- PSS1Fd
- PSS1/3C

RIVERINE

- R2UBHx
- R5UBFx
- R5UBH

FRESHWATER EMERGENT WETLAND

- PEM1Cd
- PEM1Ad
- PEM1Fd
- PEM1Fx

FRESHWATER POND

- PUBHx
- PUBH

LAKE

- L1UBHx
- L2ABHx
- L2ABFx

IPAC USER CONTACT INFORMATION

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LEAD AGENCY CONTACT INFORMATION

Lead Agency: Army Corps of Engineers

Appendix B

Wood Stork Prey Biomass Calculation

The wetland class and related hydroperiod included in this Wood Stork Biomass Assessment worksheet is based on National Wetland Inventory data and not field delineations. The percent of exotics is based on general observations during a field visit in May 2023, but an assessment was not made for each individual wetland.

IMPACT AREA									
Hydroperiods	**Acres**	**% exotics**	**F.S.V**	**m^2**	**m^2 suitable**	**fish g/m^2**	**available fish**	**32.5% consum.**	**Biomass (kg)**
Class 1 (0-60 days)	30.74	0-25	1	124,400.88	124,400.88	0.26	32,344.23	10,511.87	10.51
Class 2 (60-120 days)	0.00	0-25	1	0.00	0.00	0.52	0.00	0.00	0.00
Class 3 (120-180 days)	1,020.80	0-25	1	4,131,047.96	4,131,047.96	1.196	4,940,733.36	1,605,738.34	1,605.74
Class 4 (180-240 days)	1,005.97	0-25	1	4,071,032.83	4,071,032.83	2.184	8,891,135.70	2,889,619.10	2,889.62
Class 5 (240-300 days)	57.45	0-25	1	232,492.85	232,492.85	2.704	628,660.68	204,314.72	204.31
Class 6 (300-330 days)	465.78	0-25	1	1,884,952.51	1,884,952.51	3.12	5,881,051.82	1,911,341.84	1,911.34
Class 7 (330-365 days)	90.28	0-25	1	365,351.69	365,351.69	3.38	1,234,888.73	401,338.84	401.34
			FALSE	0.00	0.00	FALSE	0.00	0.00	0.00
			FALSE	0.00	0.00	FALSE	0.00	0.00	0.00
			FALSE	0.00	0.00	FALSE	0.00	0.00	0.00
			FALSE	0.00	0.00	FALSE	0.00	0.00	0.00
			FALSE	0.00	0.00	FALSE	0.00	0.00	0.00
			FALSE	0.00	0.00	FALSE	0.00	0.00	0.00
			FALSE	0.00	0.00	FALSE	0.00	0.00	0.00
			FALSE	0.00	0.00	FALSE	0.00	0.00	0.00
TOTAL	**2,671.02**								**7,022.86**

Appendix C

Florida Panther Habitat Assessment

PROJECT WORKSHEET

Habitat Type	*Assigned value*	Habitat types of land to be developed (hectares)				Habitat types of land after development (hectares)			
		Primary/d Zone	Secondary Zone	Other Zone	Primary Equivalent Habitat Units	Primary/d Zone	Secondary Zone	Other Zone	Primary Equivalent Habitat Units
Pine forest	9.5				0				0
Hardwood-Pine	9.3				0				0
Cypress swamp	9.2				0				0
Hardwood swamp	9.2			12	37				0
Hardwood Forest	9				0				0
Dry prairie	6.3			39	82				0
Unimproved pasture	5.7			1895	3601				0
Shrub swamp/brush	5.5			22	40				0
Improved pasture	5.2			7534	13059				0
Cropland	4.8			19	30				0
Orchards/groves	4.7				0				0
Marsh/ wet prairie	4.7			2776	4349				0
Xeric scrub	4.5				0				0
Exotic/Nuisance plants	3				0				0
Coastal wetlands	3				0				0
Barren/Disturbed lands	3			17	17				0
Water	0			4	0				0
Urban	0			74	0				0
Reservoirs*					0			12392	0
STA*					0				0
TOTAL		0.00	0.00	12392.00	21214.93	0.00	0.00	12392.00	0.00

CONTINUE

CLEAR SHEET

COMPENSATION TO OFF-SET
42006
Habitat Units

*NOTE: The assigned value for Reservoirs and STAs varies by size, proposed future management, and their position in the landscape.
See the associated methodology document for guidance on starting values and considerations.

Appendix D

LOCAR Benefit Model

APPENDIX D
LOCAR BENEFIT MODEL

Table of Contents

List of Tables

List of Figures

D LAKE OKECHOBEE COMPONENT A RESERVOIR BENEFIT MODEL

This appendix describes the documents and methodology used to quantify the ecological benefits and support plan evaluation, comparison, and selection for the Lake Okeechobee Component A Storage Reservoir (LOCAR or Project).

D.1 Model Documentation

The Department of the Army ER 1105-2-100, "Planning Guidance Notebook," requires that ecosystem restoration planning contribute to national ecosystem restoration (NER), which is measured in terms of increases in the net quantity and/or quality of desired ecosystem resources. The U.S. Army Corps of Engineers (Corps) uses NER benefits as the basis to compare alternatives and select plans for ecosystem restoration projects. The LOCAR planning model builds on previous planning models that underwent peer review per EC 1105-2-412, "Assuring Quality of Planning Models" and applies similar performance metrics.

D.2 Overview

The LOCAR planning model was specifically developed to evaluate Project alternatives for an aboveground storage reservoir used to store water that would otherwise go into Lake Okeechobee. The primary areas to be evaluated include Lake Okeechobee and the St. Lucie River and the Caloosahatchee River and Estuary (Northern Estuaries). The planning model was developed by South Florida Water Management (SFWMD) staff and the Jacksonville District Corps with support from multiple federal, state, and local agencies including the U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (EPA), Florida Fish and Wildlife Commission (FWC), Florida Department of Environmental Protection (FDEP), Natural Resources Conservation Service (NRCS), Lee County, and Martin County. Members of the LOCAR Project team include Lake Okeechobee and estuary flora and fauna subject matter experts with extensive experience working in South Florida and Everglades wetland systems in the fields of ecology, hydrology, engineering, and planning.

Performance measures (PMs) were used to document the linkages between hydrologic output from models and ecosystem functions to evaluate the degree to which alternative plans met restoration objectives. Each of the PMs was updated from the prior Lake Okeechobee Watershed project based on the availability of new tools, changes to the landscape, updated knowledge on the system from peer-reviewed literature and technical reports, and Restoration, Coordination, and Verification (RECOVER) review comments. RECOVER is the interagency system-wide science team that supports Comprehensive Everglades Restoration Plan (CERP) projects. It is made up of Everglades scientists independent of the Project team. Several of the Project PMs for the planning effort were derived from those PMs approved for use in CERP by RECOVER. Each PM has a predictive target or comparable performance scores and process for how to measure the predicted performance of alternatives. Targets were based on peer-reviewed relationships between hydrology and ecological species or communities and technical synthesis reports of multiple data sources identifying restored conditions in Lake Okeechobee and the St. Lucie and Caloosahatchee Estuaries. PM scores were displayed as a function of restoration potential or achievement of the target. Habitat unit (HU) scores were produced by indexing the scores. The indexed scores were then multiplied by their proportion of the total index score for a given ecological zone and multiplied by the area to get the HUs. HUs are then evaluated for the Existing Conditions Baseline (ECB), Future Without

Project (FWO) condition, and Project alternatives to identify the best performer for each zone and the combined area.

D.2.1 Description of Project Performance Measures

Three PMs were developed to measure two study objectives (**Table D-1**) for two ecological zones (**Table D-2**):

1. **PM 1 Lake Okeechobee**–Hydrologic regimes in Lake Okeechobee specific to two criteria: 1) Lake stage envelope and 2) Extreme high and low lake stage.
2. **PM 2 Caloosahatchee Estuary Salinity**–Freshwater inflows to manage salinity in the Caloosahatchee Estuary to benefit native flora and fauna.
3. **PM 3 St. Lucie Estuary Salinity**–Freshwater inflows to manage salinity in the St. Lucie Estuary to benefit native flora and fauna.

The complete RECOVER-approved PM Documentation Sheets are located in **Subsection D.8**.

Table D-1. Study Objectives Linked to PMs.

Objective	PM 1 - Lake Okeechobee Stage	PM 2 – Caloosahatchee Estuary Salinity	PM 3 – St. Lucie Estuary Salinity
Improve timing and distribution of flows into Lake Okeechobee to maintain ecologically desired lake stage ranges.	Yes	N/A	N/A
Reduce flows from Lake Okeechobee to improve the salinity regime and the quality of oyster, submerged aquatic vegetation (SAV), and other estuarine community habitats in the Northern Estuaries.	N/A	Yes	Yes

Table D-2. Ecosystem Zones Linked to PMs.

Ecosystem Zones	PM 1	PM 2	PM 3
Lake Okeechobee	**Yes**	**Yes**	N/A
Estuaries–Oysters	N/A	**Yes**	**Yes**

D.2.2 Hydrologic Models Used

Several hydrologic modeling tools were used to provide the output used in PMs 1, 2, and 3. Each of the PMs has defined metrics and targets. The PMs are hydrologic metrics based on output from a regional hydrologic model—the Regional Simulation Model Basins (RSM-BN). This model was developed by the SFWMD Hydrology and Hydraulics Bureau. These models provided daily, detailed estimates of hydrology across the 52-year period of record (January 1965 to December 2016) and were used to evaluate system responses to Project alternatives.

The RSM-BN is a link-node model designed to simulate the transfer of water from a pre-defined set of watersheds, lakes, reservoirs, or any waterbody that receives or transmits water to another adjacent

waterbody. The model domain covers Lake Okeechobee and four major watersheds related to the northern portion of the Project Area: Kissimmee River, St. Lucie River, Caloosahatchee River, and Everglades Agricultural Area (EAA).

Model output was maintained in a data access, storage, and retrieval system managed by the SFWMD and Corps under the CERP Information and Data Management Program. Output for each PM sub-metric was provided in a comma-separated-value (csv) format with charts and graphics to aid in the assessment of restoration benefits.

PM targets were primarily based on output from the Natural System Model version 4.6.2 (NSM), which simulates the hydrologic response of a pre-drained Everglades. The NSM has been used as a planning tool in several Everglades restoration projects. Additional documentation of NSM can be found at https://www.sfwmd.gov/science-data/nsm-model.

The hydrologic models referenced above have been validated through the Corps Engineering Model Certification process established under the Engineering and Construction (E&C) Science and Engineering Technology (SET) initiative.

D.2.3 Spatial Extent of the Benefited Area

The Study Area includes Lake Okeechobee (PM 1; **Figure D-1**) and the Northern Estuaries (Caloosahatchee [PM2; **Figure D-2**] and St. Lucie [PM3; **Figure D-3**]).

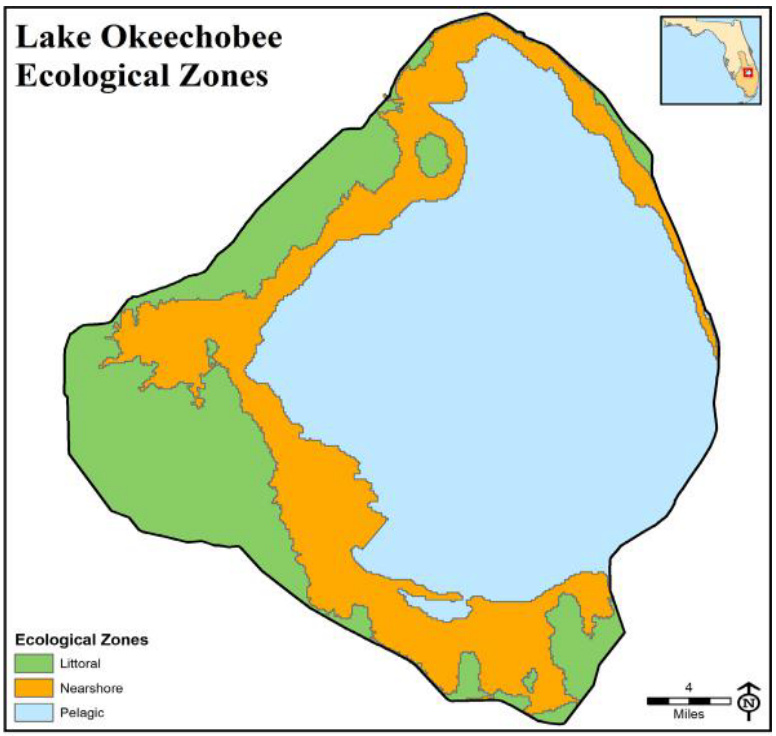
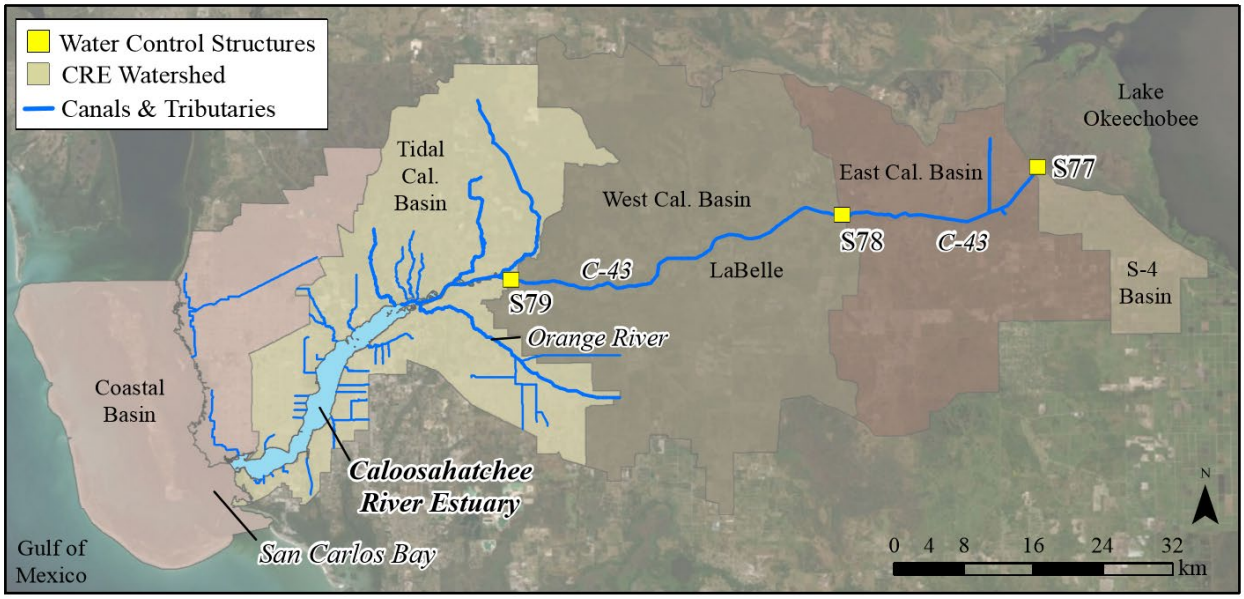
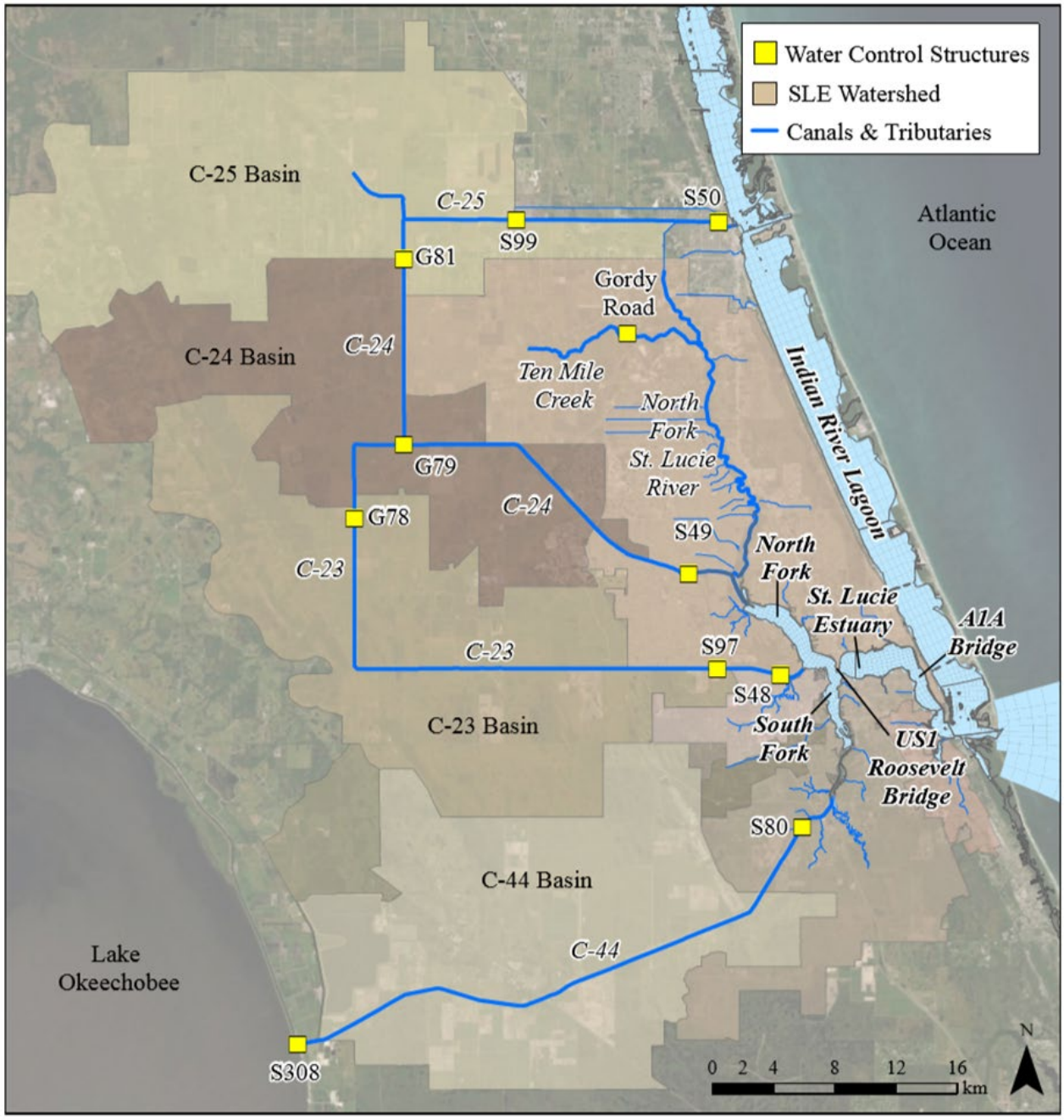


Figure D-1. Littoral, Nearshore, and Pelagic (Limnetic) Habitats in Lake Okeechobee (450,000 acres total).



Note: Oyster habitat in the Caloosahatchee River and Estuary (CRE) for use in benefits analysis is 980 acres (map from RECOVER 2020).

Figure D-2. Caloosahatchee Estuary Watershed, Connections to Lake Okeechobee and Tributaries, and Water Control Structures.



Note: Oyster habitat in the St. Lucie River and Estuary (SLE) for use in benefits analysis is 434 acres (map from RECOVER 2020).

Figure D-3. St. Lucie Estuary Watershed, Connections to Lake Okeechobee and Tributaries, and Water Control Structures.

D.3 Lake Okeechobee Benefit Calculations

This section describes the habitat unit calculations for Lake Okeechobee.

D.3.1 Lake Okeechobee Performance Measures

This subsection provides a brief description of the Lake Okeechobee PMs, including the target(s) for each, and the applicable metrics for the target(s).

D.3.1.1 PM 1.1 – Lake Okeechobee Stage Envelope Performance Measure

Historically, littoral marshes of Lake Okeechobee expanded well outside the current footprint of the lake, with high-water events pushing the lake laterally into short-hydroperiod wetlands in the surrounding watershed. Since construction of the levee (Herbert Hoover Dike), littoral marshes are restricted within the lake's current footprint. If lake stages are managed too high, the entire marsh retreats upslope, extirpating shorter hydroperiod wetlands at high elevations. If lake stages are managed too low, high elevation marshes transition to terrestrial communities, and the entire marsh moves downslope. Currently, the littoral marsh generally occupies elevations from the base of the surrounding levees (15.0 feet [ft] National Geodetic Vertical Datum of 1929 [NGVD29] to approximately 12.0 ft NGVD29 in elevation) (Havens 2002), although fringing stands of bulrush and aquatic grasses can extend to around 10.0 ft in elevation (Graham et al. 2020), and beds of submerged vegetation to 8.0 or 9.0 ft, when conditions allow (Havens et al. 2004). Lake stage has a profound effect on the health of these littoral marshes and the lake in general (Havens 2002), not just due to direct hydrologic relationships, but to the varying connectivity of the central, muddy portion of the lake with littoral and nearshore areas at different lake stages (Havens 1997). Seasonally variable water levels within the range of 12.0 ft (NGVD29) as a June to July low and 15.0 ft (NGVD29) as a November to January high have been supported by numerous studies (Johnson et al. 2007, Havens and Gawlik 2005, Havens 2002) as the best tradeoff between wet and dry conditions on the lake, supporting short- to long-hydroperiod communities and capturing key parameters. In order to establish seasonal targets and allow for inter-annual variation, an ecological envelope was created by establishing transitions to these high and low targets and adding a buffer; first in 2007 (RECOVER 2007) and then updated in 2020 (RECOVER 2021). The resulting envelope is a 12.0 ft to 15.0 ft seasonally variable stage, ranging from 14.5 to 15.5 ft in the winter and from 11.5 to 12.5 ft in the summer.

This PM is based on the amount of time lake stage remains within the desired envelope of 11.5 to 15.5 ft, and good performance should result in an increase in spatial extent of bulrush along the western lakeshore; increased spatial extent of spikerush, beakrush, willow, and other native plants in the littoral zone; increase in spatial extent of vascular submerged plants; a shift in taxonomic structure of zooplankton to better support fishery resources; an increase in diversity, distribution, and abundance of forage fish in the littoral and nearshore zones; and an increase in the use of the littoral zone for wading bird foraging and nesting.

Recovery from extreme high lake stage events can be expedited with low lake stages, as documented for submerged plants (Havens et al. 2004, Jin and Ji 2013) and for sport fish (Havens et al. 2005). Most evidence of recovery has been from extreme low events (under 10 ft) during regional droughts (2001, 2007, 2008, and 2011), but recent evidence from 2019 shows benefits of even moderate low stages (RECOVER 2020). Light penetration improves non-linearly on Lake Okeechobee as stages decline due to

the combination of reduced depth, shoreline bathymetry, reduced turbidity, reduced phytoplankton growth, and positive feedbacks to water clarity as SAV coverage expands. Therefore, impacts from high-water events are reduced both in duration and extent when followed by low lake stages.

As a result, two ecological envelopes were developed: one for normal conditions (Normal Envelope, **Figure D-4**), and one for lower stages (Recovery Envelope, **Figure D-5**) following years with high-water impacts. The use of two envelopes allows for variable targets based on antecedent conditions and defines the timing, duration, and frequency of low-water events.

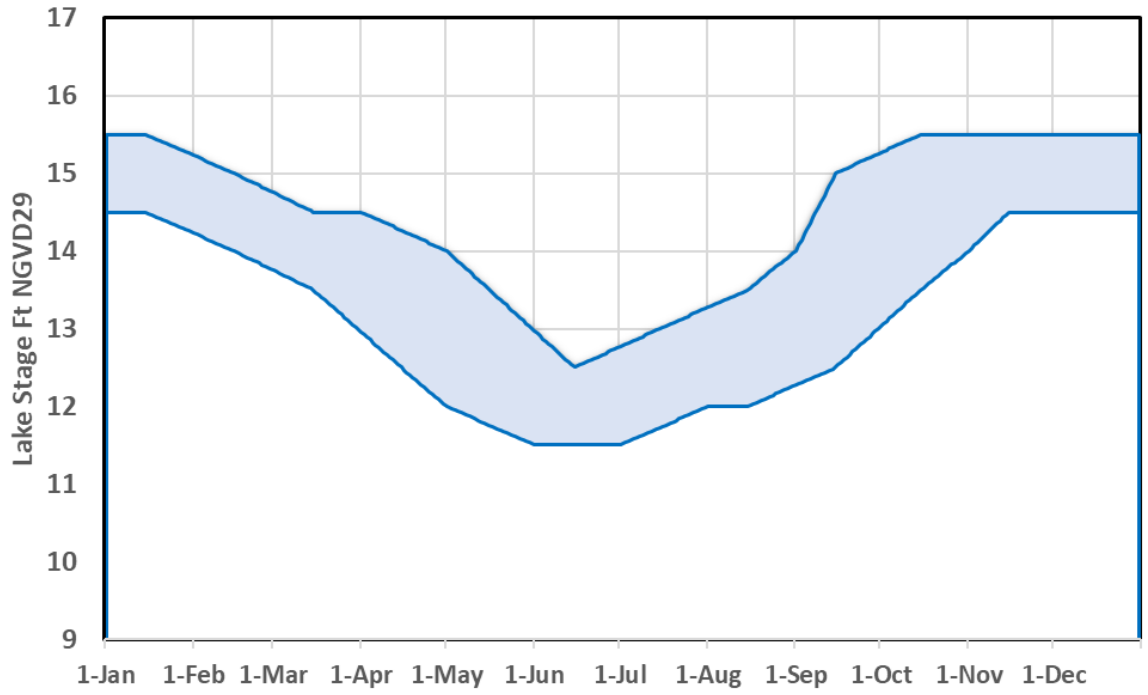


Figure D-4. Lake Okeechobee Stage Envelope Targets Under Normal Conditions.

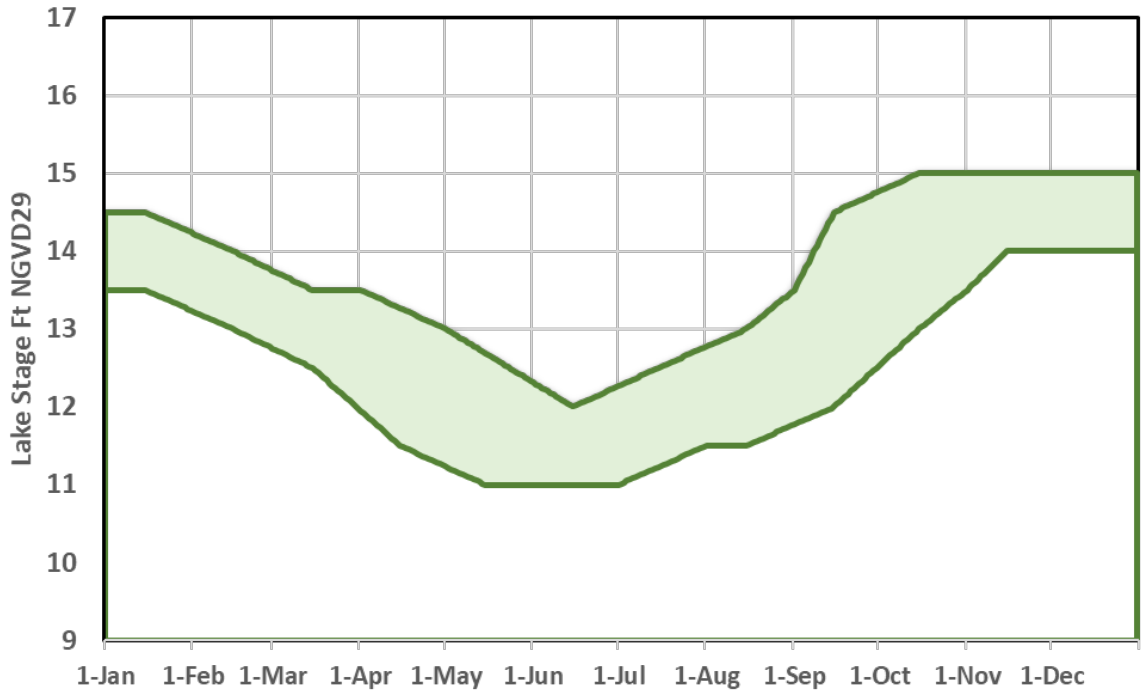


Figure D-5. Lake Okeechobee Stage Envelope Representing Lower Stage Targets After High-water Impacts to Lake Ecology.

The Recovery Envelope would be triggered when high-water events are likely to cause substantial stress to SAV or reductions in coverage if not followed by optimal growing conditions the following year. Historically, such events are related to hurricanes, extreme highs (over 17 ft), or high summer stages (Welch et al. 2019). The macroalgae muskgrass (*Chara* spp.) is a good indicator of SAV growing conditions on the lake (Harwell and Sharfstein 2009), dramatically increasing areal coverage when light penetration is high (Havens et al. 2002, Havens et al. 2004). The lowest coverage of this species is related to 30-day minimum summer stages over 13.0 ft (RECOVER 2020). Therefore, a shift from Normal to Recovery envelope (starting Jan 1) would occur when:

- Stages are over 17 ft (5.18 meters [m]) at any time of the year (e.g., 2003, 2004, 2005, 2017)

OR

- The 30-day minimum lake stage (elevations exposed for at least 30 days nonconsecutively) in the June 1 to July 31 window is over 13.0 ft (3.96 m), which represents the years (excluding hurricanes) with the lowest coverage of *Chara* on record (2003, 2010, 2013, 2016)

The thresholds for a shift back to the Normal envelope would similarly be related to SAV coverage (i.e., whether stages were low enough for long enough to allow sufficient germination, growth, and expansion of the populations to survive higher water in the winter and subsequent years). Earlier studies suggest that extreme low stages dry out areas that would otherwise be colonizable by vascular SAV species and that a more diverse community may not establish until 1 to 2 years after extreme low stages. Moderately low stages, however, recently produced rapid expansions of vascular and macroalgae SAV, with peak vascular biomass occurring at elevations that were dried or nearly dried out in the summer of 2019 (RECOVER 2020). The thresholds below approximately correspond to those conditions. However, when

heavy rainfall and/or tropical systems impact the lake after low stages, much or all the recovery process can be lost, as was observed in 2017 (low stages followed by rapid ascension rates and then Hurricane Irma) (Welch et al. 2019).

Therefore, a shift from Recovery Envelope to Normal Envelope (starting January 1) would occur when:

- Lake stages are below 12 ft (3.66 m) for 90 days (nonconsecutively) between April 15 and September 15

OR

- Stages are below 11.5 ft (3.51 m) for 60 days (nonconsecutively) between May 1 and August 1
- One of above criteria are met **AND** Lake stages do not exceed 16 ft (4.88 m) before January 1

Evaluation is based on the 52-year (January 1, 1965, to December 31, 2016) hydrograph of lake stages that is simulated by the RSM-BN model. Daily deviations of lake stage from the ecological envelope (Normal or Recovery, whichever has been triggered that year in the model) are determined, and a scoring factor is applied based on distance from the envelope and time of year (RECOVER 2020). This is done separately for stages above and stages below the envelope.

D.3.1.2 PM 1.2 – Lake Okeechobee Extreme High and Low Lake Stage Performance Measure

There is also a wide body of published research on the adverse impacts of extreme high and low water levels on the littoral and near-shore areas of Lake Okeechobee (Havens 2002). Extreme high stage (above 17 ft NGVD29) allows wind-driven waves to directly impact the littoral emergent plant and near-shore submerged plant communities, causing physical uprooting of plants. High stage also permits suspended solids from the mid-lake region (where unconsolidated sediments are thickest), which are transported to the shoreline regions, reducing water clarity and light penetration. This in turn reduces the depth at which SAV growth can occur (James and Havens 2005). High-stage conditions also allow deposition of unconsolidated mud which can cover the natural sand and peat sediment, reducing their ability to sustain healthy and balanced vegetative communities. At extreme high stage, nutrient-rich water from the mid-lake region is transported into the littoral zone where it causes changes in periphyton biomass and taxonomic structure and induces shifts in plant dominance including expansion of cattail and lily. Overall, high lake stages result in extirpation or reduced growth of emergent and submerged plants, adverse impacts to germination of submerged plants, reductions in fish spawning and fish reproductive success, and undesirable shifts among species in the macroinvertebrate community. Detailed research results regarding high stage impacts on the lake's plant and animal communities can be found in Maceina and Soballe (1990), Havens (1997), Havens et al. (1999), and Havens et al. (2001).

Conversely, extreme low stage (below 10 ft NGVD29) can result in desiccation of the entire littoral zone, the shoreline fringing bulrush zone, and nearly all of the lake area that would otherwise support submerged plants. As a consequence, in-lake habitat for reptiles, amphibians, wading birds, snail kites, apple snails, or fish that depend on aquatic plant-dominated regions for successful foraging and recruitment is severely compromised. Extreme low stage also encourages invasive exotic plants, such as torpedograss and melaleuca, to establish in areas of the littoral zone where they did not formerly occur, displacing native vegetation and increasing fire risk. Recovery from the impacts of prolonged low-stage events (below 10 ft mean sea level) is slow, requiring multiple years of appropriate stage regime to

recover, as documented for submerged plants by Havens et al. (2004) and for sport fish such as largemouth bass by Havens et al. (2005).

Evaluation is based on the 52-year (January 1, 1965, to December 31, 2016) hydrograph of lake stages that is simulated by the RSM-BN model. For extreme high and low lake stage events, a tally is made of the total number of weeks that the stage is above 17 ft or below 10 ft NGVD29.

D.3.2 Lake Okeechobee Habitat Unit Calculation

The calculation of ecosystem benefits (quantitative scoring) consisted of the following steps: 1) Normalize Scores—normalizing PMs output to a common scale of 0 to 1, 2) Weight scores and combine them, and 3) Calculate HUs—multiply the combined PM score by 450,000 acres, as lake stage conditions are considered to impact the entire lake.

In Step 1, PM scores were calculated for restoration alternatives and then scaled to a 0 to 1 scale using the normalization process described in this subsection for each PM. In Step 2, PM output scores are weighted by the severity of ecological impact associated with each PM, and in Step 3 they are multiplied by the area of the lake to generate HUs. The process is described in more detail below. See RECOVER (2020) for more information on scoring prior to normalization.

D.3.2.1 Lake Okeechobee – Normalization, Combining Score and Calculating HUs

Normalization

Raw scores from PMs can be normalized by setting boundary conditions, or best- and worst-case scenarios, to develop a relativized score. The best- and worst-case scenarios for each PM were set according to a recent Lake Okeechobee Regulation Schedule study, which provided scores for a variety of single-objective management strategies that represented realistic boundary conditions for the system based on a 52-year period of record (POR) (Iteration 1 results from the Lake Okeechobee System Operating Manual [LOSOM] development). All the response curves (shown below) convert the annual average of the raw scores for each component of the PM to a standardized scale of 0 to 1, expressed as a percentage. Once a standardized score is calculated, it can be converted to other units of measure, such as habitat units, and/or combined with other scores to get a weighted or non-weighted average score for any alternative being evaluated. This method can be used for any modeled POR since it is based on annual averages.

The approach assumes a linear increase in risk of ecological damage between the optimal and most severe conditions, which is the most conservative approach to take until there are data to support a more complex relationship. The equations below would need to be re-calculated if better boundary conditions for any PMs are identified in the future, but it can be used for any modeled POR since it is based on annual averages.

Lake Stage Envelope

Separate response curves were developed for stages above and below the envelope, based on assumptions of best- and worst-case performance for each.

- For scores above the envelope, the response curve is a line between average annual scores of 144.7 (target) and 816.3 (worst case). Raw scores can be converted using the following equation:

Standardized score (%) = raw score * -0.1489 + 121.550
(**Figure D-6a**)

- For deviation of lake stage below the envelope, the response curve is a line between 103.4 (target) and 464.6 (worst case). Raw scores can be converted using the following equation:

Standardized score (%) = raw score * -0.2769 +128.635
(**Figure D-6b**)

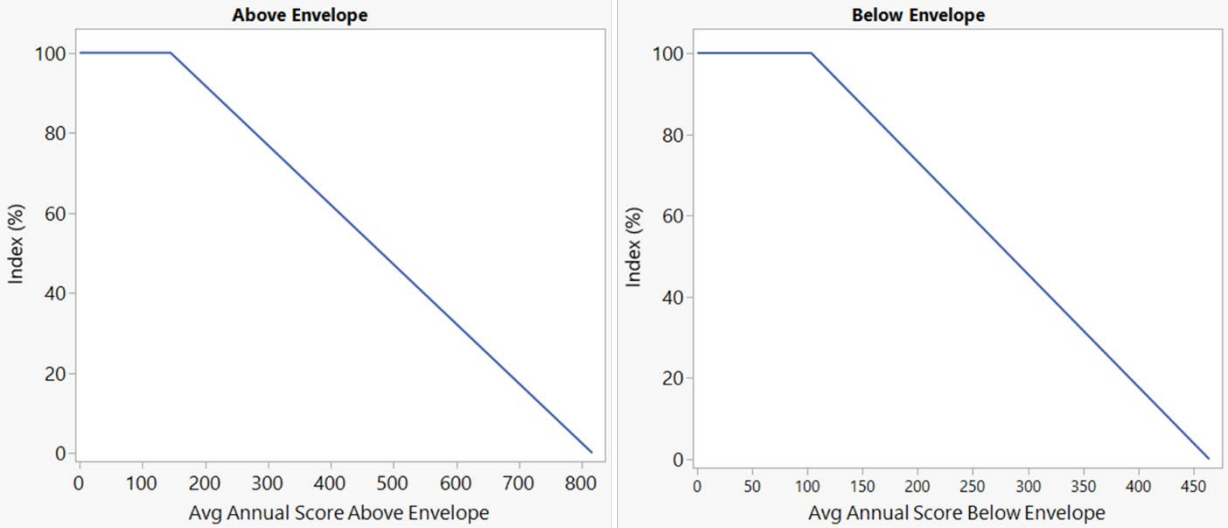


Figure D-6. Response Curves for Converting Raw Average Annual Scores to Normalized Scores for Above (a) and Below (b) Lake Stage Envelope Performance Measures.

High and Low Lake Stage

The same approach is used for high and low extreme stage PMs but based on percent duration (number of days in POR) above or below extreme stages.

- For time above 17 ft NGVD: The target is no exceedances, or 0 percent duration, and the worst-case scenario was 6 percent duration. The response curve is a line between 0 percent (target) and 6 percent (worst case). Raw scores can be converted using the following equation:

Standardized score (%) = raw score * -16.67 +100
(**Figure D-7a**)

- Time below 10 ft NGVD: The target is no exceedances, or 0 percent duration, and the worst-case scenario was 9 percent duration. The response curve is a line between 0 percent (target) and 9 percent (worst case). Raw scores can be converted using the following equation:

Standardized score (%) = raw score * -11.11 +100
(**Figure D-7b**)

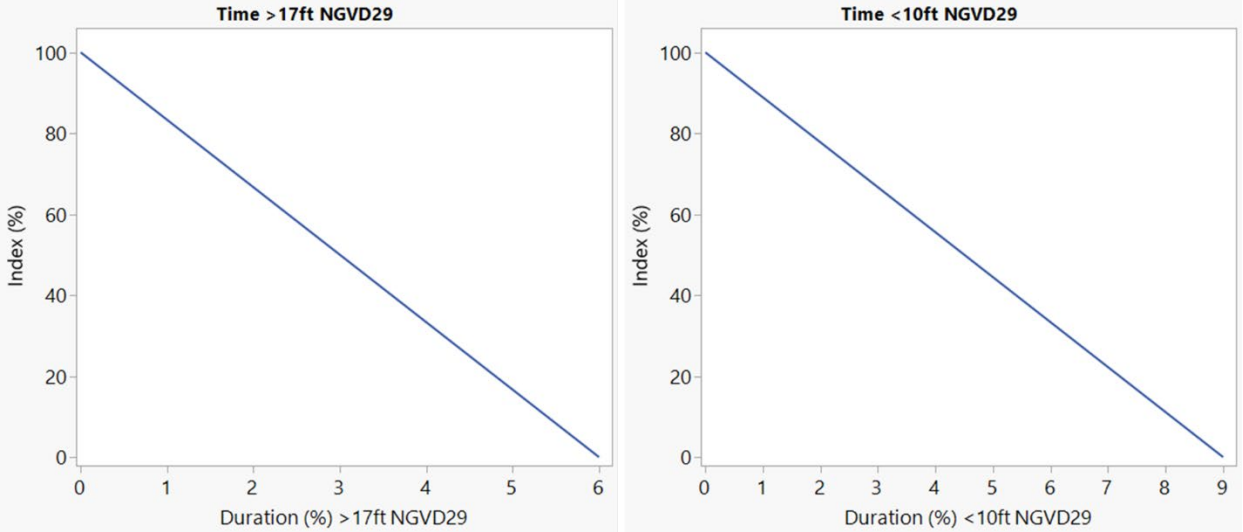


Figure D-7. Response Curves for Converting Percent Duration Above 17 ft NGVD (a) and Below 10 ft NGVD (b) Over the Period of Record to Normalized Scores.

Weighting of Normalized Performance Output

The four PMs are combined prior to calculating habitat units and weighted according to risk.

- High stage (above envelope and time above 17 ft NGVD) is applied a weight of 66.7 percent.
- Low stage (below envelope and time below 10 ft NGVD) is applied a weight of 33.3 percent.

The weighting formula for the Final Combined Score (%) =

[(PM Above Envelope +PM >17 ft) *0.667 + (PM Below Envelope +PM <10 ft) *0.333]/2

This approach is consistent with past research showing high stages can have potentially more damaging impacts to lake ecology than low stages, in that the latter can be beneficial if the return frequency is low enough. This method also accounts for the fact that raising lake stages to avoid low-stage impacts would be counterproductive in terms of lake health, because even the wettest possible schedules still have occasional droughts that overwhelm the system. The best long-term solution is to provide sufficient watershed storage to offset both high and low stages. Assigning more weight to high lake stage PMs effectively assigns better scores to alternatives that reduce both high and low stages vs alternatives that offset high stage scores with improvement in low stage scores (i.e., very wet alternatives).

Calculating Habitat Unit

The combined, weighted scores for each alternative are then multiped by 450,000 ac, the approximate size of Lake Okeechobee. **Figure D-8** shows the stage duration curves for the final array of alternatives. The total acres of lift for any alternative are equivalent to the difference between the FWO score and the alternative score.

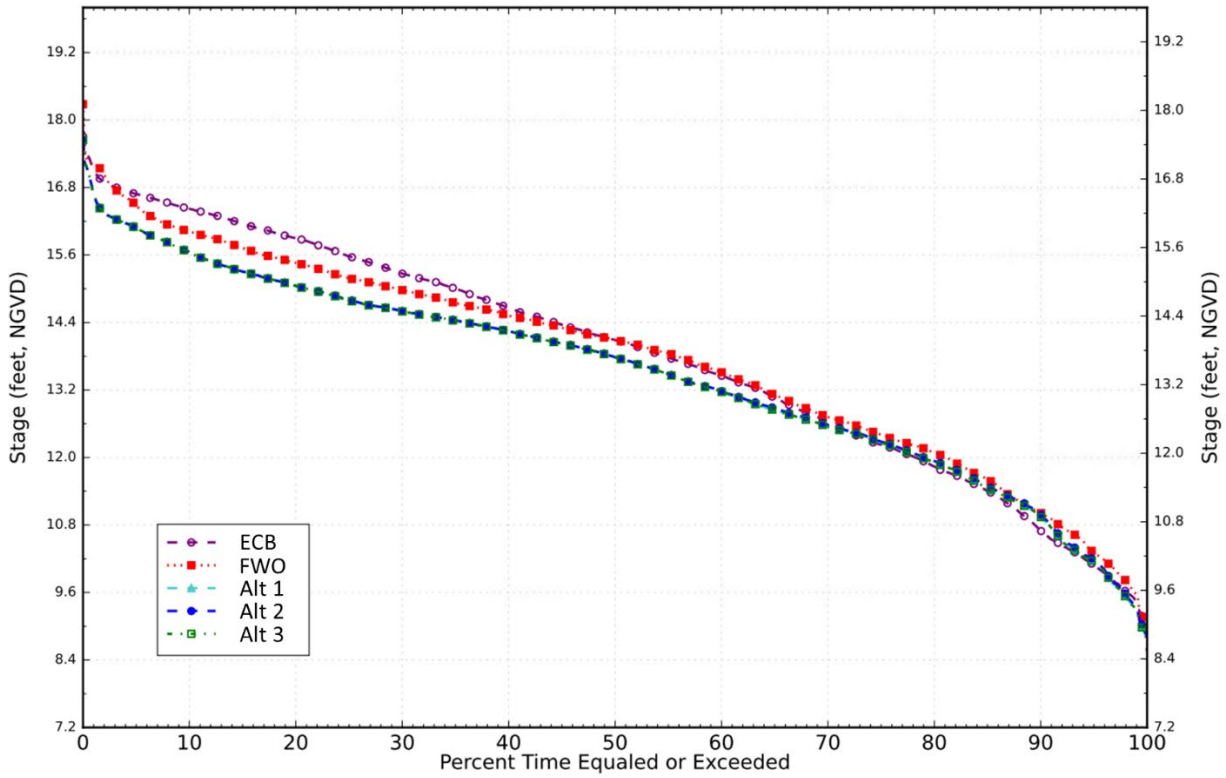


Figure D-8. Lake Okeechobee Stage Duration Curves for the Final Array of Alternatives.

D.3.2.2 Lake Okeechobee Stage PM HUs

Lake Okeechobee Stage Envelope and Extreme Stage PM

Outputs were normalized using the approach outlined above, creating individual scores of 0 to 100 percent for each metric (**Figure D-9)**. Those normalized scores for above and below the envelope, and above and below 17 ft and 10 ft NGVD29 were then weighted as described above, which are shown for the final array of alternatives in **Figure D-10**.

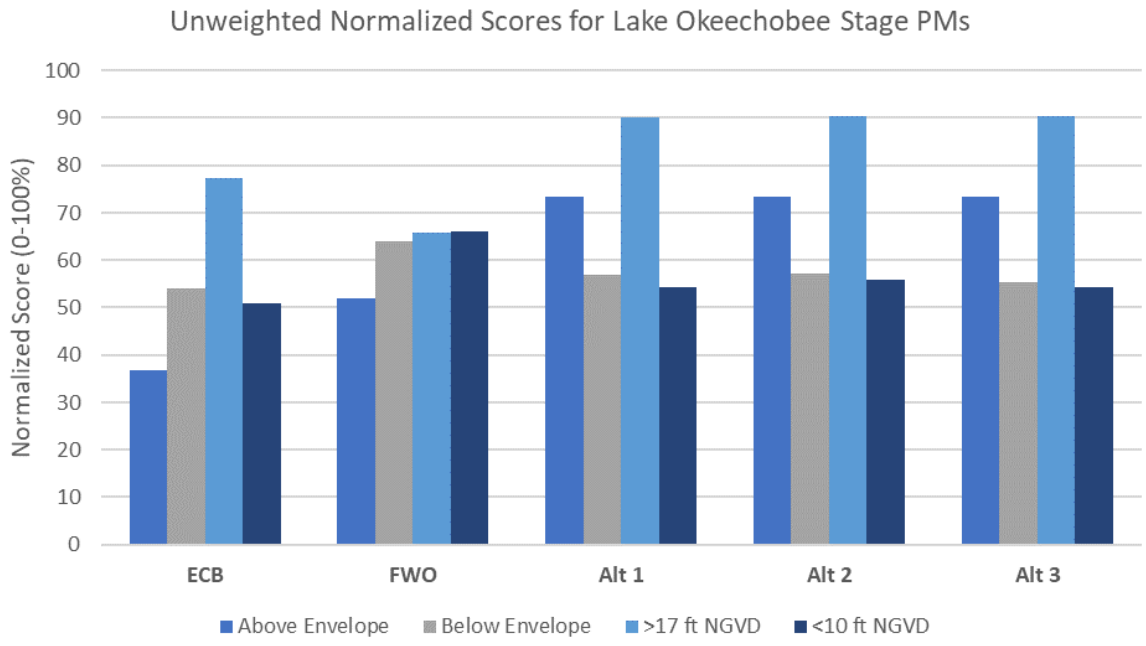


Figure D-9. Normalized Scores for Lake Okeechobee Stage PMs for the Final Array of Alternatives.

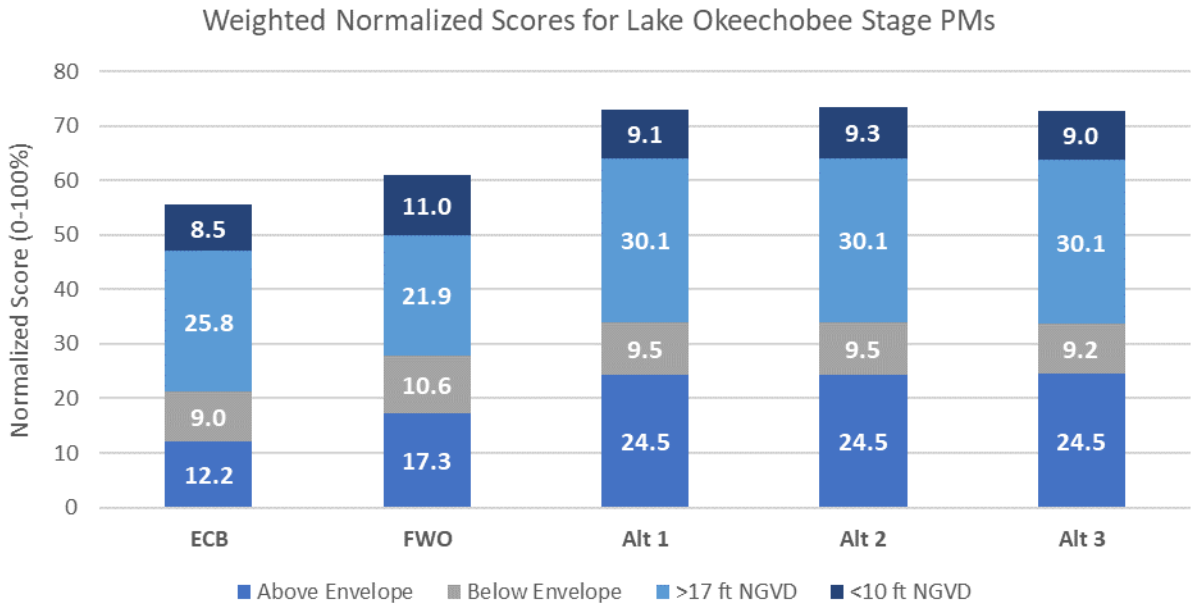


Figure D-10. Normalized and Weighted Scores for Lake Okeechobee Stage PMs for the Final Array of Alternatives.

HU Calculations for Alternatives

The normalized Lake Stage PM scores were weighted (**Figure D-11**) by the approach outlined above and combined for a finalized PM score to calculate HUs **Table D-3**.

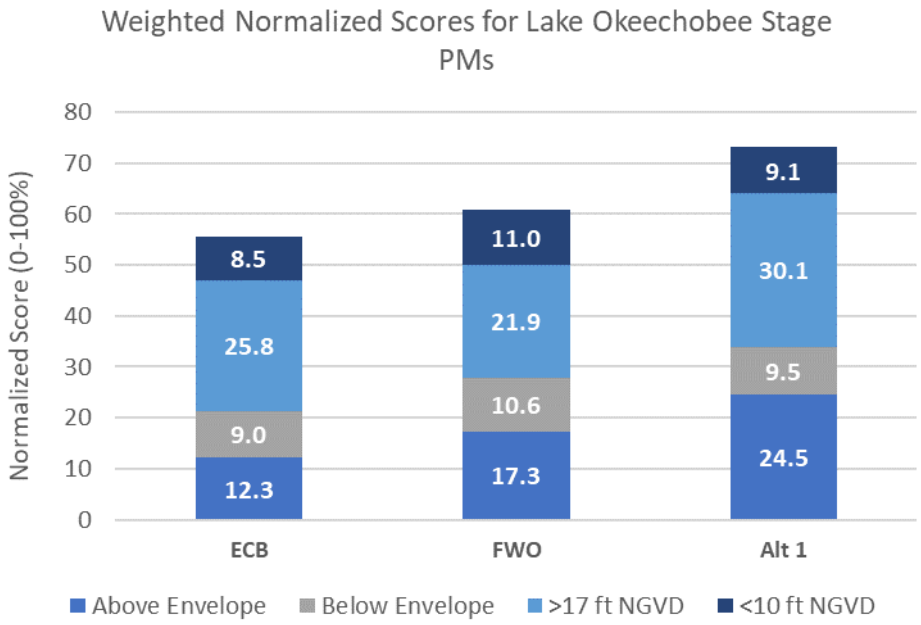


Figure D-11. Weighted and Normalized Scores for Lake Okeechobee Stage PMs Output for the Recommended Plan.

Table D-3. Lake Okeechobee Stage PM Scores, Weighted Combined Scores, and Habitat Units for the Final Array of Alternatives.[1]

Alternative	Above Envelope PM	Below Envelope PM	Extreme High PM	Extreme Low PM	Weighted Combined Score (0-100)	Habitat Units (0-450k)	Potential Lift (HUs)
ECB	569.8 (36.8)	269.3 (54.1)	1.36% (77.3)	4.41% (51.0)	55.6	250,073	N/A
FWO	467.3 (52.0)	234.0 (63.9)	2.05% (65.8)	3.05% (66.1)	61.0	274,335	N/A
Alternative 1	323.5 (73.4)	258.9 (57.0)	0.59% (90.2)	4.11% (54.3)	73.1	328,902	54,568
Alternative 2	323.7 (73.4)	258.1 (57.2)	0.58% (90.3)	3.98% (55.8)	73.4	330,369	56,034
Alternative 3	323.4 (73.5)	265.1 (55.3)	0.58% (90.3)	4.12% (54.2)	72.8	327,822	53,487

1. Lower scores are better for the PMs, while higher scores are better for the Weighted Combined Scores and Habitat Units. Normalized scores for PMs are in parentheses.

D.3.3 Lake Okeechobee Alternative Performance

Table D-4 shows the Lake Okeechobee HUs for each of the alternatives. Alternative 2 provides the greatest HU lift of 56,034 acres, followed by Alternative 1 with 54,568 acres, and then Alternative 3 with 53,487 acres.

Table D-4. Summary Lake Okeechobee Habitat Unit Trajectory by Alternative.

Alternative	ECB Lake O HUs (2033)	FWP Lake O HUs (2035)	FWP Lake O HUs (2038)	FWP Lake O HUs (2043)	FWP Lake O HUs (2058)	FWP Lake O HUs (2083)	Average Annual Lake O HU Lift (from ECB)
FWO	250,073	251,043	252,499	254,925	262,204	274,335	485
Alternative 1	250,073	269,780	289,488	297,370	328,902	328,902	1,577
Alternative 2	250,073	270,147	290,221	298,251	330,369	330,369	1,606
Alternative 3	250,073	269,510	288,948	296,722	327,822	327,822	1,555

The Lake Okeechobee average annual HU (AAHU) lifts were calculated as the difference between the Future With Project (FWP) and FWO conditions over the period of analysis (through year 2083). For the FWO condition, a straight trajectory between existing and FWO HUs was assumed to establish HU totals for each site and year.

With project HU trajectory was modeled to reflect the timeline of expected restoration effects. Lake Okeechobee HUs for each alternative are assumed to reach 25 percent potential 2 years following construction completion, 50 percent potential 5 years following construction completion, 60 percent potential 10 years following construction completion, and 100 percent potential 25 years following construction completion. At that point, the full potential of HUs will be realized for the remainder of the period of analysis. **Figure D-24** shows the trajectory of Lake Okeechobee HUs for each alternative over the period of analysis starting at an existing condition of 250,073 in 2033. The resulting average annual habitat unit lift (from ECB or FWO) is also displayed in **Table D-4**.

The AAHUs for Lake Okeechobee will be combined with the Northern Estuaries HUs for the storage cost-effectiveness and incremental cost analysis (CE/ICA). The CE/ICA is evaluated in **Section D.5.4**.

D.3.4 Lake Okeechobee Recommended Plan Performance

This section outlines the HU analysis for the Recommended Plan (Alternative 1).

D.3.4.1 Lake Okeechobee Recommended Plan Stage Performance Measures and HUs

The Lake Okeechobee Stage PM output is shown in **Table D-5** for the Recommended Plan. The scores for the envelope (above and below) and time exceeding extreme stages (above 17 ft and under 10 ft NGVD29) are combined and normalized based on their performance relative to theoretical best- and worst-case scenarios. The above envelope and time above 17 ft scores are weighted by 0.67, while the time below the envelope and time under 10 ft are weighted by 0.33. The combined, weighted score is multiplied by the 450,000-acre lake size to calculate HUs. See section D.3.2.1 for more details on the normalization and weighting methodology.

Table D-5. Summary Lake Okeechobee PM and HUs for the Recommended Plan.

Alternative	Above Envelope PM	Below Envelope PM	Extreme High PM	Extreme Low PM	Weighted Combined Score (0-100)	Habitat Units (0-450k)	Potential Lift (HUs)
ECB	569.8 (36.8)	269.3 (54.1)	1.36% (77.3)	4.41% (51.0)	55.6	250,073	N/A
FWO	467.3 (52.0)	234.0 (63.9)	2.05% (65.8)	3.05% (66.1)	61.0	274,335	N/A
Alternative 1	323.5 (73.4)	258.9 (57.0)	0.59% (90.2)	4.11% (54.3)	73.1	328,902	54,568

D.3.4.2 Lake Okeechobee Recommended Plan Performance

Table D-6 shows the trajectory of Lake Okeechobee HUs for the recommended plan from 2033 through 2083, as well as the AAHU lift. The Lake Okeechobee AAHU lift for the Recommended Plan is 1,577 from ECB, or 1,091 from FWO.

Table D-6. Summary Lake Okeechobee Recommended Plan Habitat Unit Trajectory.

Alternative	ECB Lake O HUs (2033)	FWP Lake O HUs (2035)	FWP Lake O HUs (2038)	FWP Lake O HUs (2043)	FWP Lake O HUs (2058)	FWP Lake O HUs (2083)	Average Annual Lake OHU Lift from ECB
FWO	250,073	251,043	252,499	254,925	262,204	274,335	485
Alternative 1	250,073	269,780	289,488	297,370	328,902	328,902	1,577

D.4 Northern Estuaries Benefit Calculation

The primary areas evaluated in the Northern Estuaries are Caloosahatchee Estuary (**Figure D-2**) and St. Lucie Estuary (**Figure D-3**). These two estuaries connect directly to Lake Okeechobee, as well as expansive watersheds much larger than their historical condition.

D.4.1 Northern Estuaries Performance Measures

PMs within the Northern Estuaries were used to evaluate benefit for oyster habitat based on target flows over water control structures. Within the Caloosahatchee Estuary, targets were based on freshwater flows at the S-79 structure (**Figure D-2** and **Figure D-12**). Within the St. Lucie Estuary, targets were based on freshwater flows at the S-80, S-48, S-49, and Gordy Road structures (**Figure D-3** and **Figure D-12**).

The RSM-BN outputs for the Northern Estuaries are based on the RECOVER PM for Northern Estuaries Salinity Envelope (RECOVER 2020). Each estuary has biweekly flow criteria derived from the Curvilinear, Hydrodynamic 3-Dimensional (CH3D) Model, which models estuary-wide salinities that are optimal, stressful, or damaging to key ecological indicator species. For the St. Lucie Estuary (SLE), this includes shoal grass (*Halodule wrightii*, a marine seagrass), and the Eastern oyster (*Crassostrea virginica*, a mesohaline bivalve); and for the Caloosahatchee Estuary (CRE), it includes these species in addition to tape grass (*Vallisneria americana*, a freshwater and oligohaline submerged aquatic vegetation). The below sections describe the CRE and SLE-specific flow metrics for use in alternatives evaluation, as well as HU methodology used in benefits analysis.

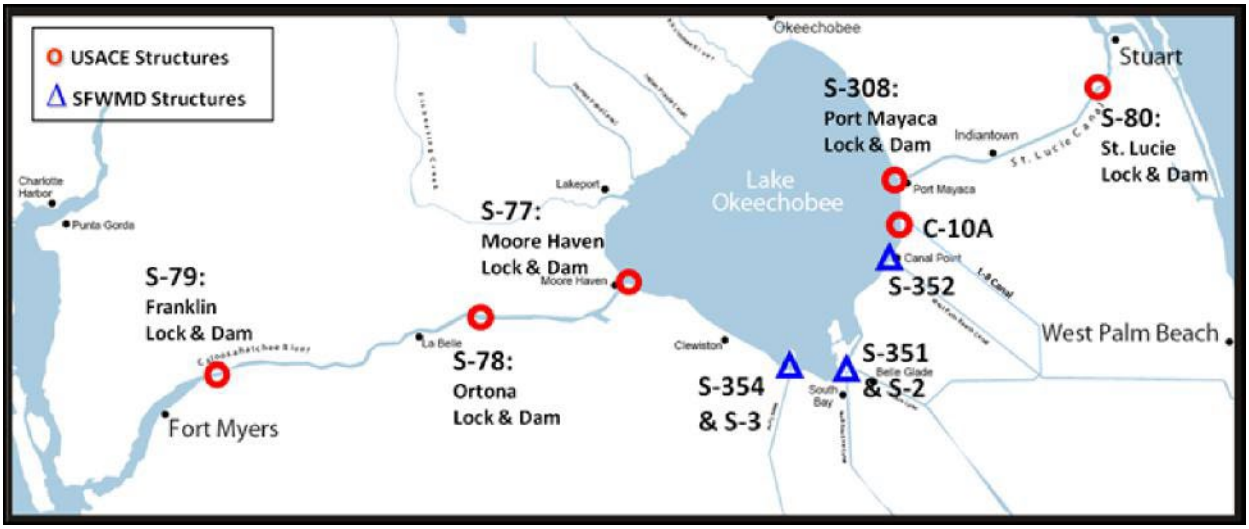


Figure D-12. Key Structures of Lake Okeechobee and the Northern Estuaries.

D.4.1.1 PM 3 - Caloosahatchee River Estuary Salinity Envelope Performance Measure

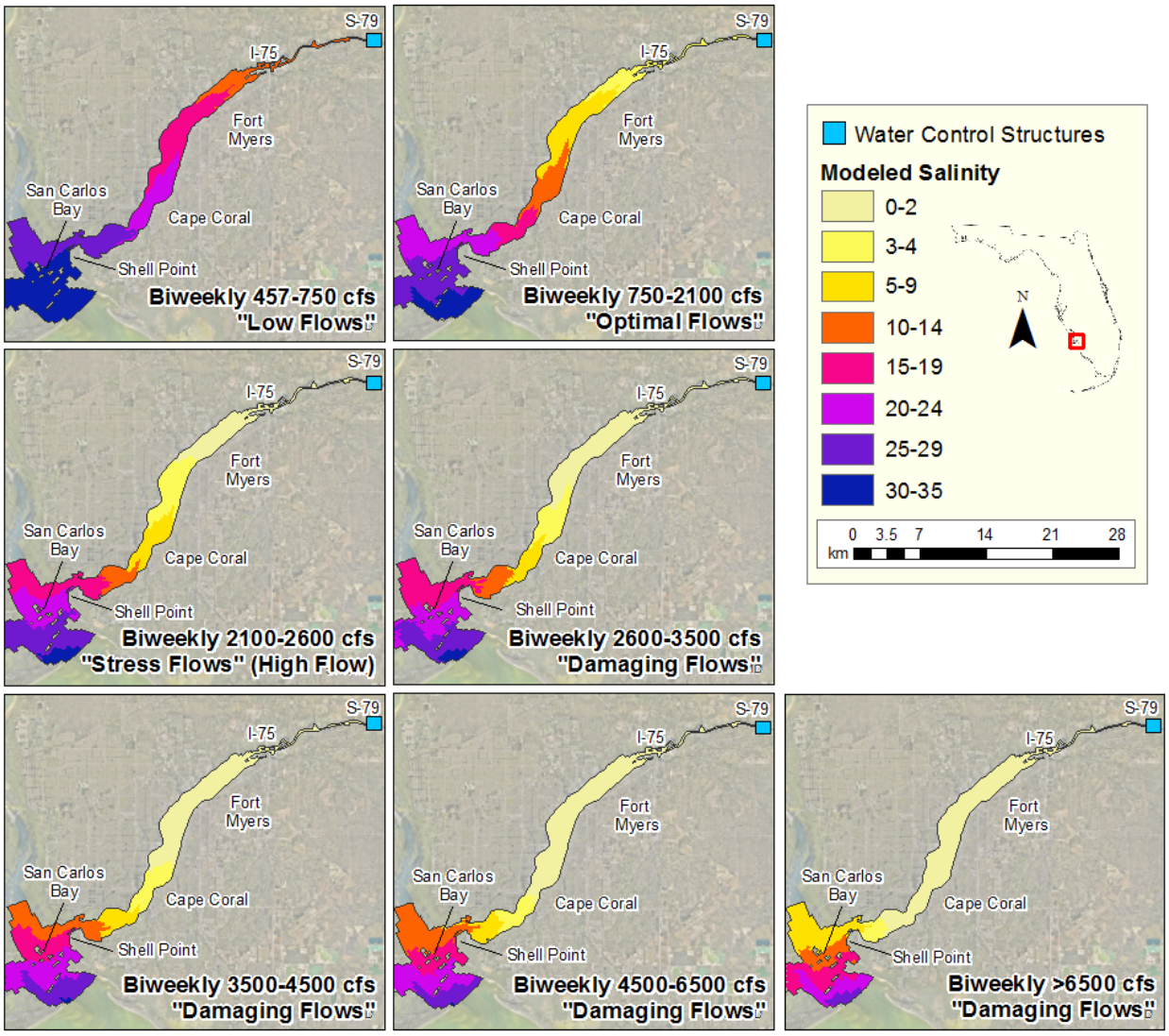
The PMs used for the CRE are from RECOVER (2020) (**Table D-7**).

Table D-7. Caloosahatchee Estuary Performance Metrics, from RECOVER (2020).[1]

Performance Metrics based on simulated flows at S-79 into the Caloosahatchee River and Estuary
Low Flow - # of 14-day periods <750 cfs
Optimal Flow - # of 14-day periods >=750 cfs and <2,100 cfs
High Flow (Basin Runoff) - # of 14-day periods >= 2,100 cfs and <2,600 cfs
High Flow (LOK Regulatory[2]) - # of 14-day periods >= 2,100 cfs and <2,600 cfs
Damaging Flow (Basin Runoff) - # of 14-day periods >= 2,600 cfs
Damaging Flow (LOK Regulatory) - # of 14-day periods >= 2,600 cfs
Damaging Flow (Total Flows[3]) - # of 14-day periods >= 2600 and <= 4500 cfs
Damaging Flow (Total Flows) - # of 14-day periods >= 4500 and <= 6500 cfs
Damaging Flow (Total Flows) - # of 14-day periods >= 6500 cfs

1 Simulated biweekly flow events that fall within each of the flow ranges below are classified based on resulting salinities and oyster and submerged aquatic vegetation salinity tolerances.
2 LOK Regulatory = Lake Okeechobee Regulatory Releases
3 Total flows from both LOK Regulatory and basin runoff

The CRE PMs (**Table D-7**) were derived from modeled salinity using the CH3D model (Sheng 1986) and evaluated by RECOVER scientists to establish categories (e.g., optimal, stress, damaging flow) according to impact to oyster and SAV species (**Figure D-13**).



Note: Average salinity is based on biweekly flows in each bin.

Figure D-13. Modeled Salinity of RECOVER (2020) Performance Measures for the CRE.

With RECOVER (2020) "Low Flows," average salinity is between 10 and 14, outside of the optimal range for tape grass (*Vallisneria americana*) whose distribution can be found upstream of Fort Myers to the tidal boundary at S-79 (**Figure D-13**). "Optimal Flows" provide an estuarine gradient throughout the CRE to support tape grass in the upper estuary, and oyster (*Crassostrea virginica*) and marine SAV in the middle and lower estuary San Carlos Bay. With "Stress Flows," there is declining salinity around Cape Coral, near the upstream extent of oyster reef in the CRE; the stress category is conservative, to minimize impact to oysters further downstream. Finally, while RECOVER (2020) defines "Damaging Flows" as anything above 2,600 cubic feet per second (cfs) biweekly, and is similarly conservative to minimize low salinity impacts, additional bins above this threshold were modeled to demonstrate impact to the lower estuary and San Carlos Bay. Biweekly flows of 3,500 to 4,500 cfs result in modeled salinity 15 parts per thousand (ppt) or less in the whole estuary; biweekly flows of 4,500 to 7,500 cfs results in salinity 10 ppt or less throughout;

and biweekly flows over 6,500 cfs results in the whole CRE as having extremely low salinities and being unable to support oysters and marine SAV. Additional impacts are felt in the San Carlos Bay.

D.4.1.2 PM 4 - St. Lucie Estuary Salinity Envelope Performance Measure

The PMs used for the SL) are from RECOVER (2020) (**Table D-8**).

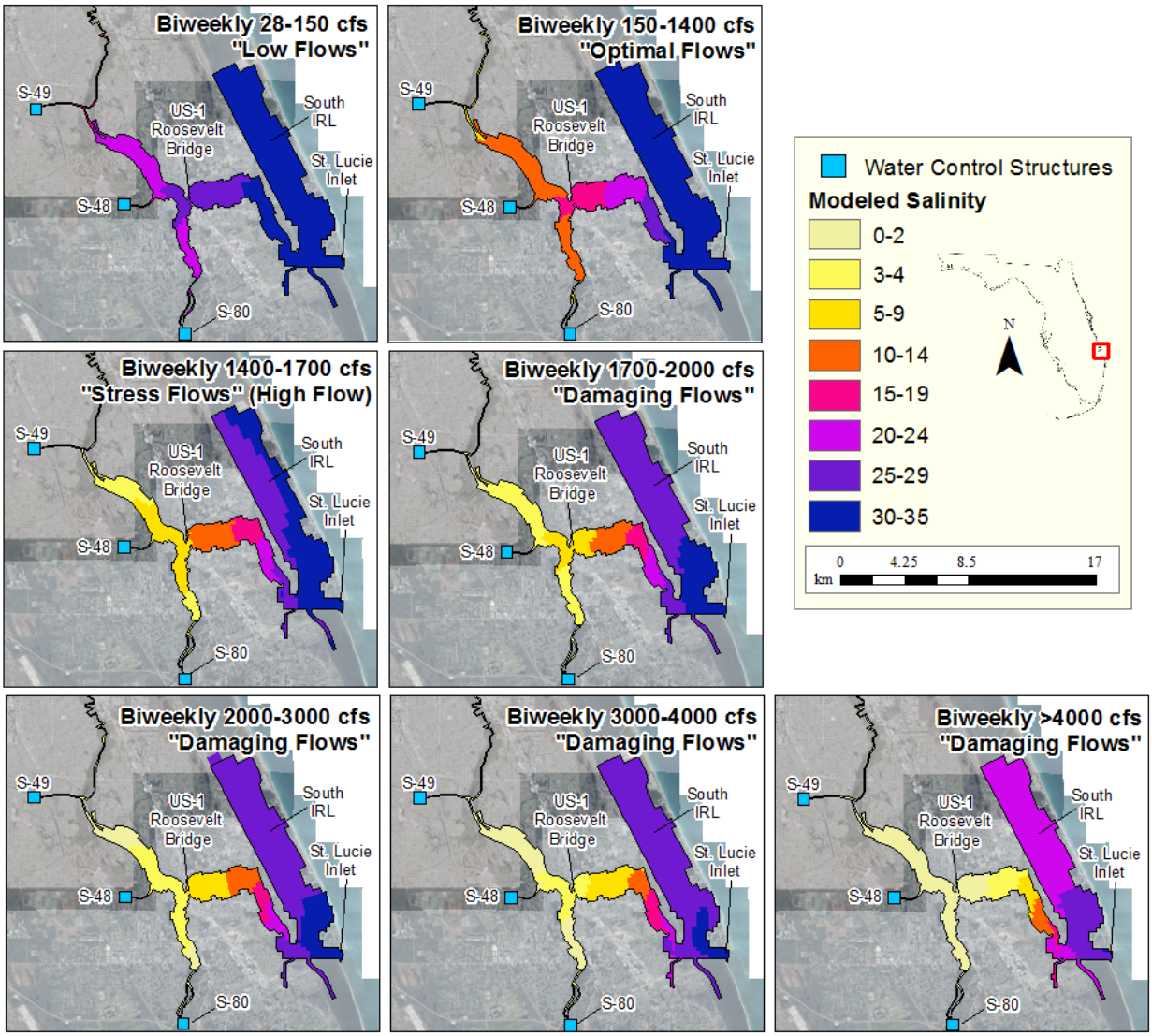
Table D-8. St. Lucie Estuary Performance Metrics, from RECOVER (2020).[1]

Performance Metrics based on simulated flows into the St. Lucie River and Estuary
Low Flow - # of 14-day periods <150 cfs
Optimal Flow - # of 14-day periods >=150 cfs and <1,400 cfs
High Flow (Basin Runoff) - # of 14-day periods >= 1,400 cfs and <1,700 cfs
High Flow (LOK Regulatory[2]) - # of 14-day periods >= 1,400 cfs and <1,700 cfs
Damaging Flow (Basin Runoff) - # of 14-day periods >= 1,700 cfs
Damaging Flow (LOK Regulatory) - # of 14-day periods >= 1,700 cfs
Damaging Flow (Total Flows[3]) - # of 14-day periods >= 1,700 and <= 4000 cfs
Damaging Flow (Total Flows) - # of 14-day periods >= 1,700

1 Simulated biweekly flow events that fall within each of the flow ranges below are classified based on resulting salinities and oyster and submerged aquatic vegetation salinity tolerances.
2 LOK Regulatory = Lake Okeechobee Regulatory Releases
3 Total flows from both LOK Regulatory and basin runoff

The SLE PMs (**Table D-8**) were derived from modeled salinity using the CH3D model (Sheng 1986), and evaluated by RECOVER scientists to establish categories (e.g., optimal, stress, damaging flow) according to impacts to oyster and SAV species (**Figure D-14**).

With RECOVER (2020) “Low Flows” in the SLE, salinities throughout the estuary are suitable for oysters and SAV, but salinities increase to 10 to 14 ppt upstream in the St. Lucie River and may have a negative impact on nursery habitat for communities of juvenile fish which often congregate in the oligohaline zone in the river (Stephens et al. 2022). “Optimal Flows” provide suitable salinities for these species in the river and estuary, without any impact to marine salinities in the southern Indian River Lagoon (IRL) near the St. Lucie Inlet (**Figure D-14**). As flows increase, salinity declines to less than 10 ppt in the north and south forks of the SLE. Historically, oyster reefs in the forks are less dense and exist in higher ratios of dead-to-live oysters per unit area than in the middle estuary; the RECOVER (2020) “Stress Flow” category is similarly conservative to protect the middle estuary from experiencing salinities under 10 ppt. With biweekly flows between 1,700 and 20,00 cfs (RECOVER [2020]). With “Damaging Flows,” the low-salinity wedge pushes further downstream into the middle estuary. Biweekly flows over 4,000 cfs result in fresh-to-extreme-low salinities throughout the forks and portions of the middle estuary, and salinities below 10 ppt past the A1A bridge.



Note: Average salinity is based on biweekly flows in each bin.

Figure D-14. Modeled Salinity of RECOVER (2020) Performance Measures for the SLE.

D.4.1.3 Northern Estuaries – Normalization, Combining Score and Calculating HUs

The calculation of ecosystem benefits consisted of the following steps: 1) Normalize Scores—normalizing each of the Performance Metrics to a common scale for (0 to 100); 2) Combine Scores and Calculate Northern Estuaries HUs—combine PMs into aggregate scores and multiply by the available habitat (acres) of oyster reef in each estuary; and 3) Compare HUs—Aggregate Northern Estuaries HUs with other resource area HUs (in the case of LOCAR, Lake Okeechobee) and compare across project alternatives, ECB, and FWO.

Normalization

RSM-BN outputs for the Salinity Envelope PM (RECOVER 2020) were normalized by setting boundary conditions, or best- and worst-case scenarios, to develop a relativized score. The best- and worst-case scenarios for each PM were set according to a recent Lake Okeechobee Regulation Schedule study, which

provided scores for a variety of single-objective management strategies that represented realistic boundary conditions for the system based on a 52-year period of simulation (Iteration 1 results from LOSOM development).

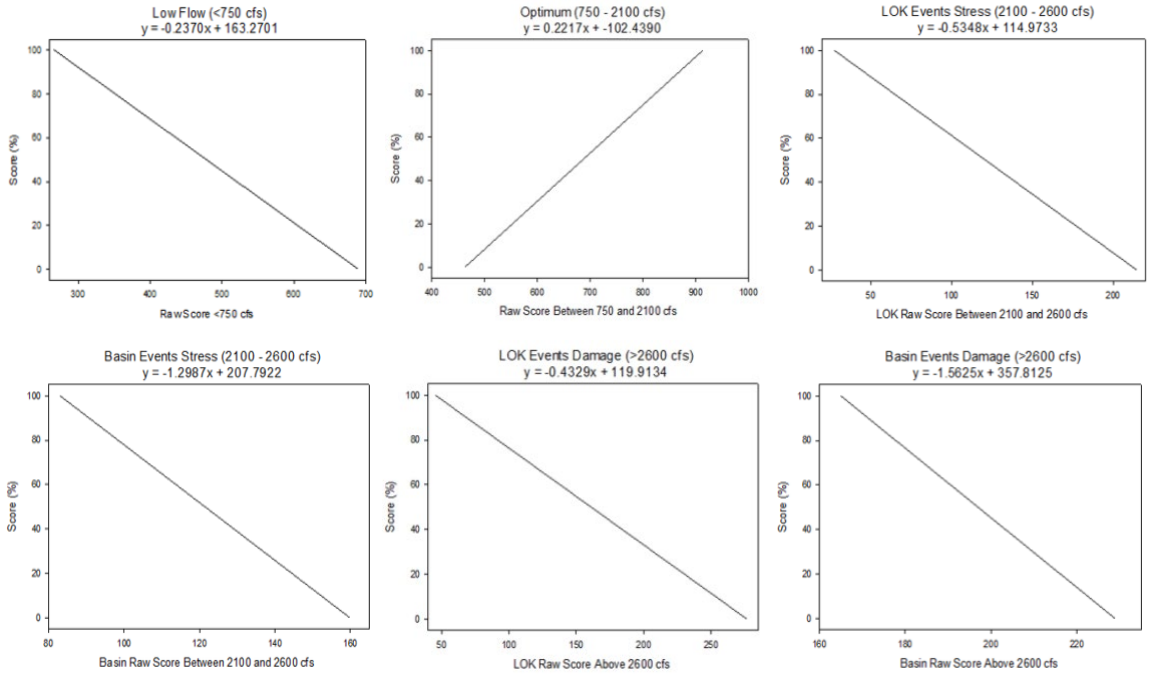
Table D-9. Salinity Envelope Performance Measure (RECOVER 2020) Modeling Results from LOSOM Iteration 1 Single-objective Management Scenarios Compared to ECB and No Action Alternative (2025).

Salinity Envelope Performance Metric	ECB	2025	ECRE	ELSE	ESFL	ABNE	LOK	WRDS	WRDC	WAS	REC	NAV
Caloosahatchee River Estuary LOSOM Iteration 1 Results												
Low Flows (Biweekly <750 cfs)	652	560	350	267	689	286	654	465	521	636	543	626
Optimal Flows (Biweekly 750-2100 cfs)	462	606	913	728	607	901	498	581	758	483	575	490
Stress (High) Flows triggered by LOK* (Biweekly 2100-2600 cfs)	147	122	126	83	157	133	114	98	160	95	124	105
Stress (High) Flows triggered by Basin Runoff (Biweekly 2100-2600 cfs)	201	170	86	215	28	104	157	186	71	149	116	146
Damaging Flows triggered by LOK* (Biweekly >2600 cfs)	229	175	172	178	165	194	172	177	189	188	184	191
Damaging Flows triggered by Basin Runoff (Biweekly >2600 cfs)	217	169	59	277	74	74	194	273	46	225	256	213
St. Lucie Estuary LOSOM Iteration 1 Results												
Low Flows (Biweekly <150 cfs)	104	105	84	176	126	73	131	173	128	152	167	151
Optimal Flows (Biweekly 150-1400 cfs)	840	828	864	937	886	903	819	940	697	874	935	882
Stress (High) Flows triggered by LOK* (Biweekly 1400-1700 cfs)	211	170	142	325	245	195	154	328	115	213	323	249
Stress (High) Flows triggered by Basin Runoff (Biweekly 1400-1700 cfs)	145	180	175	0	70	144	205	0	221	115	1	73
Damaging Flows triggered by LOK* (Biweekly >1700 cfs)	449	421	401	465	436	427	414	467	409	439	468	452
Damaging Flows triggered by Basin Runoff (Biweekly >1700 cfs)	137	166	178	4	92	103	190	0	255	99	8	76

Note: Worst and best scores were taken as boundary conditions for performance metric score normalization.

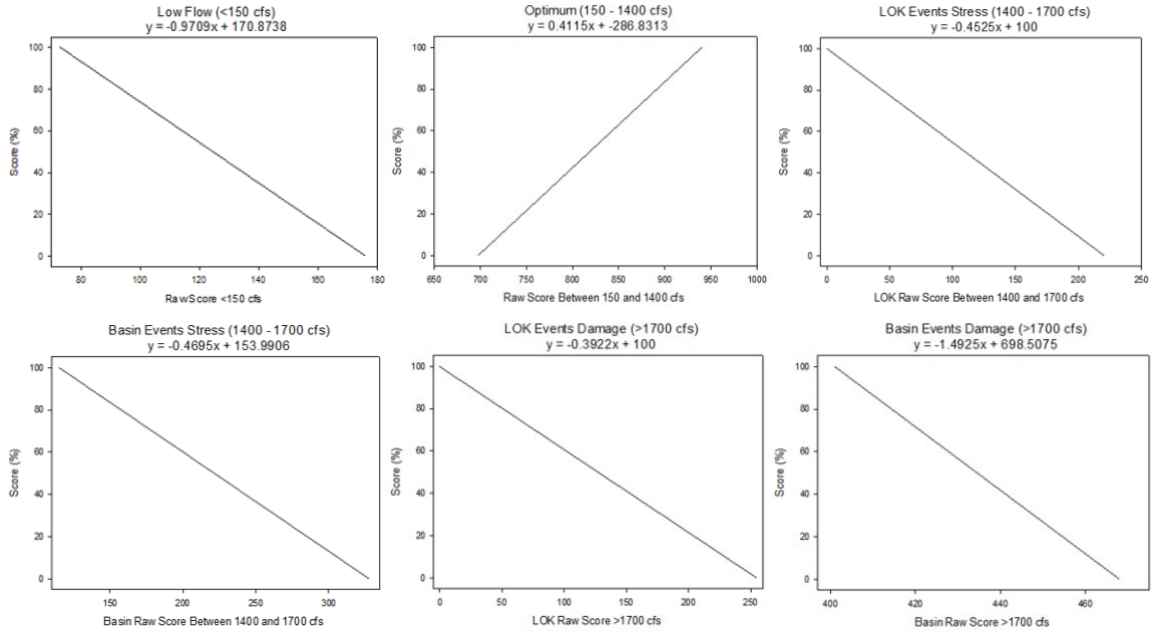
The response curves (**Figure D-15** and **Figure D-16**) convert the total number of biweekly flow events for each Performance Metric from the RECOVER (2020) Salinity Envelope PM ("raw scores") (**Appendix D.4.1.1** and **D.4.1.2**) to a standardized scale of 0 to 100, from worst- to best-case according to the boundary conditions. Once this standardized score is calculated, it can be converted to other units of measure, such as HUs, and/or combined with other scores to get a weighted or non-weighted average score for any alternative being evaluated. For this study, acreages of oysters were used to calculate HUs. Oysters were mapped in 2019 in the CRE and SLE, totaling 980 and 434 acres of reef, respectively. The 2019 maps differentiate between mostly dead or mostly live oysters within a reef or clump, but for the purpose of HU calculations, all available shell material was treated as habitat.

The approach assumes a linear increase in risk of ecological damage between the optimal and most severe conditions, which is the most conservative approach to take until there are data to support a more complex relationship.



Note: Worst- and base-case boundary conditions (x-axis) from LOSOM Iteration 1 single-objective management scenarios; and normalization score (%) 0-100.

Figure D-15. Response Curves of the CRE Salinity Envelope Performance Metrics (RECOVER 2020).



Note: Worst- and base-case boundary conditions (x-axis) from LOSOM Iteration 1 single-objective management scenarios; and normalization score (%) 0-100.

Figure D-16. Response Curves of the SLE Salinity Envelope Performance Metrics (RECOVER 2020).

Caloosahatchee Estuary Habitat Unit Calculations

Separate response curves were developed for each of the CRE Performance Metrics (RECOVER 2020) based on assumptions of worst- and best-case possible performance for each (**Section D.4.1.3.1**; **Figure D-15**). To normalize the scores, the response curves were applied to the model outputs ("raw scores") for LOCAR.

- For CRE Low Flows (biweekly flows under 750 cfs), the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 267 (target) and 689 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (-0.237*Raw Score) + 163.27

- For CRE Optimal Flows (biweekly flows between 750 and 2,100 cfs), the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 913 (target) and 462 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (0.2217*Raw Score) + (-102.44)

- For CRE Stress (High) Flows (biweekly flows between 2,100 and 2,600 cfs) triggered by Lake Okeechobee Regulatory Releases, the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 28 (target) and 215 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (-0.535*Raw Score) + 114.97

- For CRE Stress (High) Flows (biweekly flows between 2,100 and 2,600 cfs) triggered by basin runoff, the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 83 (target) and 160 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (-1.299*Raw Score) + 207.79

- For CRE Damaging Flows (biweekly flows above 2,600 cfs) triggered by Lake Okeechobee Regulatory Releases, the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 46 (target) and 277 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (-0.433*Raw Score) + 119.91

- For CRE Damaging Flows (biweekly flows above 2600 cfs) triggered by basin runoff, the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 165 (target) and 229 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (-1.563*Raw Score) + 357.81

St. Lucie Estuary Habitat Unit Calculations

Separate response curves were developed for each of the SLE Performance Metrics (RECOVER 2020) based on assumptions of best- and worst-case possible performance for each (**Section D.4.1.3.1**; **Figure D-35**). To normalize the scores, the response curves were applied to the model outputs ("raw scores") for LOCAR.

- For SLE Low Flows (biweekly flows less than 150 cfs), the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 73 (target) and 176 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (-0.971*Raw Score) + 170.87

- For SLE Optimal Flows (biweekly flows between 150 and 1,400 cfs), the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 940 (target) and 697 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (0.412*Raw Score) + (-286.83)

- For SLE Stress (High) Flows (biweekly flows between 1,400 and 1,700 cfs) triggered by Lake Okeechobee Regulatory Releases, the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 0 (target) and 221 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (-0.453*Raw Score) + 100

- For SLE Stress (High) Flows (biweekly flows between 1,400 and 1,700 cfs) triggered by basin runoff, the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 115 (target) and 328 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (-0.469*Raw Score) + 153.99

- For SLE Damaging Flows (biweekly flows above 1,700 cfs) triggered by Lake Okeechobee Regulatory Releases, the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 0 (target) and 255 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (-0.392*Raw Score) + 100

- For SLE Damaging Flows (biweekly flows above 1,700 cfs) triggered by basin runoff, the response curve is a line between the number of events from the LOSOM Iteration 1 period of simulation: 401 (target) and 468 (worst case). Raw scores are the model outputs for LOCAR for each alternative. Normalized scores can be converted using the following equation (y = mx+b):

  Normalized Score (%) = (-1.49*Raw Score) + 698.50

D.4.1.4 Caloosahatchee Estuary Final Array HUs

Table D-10 shows the RSM-BN model outputs for the ECB, FWO, and final array of LOCAR alternatives (Alternative 1, Alternative 2, Alternative 3) for the Caloosahatchee Estuary; the normalized scores for each; and average scores and habitat unit conversation (average normalized score multiplied by 980 acres of oyster reef).

Table D-10. LOCAR Model Outputs, Normalized Scores, and Average Normalized Scores and Calculated Habitat Units for Each Alternative for the Caloosahatchee Estuary.

Salinity Envelope Performance Measure Metrics – Biweekly Flow Events	LOCAR PM Raw Scores	Normalized (0-100%)	Average Score	Habitat Units
ECB				
Low Flows (<750 cfs)	549	33.16	36.55	35,817
Optimum (750-2100 cfs)	638	39.01		
LOK Triggered Stress (High) (2100-2600 cfs)	77	73.79		
Basin Triggered Stress (High) (2100-2600 cfs)	166	-7.79		
LOK Triggered Damaging (>2600 cfs)	86	82.68		
Basin Runoff Triggered Damaging (>2600 cfs)	230	-1.56		
FWO				
Low Flows (<750 cfs)	752	-14.95	54.98	53,884
Optimum (750-2100 cfs)	549	19.27		
LOK Triggered Stress (High) (2100-2600 cfs)	66	79.68		
Basin Triggered Stress (High) (2100-2600 cfs)	124	46.75		
LOK Triggered Damaging (>2600 cfs)	66	91.34		
Basin Runoff Triggered Damaging (>2600 cfs)	160	107.81		
Alternative 1				
Low Flows (<750 cfs)	586	24.39	58.39	57,217
Optimum (750-2100 cfs)	688	50.09		
LOK Triggered Stress (High) (2100-2600 cfs)	42	92.51		
Basin Triggered Stress (High) (2100-2600 cfs)	153	9.09		
LOK Triggered Damaging (>2600 cfs)	55	96.10		
Basin Runoff Triggered Damaging (>2600 cfs)	179	78.13		
Alternative 2				
Low Flows (<750 cfs)	584	24.86	58.36	57,195
Optimum (750-2100 cfs)	686	49.65		
LOK Triggered Stress (High) (2100-2600 cfs)	42	92.51		
Basin Triggered Stress (High) (2100-2600 cfs)	154	7.79		
LOK Triggered Damaging (>2600 cfs)	56	95.67		
Basin Runoff Triggered Damaging (>2600 cfs)	178	79.69		
Alternative 3				
Low Flows (<750 cfs)	586	24.39	58.29	57,129
Optimum (750-2100 cfs)	689	50.31		
LOK Triggered Stress (High) (2100-2600 cfs)	41	93.05		
Basin Triggered Stress (High) (2100-2600 cfs)	154	7.79		
LOK Triggered Damaging (>2600 cfs)	55	96.10		
Basin Runoff Triggered Damaging (>2600 cfs)	179	78.13		

The best performing of the three LOCAR alternatives for the CRE, based on HU scores, is Alternative 1 (56,217 HUs).

D.4.1.5 St. Lucie Estuary Final Array HUs

Table D-11 shows the RSM-BN model outputs for the ECB, FWO, and final array of LOCAR alternatives (Alternative 1, Alternative 2, Alternative 3) for the St. Lucie Estuary; the normalized scores for each; and average scores and habitat unit conversation (average normalized score multiplied by 434 acres of oyster reef).

Table D-11. LOCAR Model Outputs, Normalized Scores, and Average Normalized Scores and Calculated Habitat Units for Each Alternative for the St. Lucie Estuary.

Salinity Envelope Performance Measure Metrics – Biweekly Flow Events	LOCAR PM Raw Scores	Normalized (0-100%)
ECB	-	-
Low Flows (<150 cfs)	183	-6.80
Optimum (150-1400 cfs)	910	87.63
LOK Triggered Stress (High) (1400-1700 cfs)	30	86.43
Basin Triggered Stress (High) (1400-1700 cfs)	279	23.00
LOK Triggered Damaging (>1700 cfs)	41	83.92
Basin Triggered Damaging (>1700 cfs)	452	23.90
Average Score	49.68	-
Habitat Units	*21,561*	
FWO	-	-
Low Flows (<150 cfs)	163	12.62
Optimum (150-1400 cfs)	997	123.43
LOK Triggered Stress (High) (1400-1700 cfs)	49	77.83
Basin Triggered Stress (High) (1400-1700 cfs)	238	42.25
LOK Triggered Damaging (>1700 cfs)	58	77.25
Basin Triggered Damaging (>1700 cfs)	344	185.09
Average Score	86.41	-
Habitat Units	*37,503*	*1*
Alternative 1	-	-
Low Flows (<150 cfs)	209	-32.04
Optimum (150-1400 cfs)	1013	130.02
LOK Triggered Stress (High) (1400-1700 cfs)	20	90.95
Basin Triggered Stress (High) (1400-1700 cfs)	262	30.98
LOK Triggered Damaging (>1700 cfs)	29	88.63
Basin Triggered Damaging (>1700 cfs)	350	176.13
Average Score	80.78	-
Habitat Units	*35,057*	-
Alternative 2	-	-
Low Flows (<150 cfs)	208	-31.07
Optimum (150-1400 cfs)	1011	129.20
LOK Triggered Stress (High) (1400-1700 cfs)	20	90.95
Basin Triggered Stress (High) (1400-1700 cfs)	261	31.45
LOK Triggered Damaging (>1700 cfs)	30	88.23
Basin Triggered Damaging (>1700 cfs)	350	176.13
Average Score	80.81	-
Habitat Units	*35,074*	-
Alternative 3	-	-
Low Flows (<150 cfs)	210	-33.02
Optimum (150-1400 cfs)	1012	129.61
LOK Triggered Stress (High) (1400-1700 cfs)	20	90.95
Basin Triggered Stress (High) (1400-1700 cfs)	263	30.51

Salinity Envelope Performance Measure Metrics – Biweekly Flow Events	LOCAR PM Raw Scores	Normalized (0-100%)
LOK Triggered Damaging (>1700 cfs)	27	89.41
Basin Triggered Damaging (>1700 cfs)	351	174.64
Average Score	80.35	-
Habitat Units	*34,872*	-

The best performing of the three LOCAR alternatives for the SLE, based on HU scores, is Alternative 2 (35,074 HUs).

D.4.2 Northern Estuaries Alternative Performance

Table D-12 shows the combined Northern Estuaries HUs and potential lift compared to the ECB and FWO. The PMs for each estuary are combined with equal weighting. Combined, the best performing alternative is Alternative 1 at 92,274 HUs, but only marginally so compared to Alternative 2 at 92,269 HUs and Alternative 3 at 92,001 HUs. The HUs for the Northern Estuaries are combined with the Lake Okeechobee HUs for the CE/ICA analysis. The CE/ICA is evaluated in **Section D.5.4**.

Table D-12. Combined Northern Estuaries HUs for the Final Array of Alternatives.

Region	ECB	FWO	Alternative 1	Alternative 2	Alternative 3
Caloosahatchee HUs	35,817	53,884	57,217	57,195	57,129
St. Lucie Estuary HUs	21,561	37,503	35,057	35,074	34,872
Overall Northern Estuaries HUs	57,378	91,387	92,274	92,269	92,001
Potential Lift from FWO	N/A	N/A	887	882	614
Potential Lift from ECB	N/A	34,009	34,896	34,891	34,623

Note: The Northern Estuaries lifts were calculated as the difference between the FWP and FWO, and between FWP and ECB over the period of analysis.

D.5 Summary of Alternative Performance

HUs are used to compare Project alternatives compared to the FWO for each habitat zone and for the total Project Area (**Table D-13**). **Figure D-17** displays storage AAHU by alternative, and **Figure D-18** presents the percent composition of the total storage AAHU for each alternative. The storage CE/ICA identifies that Alternatives 1 and 2 are best-buy alternatives. The results are displayed in **Table D-14**.

Table D-13. Total Storage HUs for Each Storage Alternative.

Project Region	ECB	FWO	Alternative 1	Alternative 2	Alternative 3
Total Lake Okeechobee	250,073	274,335	328,902	330,369	327,822
Caloosahatchee Estuary	35,817	53,884	57,217	57,195	57,129
St. Lucie Estuary	21,561	37,503	35,057	35,074	34,872
Total Northern Estuaries	57,378	91,387	92,274	92,269	92,001
Total HUs	307,451	365,722	421,176	422,638	419,823

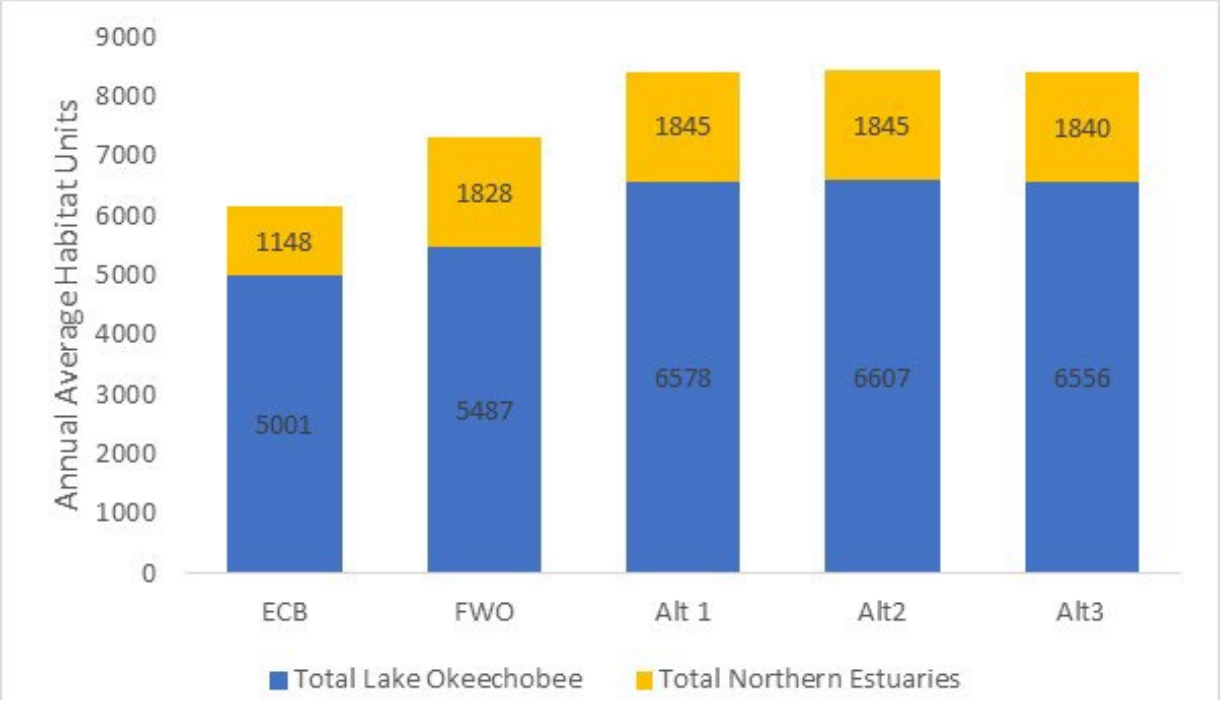


Figure D-17. Annual Average Habitat Units.

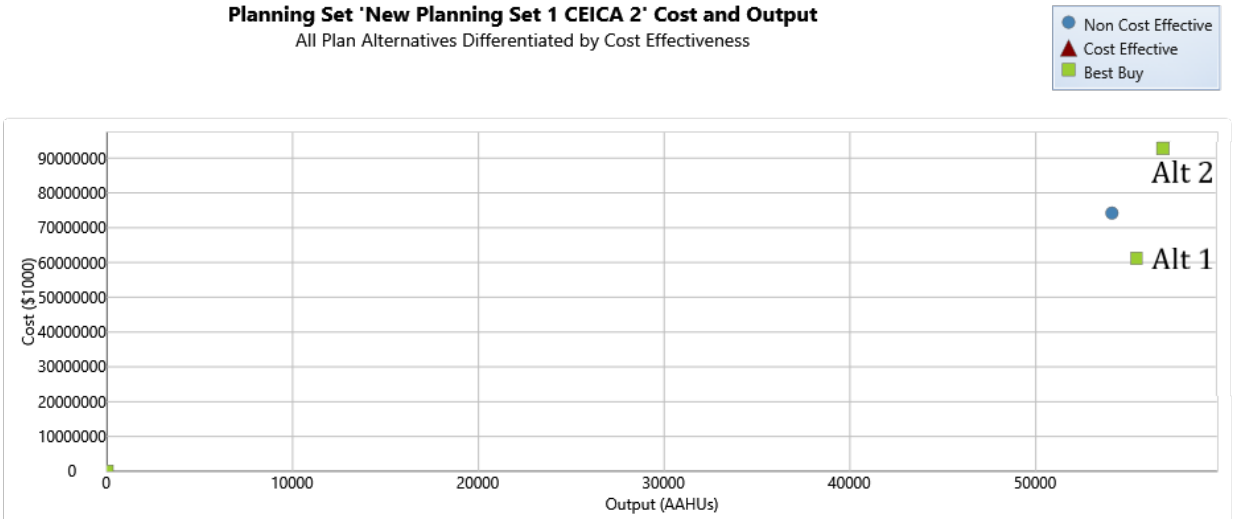


Figure D-18. Annual Average Habitat Units.

Table D-14. Cost-effectiveness and Incremental Cost Analysis Inputs

Category	ECB	FWO	Alternative 1	Alternative 2	Alternative 3
AAHUs	6,149	7,314	8,424	8,453	8,396
Difference from FWO	-	-	1,109	1,138	1,082
Annual Average Cost	-	-	$61,198,304	$92,780,560	$74,211,792
Result	-	-	Best Buy	Best Buy	Not Cost Effective

D.6 Technical Quality of the Planning Model

The planning model depends on dynamic regional hydrologic and ecologic models used to calculate environmental benefits. The environmental benefits are based on inputs derived from the RSM-BN and the working hypotheses set forth in the Lake Okeechobee and Northern Estuaries Conceptual Ecological Models (Barnes 2005, Sime 2005). These models are considered appropriate tools for planning for the CERP. The RSM-BN has been validated through the Corps Engineering Model Certification process established under the E&C SET initiative. Each of the Project PMs for the storage component of the planning effort described above were derived from those PMs approved for use by RECOVER. The scientists of RECOVER have extensive experience working in South Florida and Everglades wetlands ecosystems. These members are considered by their peers to be the experts in their fields. In addition, the conceptual ecosystem models from which the PMs were developed have been extensively peer reviewed and provide the framework for the planning and assessment of the CERP.

The basins version of the RSM model is a long-term water balance model that considers basins as large waterbodies with homogeneous properties and negligible variability of hydrologic properties of interest. Traditionally, these models have been used for reservoir capacity design problems where the capacities are large and long-term basin outflow time series are known at large time steps. Spatial variability of parameters and state variables within basins are not available or not critical for these problems where the focus is the storage behavior in the recipient waterbody. Long-term water balance models are not capable of providing spatially varying hydraulic state variables such as water levels or flow distributions within the basins. They cannot provide short-term variability of outflow releases since small-scale hydraulic behaviors are not simulated in these models. Total error consists of input data errors, model structure errors (algorithm), and parameter errors. With water balance models, you have a potential to have large structure errors when focusing on small-scale features or short-term fluctuations because some of the mechanics (algorithms) are not there. But by design, the objective is to focus on long-term variations and large spatial extents. For such spatial and temporal solutions of interest, the error is small.

The RSM-BN assumes that water in each waterbody is held in level pools. The model domain covers five major watersheds: Kissimmee River, Lake Okeechobee, St. Lucie River, Caloosahatchee River, and EAA, the latter being the latest addition. The watersheds are further divided into sub-watersheds until fundamental waterbodies can be considered as separate model nodes. Individual operating rules were encapsulated into the model that define how water is moved between two nodes. Taken together, the set of management rules defines the linkage of all nodes within the model domain. It is important to note that RSM-BN has successfully been used in project planning support for both State of Florida and CERP initiatives previously. RSM-BN has also undergone many independent scientific reviews and has received formal engineering model certification by the Corps and is approved for use in LOCAR. The computational methodology of RSM-BN uses a “water budget” approach that significantly reduces model error typically found in mesh-based models.

Output from RSM-BN are typically post-processed into project PMs and used in a comparative manner to evaluate the differences between current, no action, and a range of potential future project actions being contemplated. The primary emphasis of the evaluation involves PMs associated with Lake Okeechobee stage and flows to the Northern Estuaries. Given the intended use of RSM-BN in this study, an effort was undertaken to evaluate how sources of model error and uncertainty may affect model outputs and Project decision-making.

The RSM-BN is an excellent tool for assessing the water budget interaction in a complex hydrologic system and an effective tool in comparing the relative performance of proposed alternatives. In addition, it is generally assumed that relative performance of proposed alternatives is of equal credibility and reliability. The study planning process assumed that each performance measure used within the Project Area could be extrapolated from point locations simulated by alternative plans to larger areas they represent. It also assumed that results from hydrologic models were similar across spatial scales within these geographic regions. Due to differences in model accuracy and precision (within and among regions of each model domain), differences in sensitivities of each performance measure to changes in hydrologic conditions, the assumption that all PM results are of equal credibility could be viewed with skepticism. To address this concern, the modeling team developed and applied a methodology to validate the robustness of RSM-BN at decision-making. The analysis verified that observed differences between alternatives were not the result of differential exploitation of hydrologic model error/bias.

D.7 RECOVER Approved Performance Measures

The full, approved Lake Okeechobee Performance Measure Documentation Sheet and Northern Estuary Performance Measure Documentation Sheet are at the end of this appendix.

D.8 References

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A.3 Endangered Species Act Biological Opinion

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Florida Ecological Services Field Office

November 30, 2023

James L. Booth, Colonel
District Commander
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Service Consultation Code: 2023-0096775
Date Received: June 26, 2023
Consultation Initiation Date: August 16, 2023
Project: Lake Okeechobee Component A Reservoir (LOCAR)
County: Highlands

Dear Colonel Booth:

The U.S. Fish and Wildlife Service (Service) has received the U.S. Army Corps of Engineers' (Corps') request for consultation, dated August 16, 2023, for the Lake Okeechobee Component A Reservoir (LOCAR) Section 203 Study (Project) with the South Florida Water Management District (District) as the local sponsor. This document transmits the Service's Biological Opinion and Conference Opinion based on our review of the proposed Project and its effects on threatened, endangered, and proposed species. It is the opinion of the Service that the LOCAR, as implemented, will not jeopardize the continued existence of the eastern indigo snake (*Drymarchon corais couperi*), Audubon's crested caracara (*Polyborus plancus audubonii*), Florida panther (*Puma concolor coryi*), and Florida bonneted bat (*Eumops floridanus*) (FBB); and it is the conference opinion of the Service that the LOCAR, as implemented, will not jeopardize the continued existence of the tricolored bat (*Perimyotis subflavus*) (TCB). It also includes and summarizes our concurrences for the Corps' determinations for the Everglade snail kite (*Rostrhamus sociabilis plumbeus*) and its critical habitat, Florida grasshopper sparrow (*Ammodramus savannarun floridanus*), eastern black rail (*Laterallus jamaicensis* ssp. *jamaicensis*), West Indian manatee (*Trichechus manatus*), wood stork (*Mycteria americana*), and Okeechobee gourd (*Cucurbita okeechobeensis*). This document is submitted in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*).

This Biological Opinion and Conference Opinion is based on information provided in the Corps' August 16, 2023, consultation request letter, Biological Assessment, site visits, emails, and other sources of information. As of August 16, 2023, the Service had received all the Project information necessary for initiation of formal consultation on the indigo snake, caracara, panther, FBB, and TCB, as required in the regulations governing interagency consultations (50 CFR § 402.14). A complete record of this consultation is on file at the Florida Ecological Services Office in Vero Beach, Florida.

Consultation History

The Service transmitted a Biological Opinion for a related project, the Lake Okeechobee Watershed Restoration Project (LOWRP) (Service Consultation Code: 04EF2000-2018-F-0885), on December 19, 2019.

On June 22, 2023, the District requested confirmation of listed species and their critical habitats that may be present in the Project area through the Service's online Information for Planning and Consultation (IPAC) database system.

On June 22, 2023, the Service sent a letter to the District that identified the federally listed species and critical habitats potentially located in the Project area.

On June 26, 2023, the Service received a draft Biological Assessment from the District.

On July 12, 2023, the Service sent a 'Request for Additional Information (RAI)' to the District and Corps.

On August 16, 2023, the Service received the Corps' consultation request letter and Biological Assessment for LOCAR via email.

On October 17 and 25, 2023, and November 2, 2023, the Corps, District, and Service met to discuss options to mitigate for the loss of Florida panther dispersal pathways and caracara territories from the proposed Project.

BIOLOGICAL AND CONFERENCE OPINION

This Biological and Conference Opinion provides the Service's opinion as to whether the proposed Project is likely to jeopardize the continued existence of the indigo snake, caracara, Florida panther, and Florida bonneted bat; as well as the tricolored bat, which is proposed for listing as endangered.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY DETERMINATIONS

Jeopardy Determination

Section 7(a)(2) of the ESA requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02).

The jeopardy analysis in this Biological and Conference Opinion relies on four components: (1) the Status of the Species, which describes the range-wide condition of the species, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental

Baseline, which analyzes the condition of the species in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the species; (3) the Effects of the Action, which determine the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the species; and (4) the Cumulative Effects, which evaluate the effects of future, non-federal activities in the action area on the species.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed federal action in the context of the current status of the species, taking into account any cumulative effects, to determine if the implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the species in the wild.

DESCRIPTION OF THE PROPOSED ACTION

The purpose of the District's Section 203 LOCAR Study is to identify above-ground storage north of Lake Okeechobee, in line with Component A in the Yellow Book. The Yellow Book, or Comprehensive Everglades Restoration Plan (CERP), was approved by Congress as a framework for restoring the natural system under Section 601 of the Water Resources Development Act (WRDA) of 2000. CERP, as documented in the 1999 Yellow Book, consists of 68 components.

The purpose of the LOCAR is to detain water during wet periods for later use during dry periods for Lake Okeechobee and offer operational flexibility to draw and store water from the lake and the basin to improve its littoral ecosystems. Increased storage capacity would reduce the duration and frequency of both high and low water levels in Lake Okeechobee, which are stressful to the lake's littoral ecosystems and cause large releases from the lake which, combined with local basin runoff, are damaging to the downstream estuary ecosystems. Similar above-ground storage reservoirs are being constructed to the east, south, and west of Lake Okeechobee. The District is providing their Section 203 Study, for which this Biological and Conference Opinion evaluates the effects of the proposed Project on listed species, species proposed for listing, and designated critical habitat, to the Assistant Secretary of the Army (Civil Works) for review and decision on approval for submission to Congress for authorization. The goal of the District Section 203 Study is to identify a storage reservoir north of Lake Okeechobee, to address Everglades-related water resource issues identified in the Central and Southern Florida Project Comprehensive Review Study for the northern portion of the Lake Okeechobee Watershed, Lake Okeechobee, and Caloosahatchee and St. Lucie estuaries (Northern Estuaries) (Corps 1999).

The Project includes a 200,000-acre-foot above-ground storage reservoir with an average storage depth of 19 feet at its regular full storage level (Figure 1). The reservoir (LOCAR) would have an approximate footprint of 12,392 acres and include two pump stations, outflow culverts, outflow canal, interior divider dam with culvert, and two overflow spillways. The effects of the action for this Project include the footprint effects (construction and operation) of the features, Lake Okeechobee, and the Northern Estuaries.

Construction: The reservoir would be constructed with a perimeter dam and an interior divider dam, each having an average height of approximately 33 feet above the ground. The perimeter

dam would be approximately 18 miles around, allowing for recreational opportunities. Material from the Project footprint and the surrounding seepage canal would be used to construct the dams. A gated outflow culvert would be constructed on the west side of the reservoir to discharge water into C-41A upstream of S-83, while another gated culvert would be constructed near the southeast side of the reservoir to discharge water into C-41A downstream of S-83. The C-41A Canal would be widened to accommodate increased water conveyance.

The reservoir would be constructed to have two storage cells (*i.e.,* east and west) split by an interior divider dam to reduce wave runup. The interior divider dam would include a 1,500-cubic-foot-per-second (cfs) gated water-control structure to allow for controlled water conveyance between the two cells. Each cell would include an ungated overflow spillway designed to discharge into C-41A.

A seepage canal would be constructed outside the perimeter dam of the reservoir. Seepage from the reservoir would collect in the canal and be returned to the reservoir via seepage pump stations. If the seepage pump stations were not operational, the seepage collected in the canal would eventually overflow into the C-41A via overflow weir structures.

Operations: Two pump stations would be used to fill the reservoir at 1,500 cfs. One pump station would be located downstream of S-84 and move water from C-38 into C-41A, upstream of S-84. The second pump would be located on the C-41A canal upstream of State Highway 70 to pump water from C-41A directly into the reservoir. Water would be conveyed to the reservoir in one of two ways: (1) full or partial diversion of flow in C-41A downstream of S-83, or (2) back-pumping water from Lake Okeechobee via pumping from C-41A downstream of S-84 into C-41A between S-83 and S-84. Water would be returned to Lake Okeechobee by discharging from the reservoir to C-41A upstream and/or downstream of S-83. The location of the reservoir outflow culverts would allow for water to be conveyed south to provide opportunities for storage in surrounding canals (*e.g.,* C-41A, C-41, C-40, and C-39A). A more detailed Project Layout is shown in Figure 2.

Minimization and Conservation Measures

To reduce the Project's adverse effects and benefit the survival and recovery of listed species in the Project's action area, the Corps has agreed to the following minimization and conservation measures:

Indigo snake

1) Follow the *Standard Protection Measures for the Eastern Indigo Snake* (Service 2021a) throughout Project design and construction.
2) Conduct a gopher tortoise survey prior to construction, per the Florida Fish and Wildlife Conservation Commission's (FWC) *Gopher Tortoise Permitting Guidelines* (FWC 2023) (Guidelines). Should relocation be required, the Corps staff biologists or their consultant will follow Guidelines to excavate and relocate gopher tortoise burrows if found.

Caracara

1) For at least two years prior to construction, conduct pre-construction nesting and productivity surveys in accordance with the Service's *Species Conservation Guidelines* (Service 2004) for the caracara and the Service's *Crested Caracara Survey Protocol Additional Guidance* (Service 2016).
2) Implement the Service's *Species Conservation Guidelines* (Service 2004), which includes: if active nests are discovered, maintain a 985 feet (300 meters) buffer until the nest is no longer active.
3) Caracara nest trees will only be removed; 1) when necessary to initiate construction activities, and 2) when the nests are no longer active (*i.e.,* once nesting is complete).
4) Provide compensation for the loss of caracara nesting habitat through land protection within the vicinity of the LOCAR project. Credit for this land protection may be provided in the form of panther habitat protection if the parcels also contain suitable habitat for the caracara.

Panther

1) The Corps' Biological Assessment (Corps 2023) estimated 42,006 panther habitat units (PHUs) will be lost by construction and operation of the proposed Project. The Service recognizes this is an estimate and the exact number of PHUs to offset will need to be further refined by the Corps and Service prior to construction. As compensation for the loss of panther habitat on the Project site, the Corps has agreed to:
    a. Provide compensation for 25% of the PHUs in the form of habitat preservation and management within the Picayune Strand Restoration Project prior to the commencement of any construction.
    b. Provide compensation for 75% of the PHUs through a combination of land protection and range expansion benefits within the vicinity of the LOCAR project prior to the commencement of any construction.
    c. Donate $1 million dollars towards creating a fund to be used for panther range expansion activities (*e.g.,* opening a fund with the Fish and Wildlife Foundation of Florida, Inc.) prior to the commencement of any construction.
2) The Corps and District will submit proposals for panther/caracara land preservation to the Service's panther coordinator, caracara species lead, and Everglades Program Supervisor for review and mitigation calculations prior to a final commitment by the agencies for purchase or conservation easement establishment.
3) The Corps and District will complete all compensation for the loss of panther and caracara habitat prior to the initiation of construction for the LOCAR.
4) A 25-mile-per-hour speed limit will be posted on the site during construction activities to reduce the possibility of vehicular death of panther and other wildlife.

Florida bonneted bat

1) Conduct pre-construction acoustic/roost surveys for the FBB in accordance with the Service's *Consultation Key for the Florida Bonneted Bat* (Service 2019a) or the Service's latest guidance.
2) Provide avoidance buffers during construction around roosts identified during pre-construction surveys, per the Best Management Practices in the Service's *Consultation Key for the Florida Bonneted Bat* (Service 2019a) or the Service's latest guidance.
3) Where applicable for the Project, implement other best management practices consistent with the Service's *Consultation Key for the Florida Bonneted Bat* (Service 2019a) or the Service's latest guidance.

Tricolored bat

1) Conduct pre-construction acoustic surveys for TCBs consistent with Service-referenced guidance in the *Species Status Assessment Report for the Tricolored Bat (Perimyotis subflavus)* (Service 2021b), such as those methods found in *Analytical Assessments in Support of the U.S. Fish and Wildlife Service 3-Bat Species Status Assessment* (Straw et al. 2022).
2) If TCBs are encountered or roosts are identified during pre-construction surveys, the Corps will coordinate measures with the Service to minimize or avoid adverse effects.

In addition to the minimization and conservation measures above, the Corps has also agreed to the measures below in the project description (Corps 2023):

1) Provide training for contractors and sub-contractors on how to identify each listed species. Additionally, educational signs with pictures of each federally listed species will be posted to inform the contractors about these species. Any federally listed threatened or endangered species observed at the site during construction activities will be recorded, including the locations where they were sighted.

2) Turbidity screening and diversion will be used to control effects to the drainage ditches and connected canals. Runoff from the construction site or storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, and any measures required by area-wide plans approved under paragraph 208 of the Clean Water Act (CWA). Temporary and permanent erosion and sedimentation control features or screening will be installed.

3) Project construction shall not destroy migratory birds, their active nests, their eggs, or their hatchlings. Monitoring for such would be required by the construction contractor. A buffer zone around active nests or nestling activity would be required during the nesting season.

Pre-construction surveys will also be conducted for the Florida grasshopper sparrow, eastern black rail, and Everglade snail kite. If any of these species are identified during pre-construction surveys, the Corps will coordinate with the Service on measures to proceed. Such measures may

include reinitiation of formal consultation as provided by the Reinitiation Notice of this Biological Opinion. The Corps will also implement the construction and conservation measures as outlined in the *Habitat Management Guidelines for the Wood Stork in the Southeast Region* (Service 2009) and the *Standard Manatee Conditions for In-Water Work* (Service 2011). Consistent with the Service Wood Stork Effects Determination key (Service 2010), because the Project will result in the removal of suitable foraging habitat for the wood stork, compensation will be provided in accordance with the CWA Section 404(b)(1) guidelines and shall not be contrary to the Habitat Management Guidelines (Service 2009); habitat compensation shall be within the appropriate Core Foraging Area or within the service area of a Service-approved mitigation bank; and habitat compensation shall replace foraging value, consisting of wetland enhancement or restoration matching the hydroperiod of the wetlands affected, and provides foraging value similar to or higher than those impacted.

Action Area

The action area for the Project is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action. The LOCAR action area includes the 12,392 acre reservoir footprint and the downstream areas; therefore, the action area includes the Lake Okeechobee watershed, Lake Okeechobee, and the Northern Estuaries, as well as canals and ditches located downstream of the LOCAR. With regard to caracaras, the Service extended the action area around the reservoir to include a 1,500 meter buffer. This distance would include any adjacent breeding caracaras that do not nest within, but whose territories might overlap, the reservoir footprint. With regard to panthers, we extended the action area to include all lands located in the Service's Florida Panther Focus Area (Focus Area) within 25 miles (mi) (40.2 kilometers [km]) of the LOCAR (Figure 3). This 25-mile buffer is based on mean dispersal distances of 23.2 mi (37.3 km) (Maehr et al. 2002) and 24.9 mi (40.0 km) (Comiskey et al. 2002). The 25 mi (40.2 km) buffer distance encompasses the dispersal distance of both male and female panthers; however, male panther dispersal distances are known to exceed those reported for female panthers (Maehr et al. 2002; Comiskey et al. 2002). The size of the action area for this consultation is consistent with action areas defined in our recent Biological Opinions for the panther, and it encompasses the wide-ranging movements of sub adult panthers and the large home territories of adult panthers.

Table 1. List of threatened and endangered species in the LOCAR area.

Scientific Name	Common Name	Federal Status	Corps' Effect Determination[1]
Reptiles			
Drymarchon couperi	Eastern indigo snake	Threatened	May Affect
Birds			
Ammodramus savannarum floridanus	Florida grasshopper sparrow	Endangered	MANLAA
Aphelocoma coerulescens	Florida scrub jay	Threatened	NE
Grus americana	Whooping crane	Experimental Population, Non-Essential	N/A

Laterallus jamaicensis ssp. jamaicensis	Eastern black rail	Threatened	MANLAA
Mycteria americana	Wood stork	Threatened[2]	MANLAA
Caracara plancus (Note the listed entity is: *Polyborus plancus audubonii*)	Crested caracara (Note the listed entity is Audubon's crested caracara)	Threatened	May Affect
Rostrhamus sociabilis plumbeus	Everglade Snail kite	Endangered	MANLAA
Mammals			
Perimyotis subflavus	Tricolored bat	Proposed listing	May Affect
Eumops floridanus	Florida bonneted bat	Endangered	May Affect
Puma concolor coryi	Florida panther	Endangered	May Affect
Trichechus manatus	West Indian (Florida) manatee	Endangered	MANLAA
Plants and Lichen			
Chionanthus pygmaeus	Pygmy fringe-tree	Endangered	NE
Cladonia perforata	Florida perforated cladonia (also known as Perforate reindeer lichen)	Endangered	NE
Clitoria fragrans	Pigeon wings	Threatened	NE
Conradina brevifolia	Short-leaved rosemary	Endangered	NE
Cucurbita okeechobeensis	Okeechobee gourd	Endangered	MANLAA
Crotalaria avonensis	Avon Park harebells	Endangered	NE
Dicerandra christmanii	Garret's mint	Endangered	NE
Scientific Name	**Common Name**	**Federal Status**	**Effect Determination[1]**
Dicerandra frutescens	Scrub mint	Endangered	NE
Eryngium cuneifolium	Snakeroot	Endangered	NE
Hypericum cumulicola	Highlands scrub hypericum	Endangered	NE
Liatrus ohlingerae	Scrub blazing star	Endangered	NE
Paronchia chartacea	Papery whitlow-wort	Threatened	NE

Polygala lewtonii	Lewton's polygala	Endangered	NE
Polygonella basiramia	Wireweed	Endangered	NE
Polygonella myriophylla	Sandlace	Endangered	NE
Warea carteri	Carter's mustard	Endangered	NE
Ziziphus celata	Florida ziziphus	Endangered	NE
Critical Habitat			
Rostrahamus sociabilis plumbeus	Everglade snail kite	Endangered	MANLAA
Trichechus manatus	West Indian manatee	Endangered	NE
Notes: 1\ NE = No Effect; MANLAA = May Affect, Not Likely to Adversely Affect 2\ Proposed to be delisted (February 2023)			

SPECIES NOT LIKELY TO BE ADVERSELY AFFECTED BY THE PROPOSED ACTION

Florida Grasshopper Sparrow

The Florida grasshopper sparrow is federally listed as endangered and is one of four subspecies of grasshopper sparrows in North America (Corps 2023). The Florida grasshopper sparrow is a year-round resident of Florida and is endemic to the dry prairie of central and southern Florida. This subspecies is extremely habitat-specific and relies on fire every two to three years to maintain its habitat. The Florida grasshopper sparrow is named for one of its calls, a quiet buzz that sounds much like a grasshopper. Male sparrows sing only a few months of the year during the nesting season, for a few hours each day. Florida grasshopper sparrows nest in the spring (April to July) on the ground, under palmettos, or in grass clumps. The female lays three to five eggs, and young fledge within nine to ten days. The male sings from a low perch to defend its territory—about the only time they are readily visible—and helps raise the young. Their diet includes seeds and invertebrates. It is thought that most individuals live their entire lives within a few miles of their place of birth. The lowest counts ever reported of sparrows in the wild occurred in 2018 (approximately 51 males and 26 females). Unfortunately, the reasons for the decline are unknown, but suspects include: 1) suboptimal habitat management; 2) habitat loss, fragmentation, or conversion; 3) fire ants and other predators destroying nests; 4) diseases; and 5) genetic problems. The first releases of a captive-propagation program occurred in 2019. The closest sub-population of reported wild sparrows is about 17 miles north of the Project boundary, in the Kissimmee Prairie Preserve State Park.

The Project area was evaluated for potential habitat to support the Florida grasshopper sparrow during site visits on May 3 and July 5, 2023. The habitat within the LOCAR footprint is either not suitable or suboptimal for this species, and there is a lack or absence of land management practices (*e.g.,* fire) that would maintain more suitable habitat. Additionally, there is a lack of any confirmed presence data in or near the LOCAR footprint. However, the Corps has made a

commitment to survey for grasshopper sparrows prior to construction to confirm there are no grasshopper sparrows present. Therefore, the Service concurs with the Corps' determination that the LOCAR may affect, but is not likely to adversely affect the Florida grasshopper sparrow.

Eastern Black Rail

The eastern black rail is a sparrow-sized bird and is the rarest and smallest of all rail species. The eastern black rail is a highly secretive bird that resides in marsh habitats, is rarely seen in flight, and will walk or run throughout their marsh habitat along narrow paths created by rodents. Nesting occurs from mid-March through August, and the species construct their nests on or near the ground in very dense vegetation, over water or moist soil, or in shallow water (Watts 2022). Clutch size is typically around seven eggs and incubated for 17 to 20 days. The nestlings leave the nest within one day, and the parents are believed to care for the young and feed them.

The Project Area was evaluated for potential habitat to support the eastern black rail during a site visit on May 3 and July 5, 2023. The site comprises a mixture of managed grasslands (*e.g.,* pastures and grazing), dry prairie, oak scrub, and wetland habitats. The wetland habitats observed within the Project are predominantly a mixture of emergent vegetation, such as sawgrass and shrub-dominated wetlands, including species such as buttonbush. Water levels varied across the site from very shallow areas less than eight inches in depth to pools of one to two feet in depth. Water levels are likely variable throughout the year, but those with less than approximately three inches would be suitable for nesting (Watts 2022). Shrubby vegetation often bordered many of the wetlands and was saturated or had standing water in some areas, and beyond that was improved pasture. Generally, this habitat did not appear to be optimal for the black rail. The closest documented occurrence of an eastern black rail, according to Service records, is approximately 20 miles south of the Project boundary, near Lake Okeechobee.

The Service concurs with the Corps' determination that the Project may affect, but is not likely to adversely affect the eastern black rail because: the Project contains sub-optimal habitat for the eastern black rail; there is a lack of any confirmed presence data in or near the LOCAR; the Corps has committed to pre-construction surveys to confirm that there are no eastern black rails; the Corps will coordinate with the Service on how to proceed if eastern black rails are documented; and applicable measures (such as minimization measures and nest protection buffer zones) will be followed if eastern black rails are observed prior to construction or during construction or operations of the Project.

Wood Stork

The wood stork is a large, white, long-legged wading bird that relies on shallow freshwater wetlands for foraging. It primarily utilizes shallow wetlands where prey is concentrated, and movements during the breeding and non-breeding seasons are typically in response to the availability of such shallow wetlands. As a wading bird, wood storks are a wetland-dependent species and rely on a mosaic of wetlands for nesting, roosting, and foraging (Service 2021c). This species was federally listed as endangered under the ESA on February 28, 1984. On February 15, 2023, the Service proposed to delist the U.S. breeding population of the wood stork (88 Federal Register [FR] 9830).

Typical foraging sites include freshwater marshes, ponds, hardwood and cypress swamps, narrow tidal creeks or shallow tidal pools, and artificial wetlands, such as stock ponds, shallow, seasonally flooded roadside or agricultural ditches, and managed impoundments (Coulter et al. 1999; Coulter and Bryan 1993). During nesting, these areas must also be sufficiently close to the colony to allow wood storks to efficiently deliver prey to nestlings. The Service identifies an 18.6-mi foraging range, or Core Foraging Area (CFA), surrounding each wood stork nest colony (Service 2010). The LOCAR will result in the removal of suitable foraging habitat within the CFA of two wood stork colonies. Crayfish biomass calculations performed by the Corps in the Wood Stork Biomass Assessment show that approximately 7,022 kilograms of crayfish biomass may be lost as a result of the Project. Consistent with the 2010 Wood Stork Effects Determination Key (Service 2010), compensation will be provided in accordance with the CWA Section 404(b)(1) guidelines and shall not be contrary to the Habitat Management Guidelines (Service 2009); habitat compensation shall be within the appropriate CFA or the service area of a Service-approved mitigation bank; and habitat compensation shall replace foraging value, consisting of wetland enhancement or restoration matching the hydroperiod of the wetlands affected, and provides foraging value similar to or higher than those impacted. The Service, therefore, concurs with the Corps' determination that the Project may affect, but is not likely to adversely affect the wood stork.

Everglade Snail Kite

The snail kite is a medium-sized raptor that forages over wetlands on aquatic apple snails such as the native Florida apple snail (*Pomacea paludosa*) and the exotic island apple snail (*Pomacea maculala*) (possibly other exotic *Pomacea* species). Several factors may affect snail kite foraging and nesting success – primarily related to water levels. For example, too much or too little precipitation can result in temporary or permanent loss of apple snail habitat with a concomitant reduction in apple snail numbers or availability. Excessive precipitation, coupled with water management practices that maintain high water levels within wetlands for extended periods, can result in the death of emergent vegetation required by apple snails for successful feeding and reproduction. Conversely, apple snails may not be able to survive in wetlands that remain dry for extended periods during droughts, and juvenile native apple snails are less tolerant of dry conditions than adult snails.

The breeding season of the snail kite in Florida varies from year to year, depending on rainfall and water levels (Sykes et al. 1995). Nesting usually occurs from December through July, although breeding can continue through the summer into fall. In Lake Okeechobee, there has been a summer snail kite nesting season in six of the last eleven years. This is likely a response to the increased number of exotic apple snails in the lake and water levels favorable for nest initiation.

Converse to providing beneficial effects due to a change in lake stages, the high water levels could cause short-term, minor adverse effects to the littoral zone and nearshore aquatic vegetation that need lower lake stages to persist. This may not result in a difference in vegetation from what is currently occurring through natural conditions and current operations; but if the high lake stages do occur more often and the vegetation shifts to a different type of community,

this could impact the ability for apple snails to persist. However, the Service expects the LOCAR will keep the lake in the optimal stage range of 11.5 to 15.5 ft for more time than without the Project. The lake stage is expected to be more stable under the built condition and periods when the lake is at high-water levels are expected to be less frequent and for shorter durations. As such, moderate, long term beneficial effects to Lake Okeechobee's littoral vegetation are anticipated from the LOCAR relative to a future without the Project. These anticipated positive changes to Lake Okeechobee should benefit the snail kite.

Although there is a lack of any confirmed presence data in or near the LOCAR, the Corps has committed to conducting pre-construction surveys for snail kites at the LOCAR and will contact the Service if there is any observed foraging or nesting within the Project. Additionally, applicable measures (such as minimization measures and nest protection buffer zones) will be followed if snail kites are observed prior to construction or during construction or operations of the Project. Based on these commitments, the Service concurs with the Corps' determination that the Project may affect, but is not likely to adversely affect the snail kite.

Everglade Snail Kite Critical Habitat

Critical habitat for the snail kite was designated on September 22, 1977 (FR Volume 42, Number 184). Approximately, 841,635 acres (340,600 hectares) of critical habitat are located within nine critical habitat units that include most of the littoral marsh of Lake Okeechobee. The Project benefits described above for vegetation within the Lake Okeechobee littoral zone are mostly within the designated snail kite critical habitat. Therefore, the snail kite critical habitat in Lake Okeechobee should benefit from implementing the Project, particularly by reducing the frequency of extremely low lake stages. Due to these anticipated beneficial effects on Lake Okeechobee's littoral vegetation, the Corps has determined the LOCAR may affect, but is not likely to adversely affect Everglade snail kite critical habitat. Based on the Project's anticipated habitat improvement to the Lake Okeechobee littoral zone, the Service concurs with the Corps' determination.

West Indian Manatee

The West Indian manatee (*Trichechus manatus*) is a large, plant-eating, aquatic mammal species that is listed as threatened under the ESA (16 U.S.C. 1531 et seq.)(32 FR 4001), and is further protected as a depleted subpopulation under the Marine Mammal Protection Act (16 U.S.C. 1361-1407). Manatees may occupy any inland and coastal waters of south Florida including estuaries, bays, rivers, creeks, and canals (Service 2001) where water control structures allow. According to the Service's geographic information system database, they have been recently observed within Lake Okeechobee and its rim canal (*i.e.,* L-47 Canal), the Kissimmee River (*i.e.,* C-38 Canal), and the C-44 and C-43 Canals. Two significant threats to the Florida manatee population statewide are collisions with watercraft and the loss of warm water habitat (Runge et al. 2007). Other threats include crushing or entrapment in gates and locks; entanglement in ropes, lines, and nets; ingestion of fishing gear or debris; vandalism; poaching; loss of suitable foraging habitat; and exposure to red tide brevetoxin (Bossart et al. 1998).

The LOCAR would improve the overall manatee foraging habitat within Lake Okeechobee, local canals, and the northern estuaries. With the LOCAR in operation, Lake Okeechobee's extensive littoral zone is expected to be within the optimal lake level condition more often than without the Project, improving the foraging habitat in Lake Okeechobee for manatees. There are also expected to be fewer high-volume flow months within the Northern Estuaries, providing a beneficial effect to submerged aquatic vegetation (SAV). Reduction in high flows and accompanying flow velocities would result in lower suspended solid loading and decreased concentration of colored dissolved organic matter, thereby allowing greater light penetration to promote the growth of SAV. In addition, a reduction in high-volume discharge events from Lake Okeechobee would reduce extreme salinity fluctuations associated with such events. Although some SAV are tolerant of a wide range of salinity levels, a reduction in high-volume discharge events would reduce stress to SAV, promote increases in seagrass shoots, and have the potential to increase foraging opportunities for manatees in this region, which is likely to provide a beneficial effect. Florida manatees also depend on canals as transit from one habitat to another, sources of freshwater, and resting sites.

Standard manatee protection guidelines will be used during construction along canals and rivers accessible to manatees to avoid effects. The Corps will implement the construction and conservation measures as outlined in the *Standard Manatee Conditions for In-Water Work* (Service 2011). The Corps determined that the LOCAR may affect, but is not likely to adversely affect manatees. Based on the Corps' minimization measures and anticipated project benefits to the manatee, the Service concurs with the Corps' effect determination.

Okeechobee Gourd

The Okeechobee gourd (*Cucurbita okeechobeensis* ssp. *okeechobeensis*) is an annual or perennial vine endemic to Florida, known to occur in natural and man-made islands around the northwestern and southern portions of Lake Okeechobee. In the lake, the most stable colonies occur in the southeastern quadrant on Torry, Kreamer, and Ritta Islands. The documented population of the Okeechobee gourd around the southeastern shore of Lake Okeechobee is strongly associated with Torry muck, a soil formed in the extensive pond apple forests that once surrounded the lake. This species also occurs along the middle St. Johns River in Volusia, Lake, and Seminole Counties.

Lake water levels can affect this plant's success by drowning out individual plants (if too deep) or may facilitate seed dispersal. Around Lake Okeechobee, the gourd relies on pond apple (*Annona glabra*) trees to support its vines above rising water levels during the wet season. Other trees and shrubs, such as willow (*Salix* sp.) and bald cypress (*Taxodium distichum*), may also provide suitable support for the vines. The Okeechobee gourd also seems to readily germinate on alligator (*Alligator mississippiensis*) nests around Lake Okeechobee, which provide suitably elevated soil berms in full sun, with no competition from other plants. These disturbed sites provide areas where competition is reduced and elevated areas that promote the growth of elderberry, buttonbush, and other erect bushes and shrubs (Service 1999).

The decline of the Okeechobee gourd is largely attributable to the conversion of swamp forests to agriculture and water level management in Lake Okeechobee. For the gourd to maintain viable

and healthy populations, fluctuations in lake levels are necessary. High lake levels facilitate dispersal and inundate and destroy aggressive weeds in local habitats. As lake levels decrease, the cleared open habitats allow the quickly germinating Okeechobee gourd seeds to sprout and begin climbing before they have to compete with other pioneer species. Water regulation practices can greatly influence the timing and duration of flooding and drying cycles across remnant areas of suitable elevation and soils around Lake Okeechobee. Permanent inundation of suitable soils is detrimental to the plant. Another potential threat to this plant is the proliferation of exotic plant species around the edges of Lake Okeechobee (Service 1999).

Due to the changes in Lake Okeechobee stages and the increased time that water levels are within the beneficial stage envelopes, the Corps has determined that there may be slight beneficial effects to the Okeechobee gourd. The Service recognizes that the ephemeral nature of gourd occurrences and the lack of a systematic surveys makes it difficult to determine if the LOCAR will be beneficial to the gourd; however, we concur that LOCAR may affect, but is not likely to adversely affect the gourd.

STATUS OF THE SPECIES

Indigo Snake

Please see Enclosure for the Species Status Assessment for the indigo snake.

Caracara

Please see Enclosure for the Status of the Species for the caracara.

Panther

Please see Enclosure for the Status of the Species for the panther.

Florida Bonneted Bat

Please see Enclosure for the Status of the Species for the FBB.

Tricolored Bat

Please see Enclosure for the Species Status Assessment for the TCB.

Summary of threats to the species

Indigo snake

The primary threats to indigo snakes are habitat loss or fragmentation and direct injury or mortality from vehicle or equipment use. Collisions with motor vehicles on Florida's extensive roadway system may be a significant source of indigo snake injury and mortality. Additionally, habitat degradation due to lack of management, including prescribed fire, is a threat to indigo

snakes. This action will replace upland indigo snake habitat with less suitable open water habitats and result in mortality or disturbance during construction.

Caracara

As the population of caracaras in Florida appears to be habitat-limited, the primary threat to adult caracaras is the loss of breeding habitat. For juvenile and sub-adult caracaras, the threats are road mortality and loss of habitat, specifically gathering and roosting areas. This action will result in complete or partial loss of habitats that support breeding pairs. There is also a likelihood for disturbance of the species during the construction and operation of the Project.

Panther

The primary threats to Florida panthers are loss, degradation, and fragmentation of habitat, disturbance from construction and operation, intraspecific aggression, and mortality from vehicular collisions. This action is likely to affect dispersal pathways as upland and wetland habitats are converted to an above-ground reservoir.

Florida bonneted bat (FBB)

Threats to the FBB stem primarily from a lack of information about their distribution and life history. This may lead to inadvertent habitat loss or fragmentation. While FBB roosts have been documented in native slash and long-leaf pine trees, roosts have also been reported on telephone poles (at least one occurrence) and under concrete roof tiles. For the proposed action, loss of FBB roost habitat (trees) is possible. The Service also anticipates that the forage base will change as the habitat is altered from uplands to wetlands, but prey items will be available after construction.

Tricolored bat (TCB)

The primary threats to the TCB are white-nose syndrome (WNS) (although no cases have been documented in Florida) and habitat loss. TCBs have experienced severe population declines since the onset of WNS in 2006. These declines have been more precipitous in the species' northern range (Turner *et al.* 2011). WNS results from infection by the fungus *Pseudogymnoascus destructans* and affects the hibernation and hydration cycles of hibernating bats, causing them to arouse more often, depleting crucial fat reserves and ultimately resulting in death (Frick et al. 2010; Lorch et al. 2011; Langwig et al. 2015). In areas where WNS has been documented, TCB populations have declined by more than 90 percent (Cheng et al. 2021). Although early models indicated the causal fungus should have reached Florida by now (Ihlo 2013), it has not yet been detected on a bat or at a hibernaculum in the state, due to migration into Florida from hibernacula north of the state appearing to be limited (Smith et al. 2022).

Forest habitat is a primary component of roosting, foraging, and commuting habitat for TCBs. Wetlands and water features are important foraging sources. These habitat losses influence the survival and reproduction of TCB colonies. Changes in land cover may be associated with losses in suitable roosting or foraging habitats, longer flights between suitable roosting and foraging

habitats due to habitat fragmentation, fragmentation of maternity colonies, and direct injury or mortality. Impacts from habitat loss vary depending upon the timing, location, and extent of the removal. Impacts from forest habitat removal may range from removing a small portion of foraging habitat in largely forested landscapes with robust TCB populations to significantly removing roosting habitat in highly fragmented landscapes with small, disconnected populations (Service 2021).

ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the status of the species, its habitat, and ecosystem, within the action area. The environmental baseline is a "snapshot" of a species' health at a specified point in time. It does not include the effects of the action under review in the consultation.

Status of the Species within the Action Area

Indigo snake

Due to their diurnal and somewhat cryptic nature (*i.e.,* being underground at night for some portion of daylight hours), indigo snakes are not as readily observable as other Florida snakes (*e.g.,* black racers, corn snakes). The Service's Geographic Information System (GIS) database contains three records of indigo snakes near the Project site: 3 mi south near Brighton Reservation, 6 mi west near southern Lake Istokpoga, and 5 mi north near the Kissimmee River. Although there are no documented indigo snake occurrences within the proposed reservoir footprint, the Project site does contain suitable habitat. Additionally, gopher tortoise burrows were observed onsite during a site visit on July 5, 2023. While the indigo snake is less dependent on gopher tortoise burrows for overwintering shelter in central and south Florida than in north Florida, they do still use them for refugia. Based on the occurrences of indigo snakes near the Project's footprint, suitable habitat onsite and adjacent to the site, and presence of features such as refugia, the Service expects that the indigo snake is reasonably certain to occur on the Project site.

The size of the action area represents a small portion of the combined acreage of all habitats usable by indigo snakes in southern Florida. Within the action area, much of the land cover is improved pasture. In general, this land use does not have the herbaceous cover needed by indigo snakes. Additionally, the distribution of improved pasture throughout the action area may cause fragmentation of other more suitable habitats. Other land uses, such as roads and canals, may further fragment the indigo snake habitat within the action area.

Recent studies demonstrated the densities of indigo snakes at Archbold Biological Station (ABS) (in Highlands County, 12 miles southwest of the LOCAR) and the C-44 citrus grove (now reservoir and Stormwater Treatment Area (STA) project in Martin County, 40 miles southeast of the LOCAR). A 26-year study conducted by Layne and Steiner (1996) at ABS estimated a population density of 2.6 indigo snakes (1.9 males, 0.7 females) per 100 hectares (ha) (247 acres). They also estimated a more conservative density based on five snakes (three males and two females) that occupied 314 ha at 1.6 indigo snakes per 100 ha (0.96 males to 0.64 females).

ABS encompasses a high percentage of native Florida habitats for indigo snakes (*i.e.,* the study area comprised of 60 percent xeric pine and oak uplands and 40 percent pine flatwoods, bayheads, swale, and seasonal ponds). Indigo snakes have been observed at ABS in all natural and man-altered habitats with no obvious habitat preferences (Layne and Steiner 1996).

At the C-44 site, which was mostly citrus irrigated from canals, the average home range for four male indigo snakes using the minimum convex polygon method was 42.61 ha (105.29 ac); one female snake tracked for 18 months had a home range of 13.79 ha (34.08 ac; Ceilley et al. 2014). These home ranges convert to a 100 ha density of 2.35 males and 7.25 females (9.60 total indigos per 100 ha). These home ranges are smaller than previously reported in the literature, and Ceilley et al. (2014) suggested the C-44 site contained high-quality habitat and/or a high indigo snake population density. In Bauder et al. (2016), the most recent of these studies performed in Florida, radio telemetry data was summarized to provide an estimated mean annual home range of 369 ac for males (n = 40) and 121 ac for females (n = 31).

The density of indigo snakes in project features, and therefore, the number potentially affected by the action, would be based on habitat quality and the presence of resources like prey, cover, underground refugia, and other indigo snakes. Improved pasture, comprised primarily of short-stature exotic grasses, does not provide much cover for a large snake such as the indigo, especially if burrows or other underground refugia are sparse. Where there are forested or shrubby wetlands and uplands (including some agriculture like citrus), there is more likely to be abundant prey items and more refugia; hence, more indigo snakes.

Caracara

Caracaras occupy and reproduce in the action area; it is within the center of the species' range in Florida (Service 1999). As a result, the territory density here is as high as anywhere within the species' range in Florida. For example, in 2015 there were 12 caracara nests reported from STOFs Brighton Reservation (Haas 2015) (on roughly 24,100 acres of pasture habitats). Morrison and Humphrey (2001) identified an average caracara home range of about 2,976 acres. The overall number of caracara territories in the action area is directly proportional to the large amount of open, dry prairie, rangeland, or pasture habitats (*i.e.,* improved, unimproved, and woodland pastures). Despite some development around the City of Okeechobee, the area is primarily rural and agricultural. From the mid-1990s to 2018, approximately 80 observations were within the action area (not including Lake Okeechobee, C-43, C-44, or the northern estuary portions of the action area, which is essentially an aquatic habitat).

While no caracara nest surveys have been conducted for the LOCAR, numerous caracaras have been observed utilizing the site. Recently, caracaras were documented within the Project footprint during site visits on May 3 and July 5, 2023. This region of Highlands County also contains numerous historical caracara nest locations and observations indicating the importance of this area to the species. According to the Service's GIS database, there is also a communal roost and gathering area south of the Project. Communal roosts or gathering areas are temporary settling areas where groups of birds of all ages, including non-breeding adults, will spend lengths of time.

Panther

The Project is located within the "Thatcher Dispersal Pathways" of the panther focus area (Kautz et al. 2006). The Project site does not contain suitable denning habitat, but, with the exception of the deepest parts of the above-ground impoundment in the northern Project site, the entire 12,392 acres (plus 484 acres of upland habitat that will be isolated inside the southern Project site) does provide suitable foraging habitat. The Service is not aware of any panther activity or panther signs (*e.g.,* scat, tracks, scrapes, etc.) that have been observed within the proposed reservoir footprints. However, given the telemetry data (discussed below), it is expected that panthers are likely to use the action area as a dispersal pathway for northern expansion.

The Service used current and historical radio-telemetry data, information on habitat quality, prey base, and evidence of uncollared panthers to evaluate panther use in the action area. Panther telemetry data are collected three days per week from fixed-wing aircraft, usually in early to mid-morning. However, researchers have shown panthers are most active between dusk and dawn (Beier 1995) and are typically at rest in dense ground cover during daytime monitoring flights (Land 1994). Comiskey et al. (2002) suggested that, because data is collected when panthers are least active, these locations may present an incomplete picture of activity patterns and habitat use. However, this potential bias was not detected in a recent analysis by Land et al. (2008) using Global Positioning System (GPS) satellite location data collected throughout a 24-hour day. This study revealed panther habitat selection patterns are similar when using either aerial telemetry data collected during the day or 24-hour satellite GPS location data. Both methods showed upland and wetland forests were the habitats most selected by panthers. The study also indicated that grassland-dry prairie habitats were used more at night than during daytime hours.

Only a subset of the panther population has been radio-collared. For example, 42 radio-collared panthers, representing about 40 percent of the estimated panther population, were monitored in 2013. However, the large database of telemetry locations taken from radio-collared panthers south of the Caloosahatchee River can be used to estimate the size and number of home ranges and travel corridors south of the Caloosahatchee River. The FWC also uses observational data collected during telemetry flights to assess the yearly breeding activity of radio-collared panthers. Female panthers accompanied by kittens or male panthers within proximity of an adult female are assumed to have engaged in breeding activity during that year.

A total of 233 telemetry locations, from six panthers, have been documented within 25 miles of the Project from 1972 through 2019 (FWC 2022a). None of those telemetry points were documented on the Project site. One panther was documented within 5 miles of the Project site, approximately 3.5 miles northwest. The closest panther mortality occurred approximately 12.5 miles southwest of the Project boundary. The status and activities of uncollared panthers within the action area are unknown. According to FWC (2022b), there have been 11 panther deaths documented within 25 miles of the Project site between 1972 and 2022 (Figure 3). Data show that nine of those deaths were attributed to motor vehicles and two were from unknown causes.

Florida bonneted bat

The only reported observation of the FBB in the action area for the Project was at Platt's Bluff Boat Ramp in 2008 about 5.0 miles east of the LOCAR boundary, near the Kissimmee River. Florida bonneted bats are closely associated with forested areas because of their tree-roosting habits (Robson 1989; Belwood 1992; Eger 1999), but specific information is limited. Eger (1999) noted that in forested areas, old, mature trees are essential roosting sites for this species. Recent acoustical data and other information indicate that the Florida bonneted bat uses forests and various other natural areas. Improved pasture (treeless) is not likely to have many potential roost sites. The use of the pasture and pasture wetlands for foraging habitat would be predicated upon the roosting habitat being within the FBB nightly flight ability. The average FBB foraging distance is unknown. Data from recovered GPS satellite tags on Florida bonneted bats tagged at Babcock-Webb Wildlife Management Area (WMA) found the maximum distance detected from a capture site was 24.2 mi (38.9 km); the greatest length traveled in a single night was 56.3 mi (90.6 km) (Ober 2016; Webb 2018a-b). No FBB acoustical surveys have been conducted on the Project site. However, given the general suitable habitat requirements for FBB for roosting and foraging and the considerable scale of the Project, the Service expects that the FBB is reasonably certain to occur on the Project site.

Tricolored bat

This Project lies within the range of the proposed federally endangered TCB. The proposed action area contains 12,392 acres of suitable TCB foraging and/or roosting habitat, which commonly forage along waterways and forest edges, and roost primarily in deciduous hardwood trees (Service 2021b). For the purposes of this Conference Opinion, it has been assumed that the entire Project footprint is suitable habitat. No survey data is available through the U.S. Geological Survey (USGS) North American Bat Monitoring Program or other sources showing that TCB have been detected in the Project's action area. TCBs will use leaf clusters, moss, lichens, and some evergreen trees to roost during the non-hibernating season and move to a more robust (caves, mines, etc.) shelter to hibernate. In the southern portions of its range, where caves are limited, TCBs typically hibernate in road-associated culverts (Service 2021). A recent study on the TCB by Smith et al. (2022) found evidence that suggests TCBs at the southern edge of its range (*i.e.,* South Florida) may move north to find cooler hibernacula to support torpor and reproductive success. Furthermore, as TCBs generally move between winter hibernacula and summer roosting sites, up to 151 miles (Samoray et al. 2019), this species may only use the Project site seasonally. For these reasons, the Service expects that the TCB is reasonably certain to occur on the Project site.

Factors affecting the species environment within the action area

The factors that affect the species environment of the indigo snake, caracara, panther, FBB, and TCB within the action area include, but are not limited to Federal, State, or private actions and other human activities. Examples include construction of highways and urban development, agriculture operations, resource extraction, pesticide/rodenticide application, public lands management (prescribed fire, public use, exotic eradication, etc.), hydrological restoration projects, and public and private land protection efforts.

Indigo snake

For the indigo snake, habitat is the key factor to the extent and abundance of this species in the action area. Where improved pasture is not very suitable due to lack of prey and cover, forested uplands, citrus, and wetland edges (including some canals or drainage features) with underground refugia are important habitats to maintain the indigo snake population in the action area.

In Highlands County and surrounding counties, recent interest in dispersed water storage projects on private lands, construction of reservoirs, and additional proposals for the construction of STAs as part of the CERP also threaten to impact indigo snake habitat. Foraging or nesting habitat within these project sites may become inundated with water, even if only on a seasonal basis, and eventually may reach a depth at which that habitat is no longer available to foraging indigo snakes or suitable for nesting and sheltering. Although the mechanism of the "development" (*i.e.,* inundation with water) may be different than a typical residential or commercial development, the potential loss of habitat to foraging, nesting, and sheltering indigo snakes is the same.

Caracara

The factors that have contributed to the baseline condition of the action area for the caracara is its relatively rural nature (compared to other portions of Florida) that allows for maintenance of large areas of pasture or pasture-like habitat with wetlands and suitable cabbage palms for nesting substrate. This includes the Project site itself, which is primarily used for agricultural purposes. In that regard, the preservation of ranching-type activities to maintain the open habitat in this area is important for long-term persistence of caracaras. As with the indigo snake, CERP projects in the area may lead to conditions where the habitat is no longer available to foraging caracaras or suitable for nesting.

Panther

Commercial and residential development threatens the panther throughout its geographic range. While certain largescale resource intensive or utility projects may have initiated within the action area, much of the action area remains rural. The Project site and action area have been actively managed as citrus, row crops, and cattle farms for years. Panthers have adapted to using these areas for hunting and dispersal. In Highlands County, recent interest in dispersed water storage projects on private lands, construction of reservoirs, and additional proposals for the construction of STAs as part of the CERP also threaten to impact panther habitat. Foraging or denning habitat within these project sites may become inundated with water, even if only on a seasonal basis, and eventually may reach a depth at which that habitat is no longer available to foraging panthers or suitable for denning. Although the mechanism of the development may be different than a typical residential or commercial development, the potential loss of habitat to foraging and denning panthers is the same.

Florida bonneted bat

For the FBB, habitat complexity with forested uplands for roost sites and suitable foraging areas (either uplands or wetlands with good insect productivity) will dictate where the species occurs. The open pasture setting of the action area may still provide foraging opportunities for the FBB as this species should be capable of foraging up to 25 miles, or more, from a roost site. With other CERP projects in the action area, there may be an increase in foraging habitat resulting from uplands being hydrologically converted to wetlands or open water habitats of various hydroperiods. However, as land is cleared for development, the availability of roosting habitat may decline as trees or other roosting structures are removed.

Tricolored bat

Like the FBB, TCB may benefit from projects within the action area or the continuation of agricultural practices that maintain forested components (such as woodland pastures). But the removal of habitat for development which results in a change in landcover may lead to losses in suitable roosting or foraging habitat, longer flights between suitable roosting and foraging habitats due to habitat fragmentation, fragmentation of maternity colonies, and direct injury or mortality of the TCB.

Climate Change

Our analyses under the ESA include consideration of observed or likely environmental effects related to ongoing and projected changes in climate. As defined by the Intergovernmental Panel on Climate Change (IPCC), "climate" refers to average weather, typically measured in terms of the mean and variability of temperature, precipitation, or other relevant properties over time; thus, "climate change" refers to a change in such a measure which persists for an extended period, typically decades or longer, due to natural conditions (*e.g.,* solar cycles) or human-caused changes in the composition of the atmosphere or land use (IPCC 2013, p. 1450). Because observed and projected changes in climate at regional and local levels vary from global average conditions, rather than using global scale projections, we use "downscaled" projections when they are available. In our analysis, we use our expert judgment to weigh the best scientific and commercial data available in our consideration of relevant aspects of climate change and related effects. Based on the observed trends in the climate record gathered from thousands of temperature and precipitation recording stations around the world and changes observed in physical and biological systems, the scientific community is certain that the earth's climate is changing, and a warming trend in the climate is occurring (USGS 2019).

Florida is vulnerable to pulse events, sea level rise, and changes in rainfall and temperatures expected due to changes in environmental trends. National Oceanic and Atmospheric Administration (NOAA) (2017) model simulations using the more recent Coupled Model Intercomparison Project Phase 5 (CMIP5) predicts changes in precipitation seasonally for south Florida with increases in dry season rainfall up to 20 percent and decreases in wet season rainfall up to 30 percent. The change in timing of rainfall will likely stress ecosystems and cause changes in vegetation types. The changes in rainfall could reduce our ability to effectively use prescribed burning to manage habitat in optimal conditions for the indigo snake, caracara, and other

endangered and threatened species and their prey. Increased rainfall could also reduce the amount of area suitable for indigo snake, caracara, and panther foraging. It could reduce suitable refugia for indigo snakes, the number of available cabbage palms for nesting caracaras, denning areas for panthers, and roosting structures for FBBs and TCBs by increasing the area covered with standing water or the duration of inundation of seasonally wet areas. Conversely, increased rainfall in the dry season could increase prey availability for caracara and indigo snake, but decreased rainfall could decrease prey availability in the wet season.

Climate change may impact all bat species (including FBB and TCB) by affecting hibernation, mortality from extreme drought, cold, or excessive rainfall, cyclones, prey availability, loss of roosts from sea level rise, and impacts resulting from human responses to climate change, such as establishing wind turbines (Burles et al. 2009; Jones and Rebelo 2013). Climate change is also likely to influence disease dynamics as temperature, humidity, phenology and other factors affect the interactions between WNS and hibernating bats (Hayman et al. 2016; McClure et al. 2020; Hoyt et al. 2020). The overall impact of climate change for such a wide-ranging species as the TCB is challenging to determine, but overall negative impacts are anticipated (USFWS 2021b).

It is difficult to estimate, with any degree of precision, which species will be affected by climate change or exactly how they will be affected. The Service will use Strategic Habitat Conservation planning, an adaptive science-driven process that begins with explicit trust resource population objectives, as the framework for adjusting our management strategies in response to climate change (Service 2006).

EFFECTS OF THE ACTION

Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02).

Activities associated with the construction and operation of the Project that may affect the caracara, indigo snake, panther, FBB, TCB, and their habitat are discussed in the Project Description section above and include land clearing and tree removal, construction activities, water inundation, and operation activities. These activities may have numerous effects on these species and their habitat, which include: (1) loss of habitat for foraging, nesting, sheltering, and dispersing; (2) reduction in the geographic distribution of habitat for these species; (3) disturbance due to construction activities; (4) increased potential for mortality due to heavy equipment and vehicle operation; (5) increased disturbance due to human activities; and (6) increased potential for intraspecific aggression among conspecifics due to shifts in territories of near neighbors and a reduction of the geographic distribution of available habitat.

Adverse Effects

Indigo snake

Upland habitat will be lost via hydrologic conversion in the LOCAR as a result of Project construction and operation. For the purposes of this Biological Opinion, any improved pasture areas that have very low herbaceous cover (including sod areas) and aquatic vegetative communities (including wetlands and open water) are generally not indigo snake habitat. Within the LOCAR footprint, approximately 7,534 acres (or about 61 percent) are classified as improved pasture (Corps 2023) and 2,890 acres as aquatic vegetative communities or other habitat types. Therefore, approximately 10,424 acres within the LOCAR is considered unsuitable indigo snake habitat. The LOCAR will hydrologically convert approximately 1,968 total acres of habitat for the indigo snake. In other words, 1,968 acres of indigo snake habitat would be removed by the proposed action. As a result, any indigo snakes that occupy the Project area will permanently lose all or a part of their home range. The loss of reproduction and/or sheltering opportunities would depend on the amount and quality of the indigo snake's territory that is lost.

Indigo snakes might be killed, injured, or displaced by the Project's construction. Displaced snakes might also be subsequently killed or injured, including via inter- or intra-specific aggression. During construction, indigo snakes in underground refugia might be killed without being observed. Indigo snakes might also be crushed by vehicles or equipment if operators are unable to see snakes, either on the site or when traveling to and from the site. Despite the Corps' agreement to implement a 25-mph speed limit (to reduce the likelihood of vehicular mortality of indigo snakes), experience at the Corps' C-44 Reservoir and STA Project site indicates vehicles or equipment still kill indigo snakes.

We have occurrence data for indigo snakes within the action area, but not within the Project footprint. The Service used data from other indigo snake studies in Florida to estimate the number of indigo snakes on the Project site. In Bauder et al. (2016), radio telemetry data was summarized to provide an estimated mean annual home-range size of 369 ac for males (n = 40) and 121 ac for females (n = 31) (note – these data were reported in hectares in Bauder et al. (2016) but were converted to acres for this document). Using these mean home range estimates and allowing for overlap of home ranges among the sexes, we calculated that up to five male (1,968 ac/369 ac per a single male home range) and 16 female (1,968 ac/121 ac per a single female home range) indigo snakes or 21 indigo snakes total are likely to occur within the 1,968 ac of suitable habitat within the Project footprint. Because 16 female indigo snakes are expected to be present, we also estimate 16 nests with eggs could also be present during the breeding season (April to July).

Caracara

Approximately 9,785 acres of caracara habitat (*i.e.,* improved pasture, unimproved/woodland pasture, and wet prairie) will be lost via hydrologic conversion within the LOCAR. We expect that some of the proposed levees and seepage canals built for the LOCAR may serve as habitat, but the spatial extent cannot be determined at this time. Some areas are currently wetlands (albeit lesser functioning) and may not be caracara habitat now. We expect any caracara nest trees

within the LOCAR footprint will be removed and those territories may disappear depending on the percentage of habitat conversion by the action in each territory.

Caracara territories with nest trees outside of the LOCAR may also be affected (*i.e.,* reduced productivity) by disturbance during construction or operation, or if a substantial percentage of the territory is made unusable (even if the nest tree remains intact). Alternatively, territories may shift because of habitat loss or fragmentation. In this event, increased intra- or inter-species aggression may result. The current understanding of caracara population dynamics in Florida is that suitable caracara breeding habitat is occupied. The significance of this is that any breeding caracara displaced by the LOCAR will need to either displace another breeder, or lose its territory (and productivity), unless new habitat is created (*e.g.,* conversion of citrus to pasture).

We do not know exactly how many breeding pairs currently overlap the LOCAR footprint. However, until surveys are completed, we can use the average caracara territory size (*i.e.,* 3,000 acres) and known nest locations in the area to estimate the number of caracara territories affected by the action. Reported caracara nests (1995 to Present) within the LOCAR and a 1,500 meter buffer from the Project boundary are depicted on Figure 4. The Service is including the buffer zone of approximately 1,500 meters (4,920 feet) as part of the action area. This buffer zone accounts for off-site nest trees in territories that might overlap onto the project area. The buffer represents the area identified by the Service as the protective area for a caracara nest (Service 2016). We know the distribution of nests is based on habitat, and there are likely to be portions of some territories both inside and outside of the Project footprint.

To obtain a realistic estimate of the number of territories affected by the LOCAR, we used aerial images and land cover shapefiles in ArcGIS to predict the most likely location of caracara territories. We started by drawing 3,000 acre circles around reported nests within the Project footprint and the 1,500 meter buffer around the Project footprint to approximate the location and size of reported territories. We then placed additional adjacent 3,000 acre circles (to represent additional potential caracara territories) over the remaining suitable habitat until the Project components were covered (Figure 4). The result was a total of nine territories within, or affected by, the LOCAR.

It is not clear if the LOCAR would cause caracaras in partial territories lost to abandon their territories entirely, since only a portion of their territories fall within the Project boundary. However, there is a higher likelihood that the territories where nests are within or just outside of the boundary would be abandoned because nest destruction or high disturbance will occur as a result of the construction and operation of the LOCAR. This estimate of territories may change after pre-construction surveys are completed; however, for the purpose of this Biological Opinion, we will move forward with nine caracara territories affected by the Project with a likelihood of some (as many as five territories [≥50% of territory lost]) being completely lost. This number was determined as the sum of the three potential territories that are ≥50% within the Project footprint and half of the two territories with nests recorded along the southern boundary (Figure 4).

An estimated completion date was not provided by the Corps, and it is unclear exactly when the Project construction would commence. As such, it is difficult to determine the effects that the

duration of construction of the LOCAR may have on caracaras. While the Service cannot accurately quantify these productivity losses until the schedule becomes more definite, it can be generally stated that the longer the duration of project construction, the more potential there is for the productivity of breeding pairs in the action area to be impaired. Because there currently appears to be a surplus of juvenile and non-breeding caracaras in Florida, a loss of productivity for a few years is probably not as significant a threat to population persistence as a permanent loss of breeding territories. In terms of timing, because the Corps has committed to implementing the *Draft Species Conservation Guidelines for Audubon's (Florida) Crested Caracara*, nests identified during pre-construction surveys will be avoided while active, meaning construction will not occur within a nest's primary zone during the nesting season or while the nest is in-use.

Panther

The land clearing activities and construction activities associated with the Project have the potential to injure or kill panthers. However, panthers are intelligent and highly agile. While the Service finds that these animals will likely avoid the Project footprint during land clearing and construction, and injuries or mortalities of panthers due to these activities are unlikely, there still is the possibility of disturbance to panthers from construction related activities.

To construct the perimeter dam and interior divider dam, material from the Project footprint will be used. While there may be a traffic increase from the Project compared to what is present for the ongoing ranching and land management operations, the materials to construct the LOCAR are being sourced on-site, which minimizes the Project's overall impact on traffic. Additionally, speed limits during construction will be limited to 25 mph, and educational wildlife posters will be posted with the speed limits. Consequently, the Service does not anticipate a significant change in the volume of traffic within the LOCAR boundary during the construction of this Project.

A traffic study or estimate on traffic increase in terms of vehicle trips per day was not provided by the Corps. However, it is anticipated that traffic volume increases from the Project will be temporary and mainly limited to the construction phase. This construction activity will also occur primarily during daylight hours when panthers are not as active (Beier 1995). Minimal traffic is expected for the operation and maintenance of the LOCAR. There have been no panther deaths (vehicle-related or otherwise) documented within 5 miles of the Project site. The closest panther mortality was approximately 12.5 miles northwest of the LOCAR boundary. While no annual average daily traffic data was gleaned for the surrounding roads, and an estimate for the increase in vehicle trips per day was not provided, the nature of the Project (*i.e.,* construction with the use of on-site materials and minimal operational traffic) combined with the absence of available panther telemetry within a 5 mile radius and absence of previous panther mortalities means the relative change or increase in vehicle-related panther deaths as a result of this Project would be hard to detect and likely discountable.

Approximately 12,877.78 acres of panther habitat will be lost via hydrologic conversion and dam construction within the Project area. This includes 484.44 acres that, while not being used for water storage, will be functionally isolated by the proposed seepage canal. The hydrology of the Project footprint will be changing from primarily pasture upland habitat and marsh wetland

habitat to a storage reservoir with an average storage depth of 19 feet at its normal full-storage level. Water levels greater than 1.64 feet (reported as 0.5 meter) are detrimental to deer populations (MacDonald-Beyers and Labisky 2005; Cherry et al. 2019). Since deer are the panther's main prey, the Service considers the LOCAR unsuitable for panthers at water levels greater than 1.64 feet (0.5 meter). The extent of these impacts will be permanent, given the average storage depth of the reservoir. For this Biological Opinion, the perimeter and interior "dams" were also not considered suitable for panther, given their height (*i.e.,* approximately 33 feet above ground).

The LOCAR falls entirely within a portion of the Panther Focus Area identified as the "Thatcher Model Dispersal Pathways." These are the most likely dispersal routes, based on the least cost-pathway models in *An Assessment of Habitat North of the Caloosahatchee River for Florida Panthers* (Thatcher et al. 2006), to potential panther habitats to the north. If occupied by panthers, these dispersal pathways would have the greatest potential for connectivity to other habitat patches (Thatcher et al. 2009). They represent potential habitat linkages between the current range and the Babcock-Webb WMA site north of the Caloosahatchee River, which could play an important role in maintaining connectivity with the primary panther range to the south, at least for males. Specifically, the LOCAR is within the dispersal pathway represented by a 28.3-km-long habitat connection between Avon Park and Fisheating Creek. Collectively, these sites could support as many as 14-16 panthers (approximately 10-12 at Avon Park and 4 at Fisheating Creek) (Thatcher et. al 2009). Depending on local variation of important factors such as prey density, these sites may have higher or lower densities than those in southern Florida.

The Project is proposed in a portion of a dispersal pathway, and this may mean there is an effect on the species' ability to disperse north of its current range. However, measuring the exact extent to which the conversion of panther habitat to a reservoir within the dispersal pathway may result in take is complicated by several factors. For one, the dispersal pathway is not measured in the same way the habitat patches which it connects are making percentage-based calculations difficult. Instead, these pathways are reported more as linear values (*e.g.,* 28.3-km-long habitat connection). Also, the use of these pathways by panthers may be more a function of impediments than habitat availability. Major and minor highways, such as U.S. Route 98 to the north, may play a larger role in the effects to panther mortality. Finally, an effect would be predicated by the assumption that panthers are indeed utilizing the habitat patches. Major highways isolate these sites, and there is a large dissimilarity between the types of habitats connecting these sites and the types of habitats panthers prefer. Thatcher (2009) notes that the landscape matrix within which the largest habitat patches exist provides relatively poor habitat connectivity. In the LOCAR's case, the Avon Park site to the north and Fisheating Creek site to the south are isolated in this sense. While there have been documented occurrences in this pathway, reporting of 14-16 panthers in the patches linked by the dispersal pathway is simply a density estimate (Thatcher et. al 2009). Telemetry data within these areas is sparse, with only two reported panthers documented within the dispersal pathways and the 25-mile radius from the Project.

The Service's Panther Habitat Assessment Methodology (2012) was used to determine the amount of panther habitat units (PHUs) lost due to construction of the Project. The Project will result in the conversion of 12,877.78 acres of panther habitat to reservoir. This acreage includes over 18 miles of perimeter and interior "dams" that will not be functionally available to panthers.

Additionally, due to the construction of the seepage canal surrounding the perimeter dam, 484.44 acres of habitat will also functionally be unavailable to panthers. Because water levels within the reservoir will average 19 feet, the LOCAR will lead to a total of approximately 12,877.78 acres (12,393.34 ac of reservoir plus 484.44 acres of functionally unavailable habitat) of existing suitable habitat becoming unsuitable for panthers and their prey. This will result in a net loss of approximately 42,006 PHUs in the other zone (Figure 5).

Habitat loss may increase the potential for intraspecific aggression among panthers in the action area. The Project will result in the loss of about 12,877.78 acres of panther habitat. However, based on the amount and quality of panther habitat lost, the Service finds the Project should not significantly increase the potential for intraspecific aggression in the action area.

Florida bonneted bat

Within the LOCAR, the 7,534 acres of improved pasture is not likely FBB roosting habitat. There are about 1,907 acres (in disjointed patches) in the LOCAR with large trees that are potential FBB roost areas. These include the unimproved pasture/woodland pasture and mesic flatwoods habitat and all of the existing trees in these areas will need to be removed for the LOCAR.

FBB generally forage over open areas, including wetlands. Until we have precise data, we will assume that the entire LOCAR area is potential FBB foraging habitat. We do not know exactly how the quality of foraging habitat will change after the inundation of the Project site. Coleopteran (beetles) prey might decrease, as terrestrial insect species tend to be larger on average than aquatic species; conversely, dipteran (true flies and midges) productivity might increase as hydroperiod increases. Regardless, foraging habitat for the FBB currently exists within the Project footprint and will continue after completion. We have no data to determine if hydrologic improvements to Lake Okeechobee from implementing the LOCAR will improve foraging conditions for the FBB over the lake or farther downstream. Generally, for areas with limited foraging potential in the LOCAR, such as the woodland pasture, hydrologic conversion to an aquatic system (*i.e.,* the reservoir) would be expected to increase foraging potential.

We have one FBB occurrence record in the action area near Platt's Bluff boat ramp (an Okeechobee County park on the Kissimmee River, on 5/26/2008) that is about five miles to the east of the LOCAR. The Corps has committed to conduct surveys for FBB once Congress authorizes the LOCAR and access is available, but in the interim, we cannot estimate the number of FBB adversely affected by the action. Therefore, we will use acres of roosting habitat (1,907 acres) lost as a surrogate for the effects of the action on the FBB. When FBB survey data become available, reinitiation of consultation for FBB should be evaluated.

Tricolored bat

Potential effects to the TCB due to the proposed action include several direct and indirect effects on the bat and its habitat. Potential direct effects include: (1) direct mortality from the destruction of roosting sites; (2) harassment by construction activities; and (3) disruption of normal behaviors from the conversion of available habitat for roosting, foraging, breeding, and

dispersing. Potential indirect effects include reduced foraging and roosting opportunities due to habitat loss. The timing for the construction of this Project, relative to sensitive periods in the life history of the TCB, is unknown.

Any actions that occur in areas known to be occupied by the TCB and result in the removal of potential roost sites (*i.e.,* snags, trees, utility poles, buildings, etc.) or impact foraging habitat (*i.e.,* filling in of canals and ditches) are likely to have direct and indirect adverse effects to the TCB and its habitat. The Service evaluated the Project in the context of how the action has the potential to result in both beneficial and adverse effects to the TCB, at the individual, population, and landscape scales. Specifically, it is anticipated that the creation of the LOCAR will require the destruction of roosting habitat, including forested uplands such as woodland pasture, and hydrologic conversion of existing foraging habitat, including herbaceous wetlands such as freshwater marsh, for the creation of a reservoir.

The use of specific minimization measures as part of the action, such as pre-construction acoustical and roost surveys, the use of avoidance buffers around known roosts, and retention of potential roosting habitat for certain time-periods (whenever possible) are expected to reduce the potential adverse effects to the TCB as a result of construction activities. It is also anticipated that the potential adverse effects to the TCB will be reduced by implementing minimization and conservation measures identified in the Description of the Proposed Action of this Biological Opinion. However, adverse effects to the TCB are likely to occur despite the inclusion of these measures in the proposed action.

The Corps has committed to conduct surveys for TCB once Congress authorizes the LOCAR and access is available, but in the interim, we cannot estimate the number of TCB adversely affected by the action. Therefore, we will use acres of TCB habitat (12,392) lost as a surrogate for the effects of the action on TCB. When TCB survey data become available, reinitiation of consultation for TCB should be evaluated.

CUMULATIVE EFFECTS

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

Cumulative effects within the action area could result from land clearing or land cover modification that alone may not trigger a section 7 or 10 permit. For example, we are reasonably certain that private landowners might plant sugar cane or citrus on pasture and convert upland forested habitat to pasture. As a result, adverse effects to listed species may occur. In the case of pasture conversion to other non-herbaceous (or tall herbaceous) land cover, habitat for caracaras may be lost. We cannot estimate the potential for loss to caracaras; however, it would need to be on the order of 1,000 acres (the minimum breeding territory size) (Service 2017). Similarly, if forested areas are cleared, habitat for the indigo snake, Florida panther, and/or FBB and TCB roost sites may be lost. We do not have enough occurrence data to estimate the magnitude of this

effect on the caracara, FBB, and TCB, but we expect to have better FBB and TCB occurrence data before the LOCAR goes into construction.

Increased vehicle traffic is another cumulative effect that may adversely affect listed species in the action area. Road mortality has been demonstrated for indigo snakes, crested caracaras, and Florida panthers. We do not have quantitative data for the indigo snake and crested caracara other than a few caracara mortalities reported to the Service in an average year. As for the Florida panther, mortalities are well documented, and those within the action area have been summarized in the Environmental Baseline of this Biological Opinion. Because of the anticipated minimal traffic increase by the Project, a traffic impact statement was not requested. Even if the increase in vehicular traffic from the Project were known, it would be difficult to distinguish the increase of potential panther injuries and mortalities due to vehicle collisions due to increased background traffic. As central Florida becomes more developed (even outside the action area) we expect more vehicle use in the action area on State Route (SR) 78, SR 70, and U.S. 27 and a concomitant increase in road mortality of listed species.

CONCLUSION

After reviewing the current status of the indigo snake, caracara, panther, FBB, and TCB, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's Biological Opinion and Conference Opinion that the LOCAR, as proposed, is not likely to jeopardize the continued existence of the indigo snake, caracara, Florida panther, FBB, or TCB. We have reached this conclusion for the following reasons:

Indigo Snake

1) The amount of habitat anticipated to be hydrologically converted (1,968 acres) by the Project is a small fraction of the available indigo snake habitat in south Florida;
2) The number of indigo snakes and their nests that are expected to be injured or killed due to land clearing associated with the Project's development and restoration activities is expected to be relatively small (16 females and their nests and 5 males); and
3) The Corps will follow the standard protection measures for the indigo snake (Service 2021a) throughout Project design and construction, which should reduce mortality caused by vehicles, equipment, or if a snake is encountered by workers.

Caracara

1) Only three of the potential nine caracara territories are known to occur within the Project footprint; and of these three, approximately half of each territory is likely outside of the footprint of the Project;
2) We do not know how many territories would be lost entirely; however, we have predicted it is a low number considering the potential for territories on adjacent lands;
3) The Corps will implement a maximum speed limit of 25 mph on-site during the construction of the Project, reducing the likelihood of vehicle-related injuries or mortalities to adults and juveniles;

4) Pre-construction surveys will be conducted to verify the number and locations of active caracara nests prior to construction; and
5) If active nests are discovered, 985 feet (300 meters) buffer will be maintained until the nest is no longer active.

Panther

1) Due to their mobility, panthers are not expected to be killed or injured during land clearing associated with the Project's development;
2) The Corps will implement a maximum speed limit of 25 mph on-site during the construction of the Project, reducing the likelihood of vehicle-related injuries or mortalities; and
3) The amount of traffic generated by the construction and operation of the Project is minimal, and the relative change or increase in vehicle-related panther deaths as a result of this Project would be hard to detect and likely discountable.

Florida Bonneted Bat

1) There is a lack of occurrence data in the Project footprint and action area, with the only reported observation recorded in 2008 approximately five miles east of the Project boundary;
2) The Corps will conduct pre-construction acoustic/roost surveys for this species;
3) The Corps will provide avoidance buffers during construction around roosts identified during pre-construction surveys;
4) Some foraging habitat will remain and, in the case of upland habitats converted to reservoirs, likely increase; and
5) the Corps will implement other best management practices consistent with the Service's latest guidance when possible.

Tricolored Bat

1) There is a lack of occurrence data in the Project footprint and action area;
2) The Corps will conduct pre-construction acoustic/roost surveys for this species;
3) Some foraging habitat will remain and, in the case of upland habitats converted to reservoir, likely increase; and
4) If TCBs are encountered or roosts are identified during pre-construction surveys, the Corps will coordinate measures with the Service to minimize or avoid adverse effects.

The Service may confirm the Conference Opinion as a Biological Opinion issued through formal consultation if the TCB is listed in Florida. If the Service reviews the proposed action and finds there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the Conference Opinion as the Biological Opinion on the Project and no further section 7 consultation will be necessary.

INCIDENTAL TAKE STATEMENT

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

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

For species proposed for listing under the Act, such as the TCB, the prohibitions against taking the species found in section 9 of the Act do not apply until a species is listed. If this conference opinion is adopted as a biological opinion following a listing of the TCB, the Reasonable and Prudent Measures, with their implementing Terms and Conditions, will be nondiscretionary. Terms and Conditions must be undertaken, for their exemption in section 7(o)(2) to apply.

AMOUNT OR EXTENT OF TAKE ANTICIPATED

The Service has reviewed the biological information for the indigo snake, caracara, panther, TCB, and FBB. We have also reviewed information presented by the District and Corps, and other available information relevant to this action.

Indigo Snake

The Service anticipates incidental take of the indigo snakes will be difficult to detect and quantify for the following reasons: 1) they spend much time underground even during the day; 2) they are difficult to observe in tall grass or brush; 3) a reliable survey method has not been developed so it will be difficult to know how many snakes are on the site once access is

available; and 4) potential observers may be distracted or may not be experienced enough to recognize indigo snakes or snake sheds. We expect the LOCAR will remove up to 1,968 acres of indigo snake habitat. As these acres are not all contiguous, it is difficult to assess the number of territories, and therefore, the number of indigo snakes at risk. Because it is difficult to assess the number of territories of indigo snakes in the Project footprint (and therefore the number of indigo snakes at risk), we have defaulted to the conservative estimate of up to 21 indigo snakes that will be incidentally taken by the Project; and of these, we anticipate half will be killed during construction (and probably most of these will never be observed). Therefore, we anticipate the LOCAR will kill up to 11 indigo snakes, either directly (crushing or burying) or indirectly (inter or intra-specific aggression). The remaining 10 indigo snakes will be injured or disturbed but survive within or adjacent to the LOCAR footprint.

Caracara

Because caracara surveys have not been completed for the Project, we do not know exactly how many breeding pairs currently overlap the LOCAR footprint. The level of incidental take may also be difficult to detect and quantify for the other following reasons: (1) the caracara has a wide-ranging distribution; (2) the caracara has a protracted breeding season; (3) it would be difficult to find or identify dead or impaired individuals; and (4) there is a possibility for double brooding in a season, which may or may not occur in the same nest tree. As described in the Effects of the Action in this Biological Opinion, we have used the average home range size to estimate the number of caracara territories affected by the action. Based on our assessment, the Service anticipates incidental take in the form of at least partial or full territory habitat loss for up to 9 caracara breeding pairs, with as many as 5 territories being completely lost. Some of these territories may be lost entirely due to construction that will remove trees (*e.g.,* cabbage palms) and hydrologic conversion of improved pasture habitat in LOCAR.

The Service anticipates that 18 adults (a pair from each of the 9 territories in the LOCAR footprint), 27 eggs and/or nestlings (3 from each of the 9 pairs impacted by the Project), and 9 juveniles (*i.e.*, young caracaras that have fledged from the nest) (1 from each of the 9 nests inside and adjacent to the LOCAR boundary) could be incidentally taken as a result of the proposed action. Our analysis has determined that take of caracaras will occur as the result of the Project through the following mechanisms: (1) take of adult caracaras in the form of harm from significant impairment of behavioral patterns such as breeding and feeding due to loss of habitat; (2) take of adults from harm due to intraspecific aggression; (3) take of eggs, nestlings, fledglings, and juveniles from harm as a result of disrupted parental care; and (4) take of fledglings and juvenile caracaras in the form of harm resulting in direct mortality of individuals during Project construction.

Panther

The Project is expected to incidentally result in the take of panthers in the form of harm due to the loss of panther dispersal habitat in the Project footprint. Because the adverse effects of habitat loss on the fitness and survival of panthers are difficult to convert to a specific number of individuals taken, take will be quantified by the alteration or functional loss of 12,877.78 acres of panther habitat within the Project footprint.

Florida Bonneted Bat

At this time, due to a lack of FBB survey data, we cannot estimate the number of FBBs that are likely to be incidentally taken by the Project. The LOCAR will convert the type of FBB foraging habitat from upland pasture with wetlands to open water. Therefore, although the foraging habitat type will change (and we assume prey items may differ), there will still be FBB foraging habitat after the Project is constructed. Therefore, the Service has opted to use acres of FBB roosting habitat lost as a surrogate for the number of individual FBB incidentally taken by the Project until better data become available. When better data are available, we anticipate that no or a minimal number of FBBs will be killed by the Project because roosts will be identified prior to construction and bats will either relocate themselves or be relocated to adjacent areas. Such roosts, if/once identified, will be avoided in accordance with the Service's latest guidance. The Service anticipates incidental take of up to 1,907 acres of FBB roosting habitat.

Tricolored Bat

As with the FBB, due to the lack of survey data, we cannot estimate the number of TCBs that are likely to be incidentally taken by the Project. The Service anticipates incidental take of the TCB will be difficult to detect and quantify for the following reasons: 1) TCB roost sites are difficult to identify; 2) trees used by the TCB as roost sites are not easily located or examined; 3) the small size of individual TCBs make finding an injured or dead specimen unlikely; and 4) TCB are not uniformly distributed across suitable habitat. Therefore, the Service has opted to use acres of suitable habitat lost, degraded, or fragmented as a surrogate for the number of individual TCBs incidentally taken by the Project until better data become available. When better data are available, we anticipate that no or a minimal number of TCBs will be killed by the Project because roosts will be identified prior to construction and bats will either relocate themselves or be relocated to adjacent areas. If TCBs or their roosts are identified during pre-construction surveys the Corps has committed to coordinating with the Service on measures to take to minimize or avoid impacts. The Service anticipates the proposed Project to incidentally result in take of the TCB in the form of the loss, degradation, or fragmentation of up to 12,392 acres of TCB habitat.

If, during the course of this action, any of these levels of take is exceeded, such take would represent new information requiring a review of the reasonable and prudent measures provided. The Federal action agency must immediately reinitiate consultation with the Service.

EFFECT OF THE TAKE

In the accompanying Biological Opinion and Conference Opinion, the Service determined that this level of expected take is not likely to result in jeopardy to the indigo snake, caracara, panther, FBB, or TCB. Critical habitat designation for the FBB has been published in a proposed rule; however, it will not be affected by the Project.

REASONABLE AND PRUDENT MEASURES

When providing an incidental take statement, the Service is required to give reasonable and prudent measures it considers necessary or appropriate to minimize the incidental take along with terms and conditions that must be complied with, to implement the reasonable and prudent measures. The Service believes the following reasonable and prudent measure is necessary and appropriate to minimize effects of the LOCAR on the indigo snake, caracara, panther, FBB, and TCB:

1) Implementation of the LOCAR as proposed and outlined in the "Description of the Proposed Action" section of this Biological Opinion.

TERMS AND CONDITIONS

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

Indigo Snake

1) Implement the Service's *Standard Protection Measures for the Eastern Indigo Snake* (2021a).

Caracara

1) Caracara nesting and productivity surveys will be conducted starting at least two years prior to construction through the completion of construction and two years into the post-construction operational phase of the Project in accordance with the Service's most recent *Crested Caracara Survey Protocol Additional Guidance* (Service 2016). Corps staff will provide the Service with a nesting season monitoring plan prior to each nesting season and an annual report that will detail findings of any nesting activity.
2) Provide equivalent compensation for the loss of up to nine caracara territories through land protection within the vicinity of the LOCAR project. Credit for this land protection may be provided in the form of panther habitat protection if the parcels also contain suitable habitat for the caracara.

Panther

1) The Corps' Biological Assessment (Corps 2023) estimated 42,006 PHUs will be lost by construction and operation of the proposed Project. The Service recognizes this is an estimate and the exact number of PHUs to offset will need to be further refined by the Corps and Service prior to construction. As compensation for the loss of panther habitat on the Project site the Corps has agreed to include the following measures as part of the action:

a. Provide compensation for 25% of the PHUs in the form of habitat preservation and management within the Picayune Strand Restoration Project prior to the commencement of any construction.
b. Provide compensation for 75% of the PHUs through a combination of land protection and range expansion benefits within the vicinity of the LOCAR project prior to the commencement of any construction.
c. Donate $1 million dollars towards creating a fund to be used for panther range expansion activities (*e.g.,* opening a fund with the Fish and Wildlife Foundation of Florida, Inc.) prior to the commencement of any construction.

2) The Corps and District will submit proposals for panther/caracara land preservation to the Service's panther coordinator, caracara species lead, and Everglades Program Supervisor for review and mitigation calculations prior to a final commitment by the agencies for purchase or conservation easement establishment.
3) The Corps and District will complete all compensation for the loss of panther and caracara habitat prior to the initiation of construction for the LOCAR.
4) A 25-mile-per-hour speed limit will be posted on the site during construction activities to reduce the possibility of vehicular death of panther and other wildlife.

Florida Bonneted Bat

1) Provide the Service with a list of applicable and implementable FBB BMPs (from the Service's *Consultation Key for the Florida Bonneted Bat* or the latest guidance available) prior to construction or reinitiation of consultation, whichever comes first.

MONITORING AND REPORTING REQUIREMENTS

Pursuant to 50 CFR § 402.14(i)(3), the Corps and/or District must provide adequate monitoring and reporting to determine if the amount or extent of take is approached or exceeded. Reports shall be submitted to the Service at 777 37th Street, Suite D-101 Vero Beach, Florida 32960 or electronically to fw4flesregs@fws.gov. Specific monitoring and reporting requirements for the indigo snake, caracara, panther, FBB, and TCB are detailed below:

General

The Corps and District will provide an annual report to the Service on the progress the agencies are making towards meeting the compensation requirements for the loss of panther and caracara habitat anticipated from the LOCAR. The first report will be submitted to the Service by July 1, 2024, and subsequent reports will be due annually on the same date until construction begins. The report will detail any land purchases, conservation easements, or other land preservation that has occurred or is being proposed. It will also contain the most recent calculation of PHUs and caracara habitat that have been offset by the agencies.

Caracara

Caracara pairs within the Project footprint will be monitored beginning in January of each year. The goal of monitoring is to obtain detailed information on caracara breeding pairs that are affected by Project-related disturbances and the changes in habitats resulting from construction and inundation of the Project footprint. This will include the ability to evaluate changes in areas used by caracaras, changes in location of nesting, nest success, fledging success, and adult and juvenile survival. The monitoring will be conducted annually through the completion of construction and will include at least two breeding seasons prior to and post construction. The approved monitoring plan will be developed and coordinated with the Service prior to each nesting season and may include the following specific actions:

1) The monitoring may include capturing, leg banding, and/or tagging with an appropriate transmitter, one or two adult caracaras and nestlings from each breeding pair that is likely to lose its nest tree or more than 40 percent of its territory within the Project footprint during land cover conversion and construction associated with this Project. The capture and tagging/banding shall be conducted at an appropriate time so as to allow for data collection of each territory for at least two breeding seasons (minimum of 6 months that includes nesting) prior to construction, throughout construction, and at least two years following construction (or conversion of usable habitat to non-usable habitat by caracaras). In the event of tag failure or caracara mortality prior to completion of monitoring, the Corps will attempt to capture and tag the other adult from that pair. Person(s) conducting this activity must hold, or be authorized under, an active 10(a)(1)(A) Recovery permit issued by the Service.
2) In order to monitor the impacts of incidental take, the Corps will require the District to report the progress of the action and the impacts to caracaras to the Service. The Corps will require the District to submit an annual report to the Service and Corps that includes the results of caracara nesting surveys and productivity monitoring to date, fine-scale movements, and survival of tagged adults as well as hydrological conditions within the Project. The District will work with the Service to develop the specific details of this report.

Indigo snake

1) The contractors onsite will fill out wildlife logs and those logs will be submitted quarterly to the District. The Service will be notified within 24-72 hours if an indigo snake is sighted on the Project site during land clearing and construction. A monitoring report will be submitted to the Service within 60 days of the completion of construction for the Project detailing if indigo snakes were observed during land clearing associated with the Project.

Panther

1) The contractors onsite will fill out wildlife logs and those logs will be submitted quarterly to the District. The Service will be notified within 24-72 hours if a panther is sighted on the Project site during land clearing and construction.

In the event that a live indigo snake, caracara, panther, FBB, or TCB represents a construction or operational challenge, it must be reported immediately to the Service (Florida Ecological Services Office, Vero Beach, Florida; fw4flesregs@fws.gov).

DISPOSITION OF DEAD OR INJURED SPECIMENS

Any observation of a dead or injured indigo snake, caracara, panther, FBB, TCB must be immediately reported by the Corps or District (on behalf of the Corps) to the Service (Florida Ecological Services Office, Vero Beach, Florida; fw4flesregs@fws.gov). In the event that a dead indigo snake, caracara, panther, FBB, TCB is found, photographs of the scene and setting showing the position of the indigo snake, caracara, panther, FBB, or TCB must be taken before it is disturbed. Then, it will be placed in a plastic bag on ice or frozen as soon as possible for preservation. The Corps will require the agency in charge of construction to complete a report identifying, to their best ability, the activities surrounding the mortality or injury of any indigo snake, caracara, panther, FBB, or TCB and submit that to the Service within 7 days.

Upon locating a dead, injured, or sick threatened or endangered species, initial notification must be made to the nearest Service Law Enforcement Office (777 37th Street, Vero Beach, Florida 32960, 772-323-4351), as well as the biologist identified below at the Florida Ecological Service Office, fw4flesregs@fws.gov. Secondary notification should be made to the Florida Fish and Wildlife Conservation Commission: South Region; 8535 Northlake Boulevard West Palm Beach, Florida 33412; 561-625-5122. Care should be taken in handling sick or injured specimens to ensure effective treatment and in the handling of dead specimens to preserve biological material in the best possible state for later analysis as to the cause of death. In conjunction with the care of sick or injured specimens, or the preservation of biological materials from a dead animal, the finder has the responsibility to carry out instructions provided by Law Enforcement to ensure that evidence intrinsic to the specimen is not unnecessarily disturbed.

CONSERVATION RECOMMENDATIONS

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

1. The Corps and District should coordinate with the Service to monitor additional caracara territories directly adjacent to the Project footprint.
2. The Fish and Wildlife Foundation of Florida administers the indigo snake conservation fund. The Service recommends the Corps and District provide voluntary donations to these funds to support recovery actions that benefit the indigo snake.
3. Interview property owners within the action area for information regarding their observations of listed species near the LOCAR components to facilitate future surveys.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the conservation recommendation carried out.

REINITIATION NOTICE

This concludes formal consultation on the action(s) outlined in the Project consultation request. As written in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Corps involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded for the indigo snake, caracara, panther, FBB, or TCB; 2) new information reveals effects of the Corps' action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the Corps' action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease until reinitiation.

You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if the TCB is listed. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the LOCAR and no further section 7 consultation will be necessary.

Thank you for your cooperation and effort in protecting federally listed species and fish and wildlife resources. If you have any questions regarding this project, please contact Andrew Eastwick at 772-226-8142.

Sincerely,

Bonnie Irving
Everglades Program Supervisor
Florida Ecological Services Office, Vero Beach

cc: electronic w/enclosure
Corps, Jacksonville, Florida (Angela Dunn, Gretchen Ehlinger)
District, West Palm Beach, Florida (Drew Bartlett, Jennifer Leeds, Elizabeth Caneja)
DOI, Miami, Florida (Adam Gelber)
FWC, Tallahassee, Florida (FWC-CPS)
FWC, West Palm Beach, Florida (James Erskine)
NOAA Fisheries, St. Petersburg, Florida (Adam Brame)
Seminole Tribe of Florida, Hollywood, Florida (Karli Eckel, Stacy Myers)
Service, Vero Beach, Florida (Larry Williams, Timothy Breen, Andrew Eastwick)

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Figure 1. Project location in Highlands County, Florida.

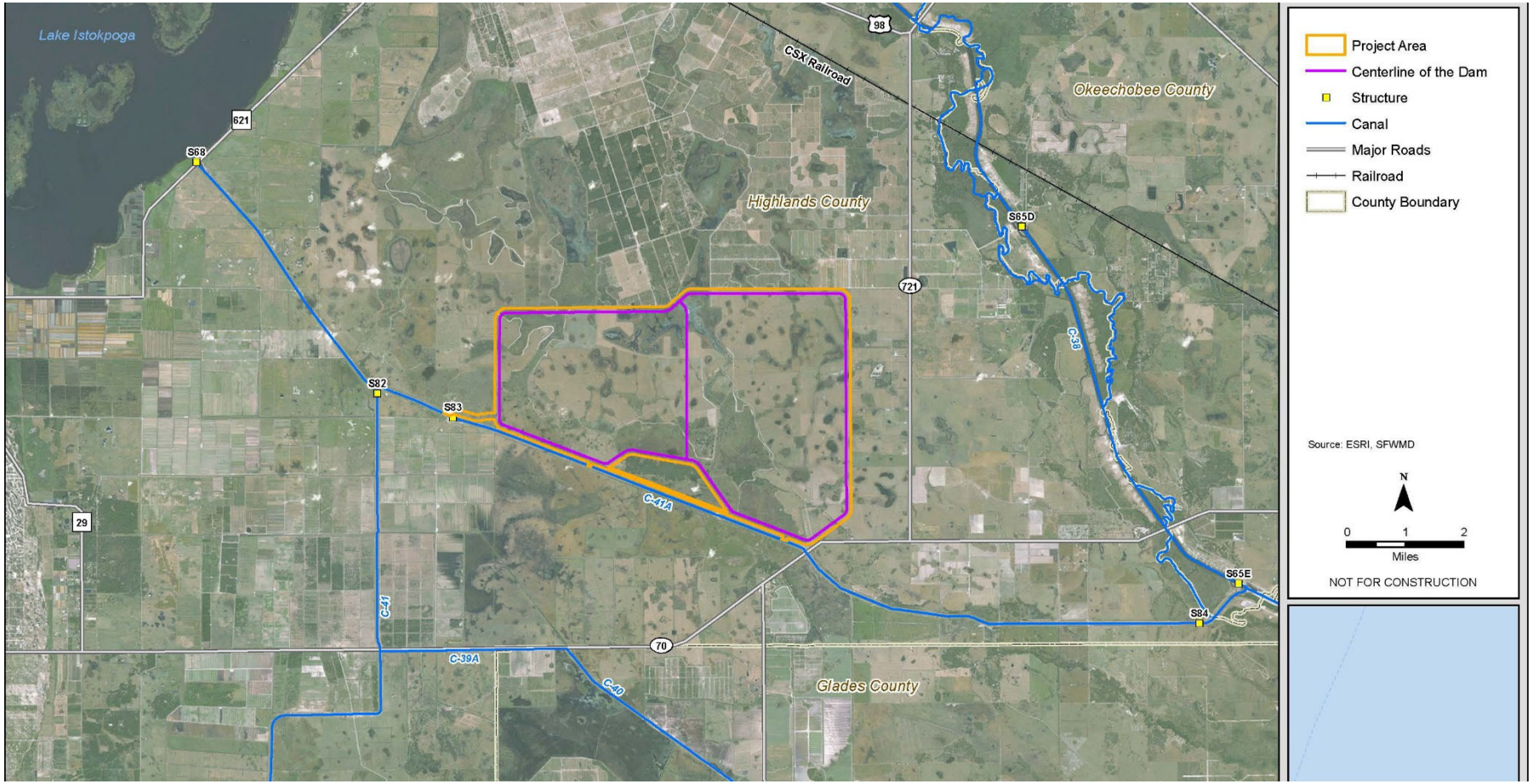

Figure 2. Project layout showing perimeter dam and internal divider dam.

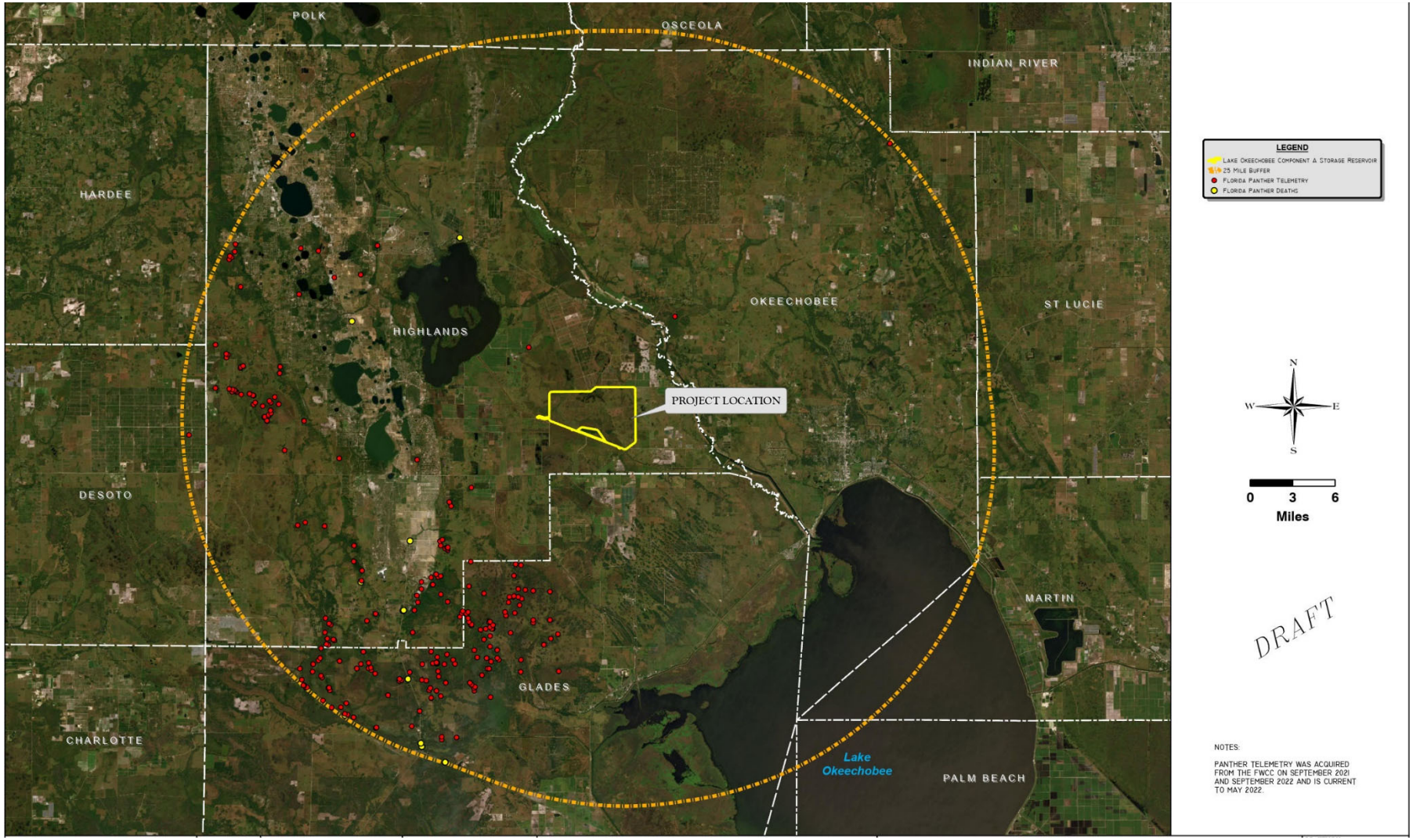

Figure 3. Aerial with Project location, Florida panther telemetry, and Florida panther moralities within 25-mile action area for the Project.

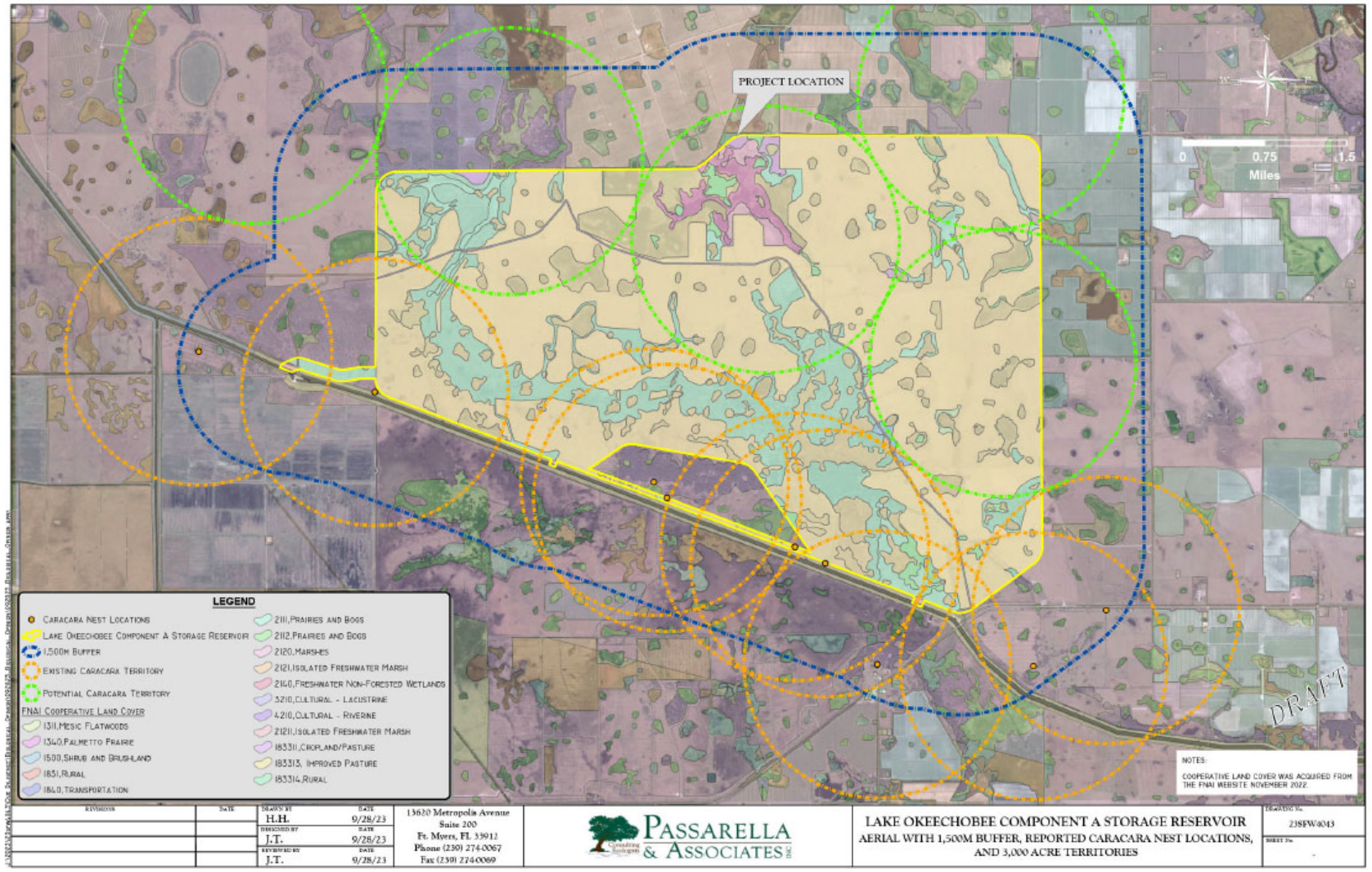

Figure 4. Aerial with reported caracara nest locations and existing and potential 3,000-acre caracara territories within 1,500-meters of the Project.

PROJECT WORKSHEET

Habitat Type	*Assigned value*	Habitat types of land to be developed (hectares)				Habitat types of land after development (hectares)			
		Primary/d Zone	Secondary Zone	Other Zone	Primary Equivalent Habitat Units	Primary/d Zone	Secondary Zone	Other Zone	Primary Equivalent Habitat Units
Pine forest	9.5				0				0
Hardwood-Pine	9.3				0				0
Cypress swamp	9.2				0				0
Hardwood swamp	9.2			12	37				0
Hardwood Forest	9				0				0
Dry prairie	6.3			39	82				0
Unimproved pasture	5.7			1895	3601				0
Shrub swamp/brush	5.5			22	40				0
Improved pasture	5.2			7534	13059				0
Cropland	4.8			19	30				0
Orchards/groves	4.7				0				0
Marsh/ wet prairie	4.7			2776	4349				0
Xeric scrub	4.5				0				0
Exotic/Nuisance plants	3				0				0
Coastal wetlands	3				0				0
Barren/Disturbed lands	3			17	17				0
Water	0			4	0				0
Urban	0			74	0				0
Reservoirs*					0			12392	0
STA*					0				0
TOTAL		0.00	0.00	12392.00	21214.93	0.00	0.00	12392.00	0.00

CONTINUE

CLEAR SHEET

COMPENSATION TO OFF-SET
42006
Habitat Units

*NOTE: The assigned value for Reservoirs and STAs varies by size, proposed future management, and their position in the landscape.
See the associated methodology document for guidance on starting values and considerations.

Figure 5. Panther habitat unit worksheet for the Project.